Professional training improvement based on training needs analysis for an IT services company

A project report presented by

Luis Daniel Hernandez Carrera

Submitted to the School of Engineering and Sciences in partial fulfillment of the requirements for the degree of Master of Engineering in Engineering Management

Monterrey Nuevo León, September 3rd, 2020
Instituto Tecnológico y de Estudios Superiores de Monterrey

Campus Monterrey

School of Engineering and Sciences

The committee members, hereby, certify that have read the thesis presented by Luis Daniel Hernandez Carrera and that it is fully adequate in scope and quality as a partial requirement for the degree of Master of Science in Engineering Management,

Jorge Alfonso Ramírez Vargas, PhD
Tecnológico de Monterrey
School of Engineering and Sciences
Principal Advisor

Maria del Socorro Jaqueline Marcos Marcos, PhD
Tecnológico de Monterrey
Committee Member

Ing. Rafael Paredes Bernal
Company Sponsor

Dr. Adán López Miranda
Master on Engineering Management Director
School of Engineering and Sciences

Monterrey Nuevo León, September 3rd, 2020
Declaration of Authorship

I, Luis Daniel Hernandez Carrera declare that this project report titled, “Professional training improvement based on training needs analysis for an IT services company” and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a master degree at this University.
- Where any part of this report has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this report is entirely my own work.
- I have acknowledged all main sources of help.
- Where the report is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself.

Luis Daniel Hernández Carrera (Student)
Monterrey Nuevo León, September 3rd, 2020
Dedication

This work is the result of not only a personal effort, but the combined strengths of the ones who love and support me always.

All my appreciation to my family, who have seen me grow and have provided good advice at every stage of my life. Special gratitude to my parents David and Mimi who always did their best and more to give my brothers and me the best opportunities in life. They were the ones who encouraged me to take on this new challenge and believed in me no matter the adversities. Every decision I have made in my life has been supported by you and you have allowed me to experience some of the best things in life. The man I am today is all thanks to you.

To Monse, my loving wife, for all the support and patience in those days where the work seemed never-ending. I will always appreciate all the things you do for me; your love and care keep me sane during the hardest times. I devote all my past, present and future efforts in building a bright future at your side.

Special thanks to my advisors, Jorge Ramirez and Maria del Socorro Marcos, without your help, this project would not have been possible; you encouraged me at every step to do my best. Your patience and advice help me create a valuable work of which I can be proud.

Finally, thanks to my manager, Rafael, who allowed me to execute this investigation and helped me get the information, support, and permissions I needed within the company.
Abstract

Software services is one of the most changing markets in the world. In order to maintain a competitive advantage, it is essential to excel in operational efficiency and prepare all employees to take on the emerging challenges presented by the clients.

This purpose of this project was to produce improvement proposals for the training activities implemented by the professional development area of the Backend technologies department. The main objective of the proposals is to reduce the amount of time employees have to spend without being assigned to a client project as each hour not charged by and employee implies big cost for the company.

Based on the literature review, a training needs assessment was executed within the company to understand market trends, business goals, and learning and learners needs. This information allowed to address specific performance problems with training activities and permitted the training programs to be focused on a business need, which will generate value for the organization.

The proposals generated focus on three main issues: create a base for evaluation of present and future training programs, developing soft skills in the employees, and improving technical knowledge within the department.
List of figures

Figure 1: Mexico Software Market Value ................................................................. 4
Figure 2: Training needs assessment stages and evaluation levels. Taken from McGoldrick & Tobey (2016) .................................................................................................................. 12
Figure 3: Training needs assessment process .................................................................. 16
Figure 4: Qualitative data analysis in TNA. Taken from Altschuld (2010) ......................... 23
Figure 5: Components of data analysis ............................................................................ 31
Figure 6: The Fishbone diagram ..................................................................................... 33
Figure 7: The Fishbone diagram in flows of work............................................................. 34
Figure 8: ADDIE Model for instructional design............................................................... 41
List of tables

TABLE 1: DATA COLLECTION PLAN ................................................................. 18
TABLE 2: Gagné’s 9 EVENTS OF INSTRUCTION. ADAPTED FROM Gagné & Medsker (1996) .................. 39
TABLE 3: TRAINING SOLUTIONS PROPOSALS ........................................................................ 68
# Table of Contents

**Declaration of Authorship** ...............................................................................................................................II

**Dedication** .........................................................................................................................................................III

**Abstract** ..............................................................................................................................................................IV

**List of figures** ....................................................................................................................................................V

**List of tables** ...................................................................................................................................................VI

**Chapter 1: Introduction** .................................................................................................................................1

- History .........................................................................................................................................................2
- Market .........................................................................................................................................................2
- Organization Structure ..................................................................................................................................5
- Problem statement ..........................................................................................................................................7
- Objective ...................................................................................................................................................8
- Scope .......................................................................................................................................................8

**Chapter 2: Literature review** ..........................................................................................................................10

- Introduction ................................................................................................................................................10

**Training Needs Assessment (TNA)** ...............................................................................................................11

- Purposes of the TNA ..................................................................................................................................12
- Types of analysis .........................................................................................................................................13
- Steps in TNA ............................................................................................................................................15

**Data collection and analysis in TNA** .............................................................................................................17

- Choosing a data collection method ..........................................................................................................19
- Qualitative data collection methods .......................................................................................................19
- Steps for Face-to-Face or virtual Focus Group Interview .......................................................................20
- Individual interviews in TNA .....................................................................................................................23
- Quantitative data collection methods ......................................................................................................24
- Extant data ................................................................................................................................................24
- Job task analysis .......................................................................................................................................25
- Assessments and tests ...............................................................................................................................26
- Surveys .....................................................................................................................................................27
- Qualitative data analysis ...........................................................................................................................30
- Causal analysis ........................................................................................................................................32

**Learning and technology** .............................................................................................................................35

**Instructional Design** .....................................................................................................................................38

- Gagne’s 9 levels of learning .........................................................................................................................39
- The Gagne Brigs model ...............................................................................................................................39
- ASSURE model ........................................................................................................................................39
- ADDIE model ............................................................................................................................................40

**Conclusion** ....................................................................................................................................................42
Chapter 3: Methodology ................................................................. 43
  Introduction .................................................................................... 43
  Research questions ......................................................................... 44
  Participants ..................................................................................... 45
  Research design .............................................................................. 46
  The process ..................................................................................... 47
  Interviews and surveys design ......................................................... 49

Chapter 4: Data analysis ............................................................... 51
  Introduction ..................................................................................... 51
  Internal and external scans ............................................................. 51
  Business need .................................................................................. 53
  Performance gap, learning and learners needs ............................... 54
  Improving actual trainings ............................................................... 62
  Potential training solutions ............................................................. 64

Chapter 5: Discussion and conclusions ........................................ 69
  Introduction ..................................................................................... 69
  Objectives conclusion .................................................................... 69
  Discussion and next steps ............................................................... 73

References ....................................................................................... 75

Appendix A: Performance Interviews ............................................ 77
Appendix B: Project Satisfaction Survey ......................................... 78
Appendix C: Course evaluation survey .......................................... 79
Chapter 1: Introduction

Organizations have several reasons to make training a priority in their project portfolio, these include achieving a competitive advantage that sets you apart, giving employees the tools needed to improve their technical knowledge and abilities, and improving the employees’ overall performance on their job. All reasons mentioned before had convinced companies to invest a large amount of money in the development of training programs. According to the Training Industry Report (2019), the average training budget for US based large companies was $17.7 millions in 2019.

However, as it should be done with any other project, companies should evaluate the impact training programs have on the organization and the return on investment they have. By doing so, it is possible to determine whether the program is achieving the goals set or if a corrective action is needed.

Furthermore, having a systematic approach to training can lead organizations to develop robust processes that have more predictable results and that are able to withstand external or internal changes in the company.

For this project, existing literature regarding other companies’ experiences and investigation results on the analysis and improvement of training programs will be explored. With this information adjustments and new activities will be proposed for a company focused in providing technology services.

The project itself takes place in a multinational company which provides consulting services, technology services and outsourcing. In order to protect the confidentiality of the data provided during the development of the project, the company has requested to
keep its name secret. From now on, we will refer the organization in which the project is developed as The Company.

History

The Company was founded in 1950. During their first years, they focused on the development and implementation of computer systems for different industries and companies. Their growth was quick, and they were able to open several offices all around the world. The first office in Mexico City was opened in 1955, being this the first office outside the US.

As new technologies were developed, The Company adjusted their business plan and started working on software packages and providing consulting services for clients of all kinds.

From the beginning, The Company was aware of the competitive advantage that they created by having well trained employees. They established a formal school for consultants in 1965 and started working on training plans for their employees.

In 2001, The Company went through big changes in their strategy. They announced 3 main pillars for this new strategy: having a bold growth, being one of the best places to work, and focus on operational effectiveness. From this point in time, The Company has been present in several important rankings for different reasons, for example, Interbrand’s “Best Global Brand”, Fortune Global 500, Working Mother’s “100 Best Companies”, just to name a few.

Market

The Company offers a wide variety of services, which are divided into 4 main markets:
• Strategy consulting: Focused in applying innovation to boost the value organizations provide to their customers.

• Interactive: Its main objective is to design and implement unique experiences for the clients.

• Operations: Provides support to organizations so that they can maximize their performance based on creating excelling operative processes through the use of vanguard technology.

• Technology: Services that seek to solve client’s problems with the use of emerging technologies, and services that thrive for the maximum performance of legacy systems.

This project is developed within the Technology branch of The Company in Monterrey city.

The technology services provided by The Company are comprised within the software market for its economic analysis. Some examples for these services include development and support for systems and enterprise applications, data analysis, management of computer systems, information security consulting, cloud computing consulting and technology innovation.

In Mexico, the software industry has experienced a constant growth in the last years and it is expected to continue growing at an accelerated pace. According with MarketLine’s market profile report for software industry in Mexico (2019), software industry generated $5.7 billions in earnings during 2019 and had a 10% growth compared to the previous year. Likewise, US had an 8.9% growth and $200.4 billions in earning during the same period.
The growth in software industry is attributed primarily to the increase in the usage for cloud computing and mobile devices among business. New technologies have allowed companies to have a shift in their business plan and move to a schema called Software as a Service (SaaS), in which the client pays monthly or annual fees to maintain their subscription to an application or service. On the other hand, the use of cloud computing and mobile devices have also allowed companies to provide their services remotely, gaining more value for their customers. Most of the demand for development and support for this kind of services comes from government institutions, financial companies.

However, consumer applications do not represent the higher portion of the earnings generated by the software industry. It is enterprise applications which is the most lucrative segment of the industry. Companies have started a digital transformation and
heavily rely on business process applications for their daily operation. These applications have automated most of the repetitive tasks once performed by employees. Also, enterprise applications manage large amounts of data that reduce the effort needed by organizations to do their jobs.

The last segment of the software industry we will talk about is data analytics. Consumer and enterprise applications generate large amount of information related to behavior which can be used to generate more value for customers. Also, manufacturing companies have started implementing data analytics in their own processes to find ways to make them more efficient. However, in order to manage that huge amount of data, companies need to invest heavily in computer systems, software packages and tools to maintain the integrity and confidentiality the data.

Organization Structure

The Company has two locations in Mexico, one in Mexico City and the other in Monterrey. These are called delivery centers because they are the main points from where the services are provided. Its geographic location, the strong emphasis on English language skills, and the competitive price offered for its services are the main advantages Mexico offers to US and Latin America clients who wish to get technology or outsourcing services in the same time zone.

The delivery centers in Mexico are organized in departments depending on the technology and tools on which they focus. Some examples are backend systems, frontend systems, supply chain, and mobile development. Each of this departments are self-organized and can define their own structure in order to reach the goals set by the
higher management. The backend department (in which this project develops) have established areas to help people achieve their full potential:

- Project Management Office
- Empowerment
- Sales
- Recruiting
- Industrialization
- Community
- Professional Development

All these areas are partially managed by employees beside their regular assignments in projects with clients. These people organize and carry out activities and programs to improve the performance and overall well-being of employees within the department.

In recent years, and in order to have a homogeneous business unit, The Company decided that departments in both delivery centers should share the same management. This means that Mexico’s and Monterrey’s delivery centers have just one head of department who is responsible for accomplishing the goals set for both locations.

This situation comes with several challenges for all departments because each delivery center is focused in two different market segments: Monterrey is the location preferred by US based clients while Mexico City focuses on Latin American clients. The main difficulty departments have is the need to analyze trends and anticipate requirements for two different market segments while still maintaining high and homogeneous quality standards in both offices.
The Company follows a matrix organizational structure where people report results to both the project management and the department management. Most of the time, different roles and technologies are needed during the development of a client project. This is the reason why project teams are conformed by people from different departments. For example, a project may need a database administrator, two backend developers, and three frontend developers. Projects inside The Company vary in size and teams could be really small, consisting of just a five-person team; or it could as big as to consist of several teams with more than 250 employees in total.

Problem statement

As part of the Professional development area within the backend technologies department, our main task is to make sure that all employees have the required knowledge and skills to provide high-quality services requested by clients. Some of the activities performed to do so are the development of training plans, the planning of workshops, courses and webinars regarding the most relevant technologies and tools, as well as promoting certifications and training employees in preparation for the certification exams.

One of the objectives that the Professional development area have is to provide employees with all the tools and resources so that they can achieve their desired career development. However, the main performance indicator for the area is the average time an employee spends without being assigned to a project with a client after being rejected for not showing the required knowledge and skills.

In most cases, clients hire The Company’s services in order to augment the capacity in their Information Technology (IT) departments. Because of this, for most
projects, The Company should propose a candidate who will be interviewed by the client to confirm that he or she meets the requirements for the vacancy. This can lead to a situation in which a person cannot be assigned to a project for a long period of time.

Even though a person is not assigned to a project, and it is not producing billable hours, The Company still pays the employee their whole salary. One of the main benefits that The Company offers to its employees is having financial stability which contributes to make it a great place to work. Derived from this situation, an efficient operation is a must to maintain a sustained growth for The Company.

Another problem that arises when an employee is not assigned to a project is the growing feeling of frustration. When people do not feel useful and appreciated in an organization, they tend to look for other job opportunities where they feel more comfortable. An employee leaving means that the company need to invest again in recruitment and training.

Objective

The main objective for this project is to present improvement proposes for the processes actually in use in the Professional development area. We will look for innovative ways to train consultants in order to reduce the average amount of time spend by employees without being assigned to a project due to a lack of technical knowledge or skills.

Scope

The project will be developed within the Professional Development area of the Backend systems department. We will execute a training need analysis to explore trends
inside and outside the organization. With the information gathered, activities proposals will be created, and goals will be set for the courses and training plans. For this project, all the proposals created will be made specifically for the Backend systems department, but the methodology could be later applied to other departments within The Company as well.
Chapter 2: Literature review

Introduction

As many other organizations have acknowledged that well-trained employees are crucial in achieving higher levels of performance, there have been several attempts to think of a reliable solution to keep employees’ skills sharp and help the business and them grow.

Companies that focus on providing services are the ones more worried about the performance of their employees, since their earnings depend entirely on their performance. Despite the fact that these companies spend large amounts of money in training, the effectiveness of training programs have been a concerning to many of them.

As said by the Committee on Capacity Building set up by the Reserve Bank of India (2019), most of the training methods used today are focused on classroom sessions, case studies, and e-learning. However, to enhance the efficiency of training, they have suggested to keep in mind that this is a matter of adult learning, so we need to use more frequently hands-on training in the form of simulations, special projects, and roles rotation. Mukerjee (2019) also states that the ineffectiveness of most training programs can be a result of a childish treatment of adult learners. Knowles (1984) explained that as a person matures, they become more self-directed. This means that adults learn better with the accumulation of experiences and their orientation towards learning shifts from being centered in subjects to being centered in problems. The last point regarding adult learning is that adults are far more interested in subjects that have immediate relevance and impact for their job or daily activities.
Designing effective training programs is a homunculus task. For many people, the first step in this process should be undertaking a Training Needs Assessment, an analysis which considers many things: organizational goals, trends in and outside the organization, the gap between employees’ skills and the skills required to fulfill their roles, and what skills the learners want to develop.

Training Needs Assessment (TNA)

A TNA is a process in which an organization analyses everything that revolves around their business to determine how training can help them achieve their goals. Allison Rosset (2009) uses a different definition: “Training needs assessment is what you do to create tangible solutions to the problem or opportunity”. This definition strives away from words like trainings, learning or skills, it focuses on what should be the main concern of any project, solving a problem or sizing an opportunity.

Broadly, we can say that the main steps needed to perform a TNA is to establish that there is a business need that is driving a performance need to finally identify a real training need. Furthermore, we need to identify all the details regarding the training need, as well as identifying issues not related to training that can be affecting the performance situation.

Despite the fact that any kind of training can yield new knowledge and skills to employees, there is always the concern that training programs may not be targeting the real problem that the organization have. Also, there is a risk that the training is not well received by the people or that it can even end up being useless for the organization.

One of the main goals of a TNA is to provide a basis on which to build to have a training program grounded in the needs of the company. With this information, we can
develop relevant goals for our programs that would help the business realize the value of the training function and its role within the organization.

Purposes of the TNA

McGoldrick and Tobey (2016) help us define the purposes that a TNA can achieve when it is performed effectively:

- It places the training need or the training request in the context of the business needs. A training program will only generate value for the organization if only when it focuses on serving a business need.
• It validates and augments initial issues identified by organizations. A TNA can reveal previously unknown information about the problem or help identify how seemingly unrelated factors can contribute in the issue that is being analyzed.

• Helps the training design to ensure that it support employees’ performance which contributes in helping meet the business goal. A large portion of the job is to gather information, identify and capture skills and knowledge so that the training maximizes its impact of the employees’ jobs.

• Identify and generate recommendations for issues not related to training that are affecting the performance situation. There are several reasons why doing this is important. First, it would be easier for us to accomplish the goals if we know all the factors involved. Second, training programs would be accountable just for the parts of the problem where it has an impact. Finally, it is an added value to the whole process that helps the company achieve its goals.

• It makes the training function relevant for the business and ensures its continuity as part of the organization.

• Set the basis for evaluation of the training programs. When a TNA is being executed, the initial situation is evaluated in four different stages. This information is used to set relevant goals during the design, and then they will be evaluated when the training program is completed. The evaluation of a training program can be the beginning of a new training request, so we enter a process of continuous improvement.

Types of analysis
The analysis tasks done during a TNA fall into three different levels (Brown, 2002):
- **Organizational analysis**: These tasks focus on discovering where training is needed within the organization and under what circumstances it should be conducted.

  Human Resources (HR) data regarding employees’ performance, can be used to identify areas where training could be useful. Also, HR and the management should anticipate and plan for trends and changes within and outside the organization. Three main kinds of changes organizations should consider carefully are:

  o **Future skills needs**: Depending on how the organization, its goals, standard procedures, and team environment change, companies should plan training programs to adapt to said changes.

  o **Changes in labor pool**: Organizations constantly experience changes in their workforce, which can be caused by the need to fill new roles, having to fill vacancies left by other employees, or wanting to accomplish goals in regard to work inclusion (woman equality, minorities).

  o Changes in laws and regulations: these changes force organizations to train their workforce to be compliant with them. Failure doing so could lead to losing clients or high penalty fees.

- **Task analysis**: A job request is analyzed to determine the skills and knowledge needed to perform it, then they are compared to the skills and knowledge of the employees to establish the training needs.

- **Individual analysis**: In this analysis the target is the employee and how he is performing in his job. If an employee’s performance review reveals gaps in the
skills or knowledge they should have, training should be conducted to help them meet the standard performance.

Steps in TNA
There are 6 steps in the TNA proposed by McGoldrick and Tobey (2016):

1. **Perform an internal and external organizational scan**: During this phase, large amounts of information are gathered from many sources, including news, reports, financial statements, customers, strategic plans, benchmarking, and the employees themselves.

2. **Collect data to identify business needs**: Derived from the first step, we can identify current business needs that can be categorized in three main groups
   a. Opportunities that must be capitalized.
   b. Problems that must be solved
   c. Business strategies that should be supported.

3. **Collect data to identify performance, learning, and learner needs**: Many sources of data should be analyzed to identify the current and the desired levels of performance, the knowledge or skills mastery employees have and what is desired, and knowledge or skills people want to acquire.

4. **Analyze data**: All the information gathered in previous steps should be analyzed in order to identify and understand the magnitude of the gaps within the actual state and the desired one.

5. **Identify potential training solutions**: Having all the information, the team can propose potential training initiatives.
6. **Provide data analysis feedback**: A report or presentation should be made detailing the data analysis, training recommendations for the program, and recommendations regarding issues not related to training.

*Figure 3: Training needs assessment process*
Being the first part of the process, a TNA should be followed by the design of a training program. For this task, the designer will have large quantities of information to set relevant goals for the program, produce adequate training activities, learning and evaluation tools, and if needed, a learning environment.

Data collection and analysis in TNA

Data collection is the fundamental activity for stages 2, 3, and 4 of a TNA (See Figure 3). The main goal of this task is to establish the need for training by identifying a gap between the desired and actual performance at each of the stages mentioned before. With this information, training programs can be designed to bridge the performance gap and ultimately add value and have a positive impact on the business.

McGoldrick and Tobey (2016) state that the process for planning data collection should be divided in 4 different thought processes:

- Identifying the questions that should be answered by the data collection
- Identifying the sources that could provide the required data
- Identifying possible data collection methods
- Choosing the data collection methods.

The reason to do this planning process is similar to the reason why a TNA is required before designing a training program. If we decide on a collection method too quickly, we might be missing the whole point of collecting the data in the first place. By taking our time to identify the questions we want to answer first, we can choose the right people to contact and tailor the data collection methods in order to meet the goals we set.

When a data collection method is decided in a sole thinking process, we hinder the creative process needed to perform a good data collection. Also, with this way of thinking,
all efforts done for planning data collection could be in vain if the particular method cannot be executed. For example, if a certain employee is not able to be interviewed, we would need to rethink the questions and the goals of the interview.

When identifying the questions we need to answer, the potential data sources, and the collection methods, McGoldrick and Tobey (2016) suggest to have an open mind and think of what would we ask if we could ask any questions we wanted, what would be our data source if there were no constraints, and how could we perform the data collection if we had unlimited resources. It is during the fourth stage when we can limit the data collection process to the limits of our reality. McGoldrick and Tobey (2016) also present a tool useful for organizing the data collection options and keeping the four-thought process separate (Table 1).

<table>
<thead>
<tr>
<th>Needs assessment stage</th>
<th>Questions to be answered</th>
<th>Data sources</th>
<th>Potential data collection methods</th>
<th>Data collection method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1: Business needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 2: Performance needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 3: Learning needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 4: Learner needs</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The last consideration we need to have when planning the data collection process is to acknowledge that the point of collecting all the information is not doing research, but to help the organization take action on a problem (Block, 2000)
Choosing a data collection method

Once we have identified all the possibilities regarding data collection for the TNA, the next step is to decide what methods are best suited for our current situation. Some of the factors we need to consider when choosing a method are the time available for the analysis, the resources needed to implement the method, other cost and expenses, the availability of data sources, and the skill level of the assessor. Many authors suggest the use of as many different data collections methods and data sources as possible to generate information about the issue from a greater number of perspectives (McGoldrick & Tobey, 2016; Bartram et. Al. 2000; Altschuld, 2010).

Data collection methods can be either qualitative or quantitative. Quantitative methods are those which yield hard data in the form of frequency, percentage, portion, or time. On the other hand, qualitative methods are used to generate soft data which is intangible. Examples of qualitative data are opinions, feelings, attitudes, values, and desires.

Qualitative and quantitative data collection methods should be used together during this stage of the TNA to produce better results. For example, qualitative methods could be used to discover how people feel about a particular issue within the organization, then a quantitative method can be used to determine to which extend people feel the same way or how many people fit the scenarios described before.

Qualitative data collection methods

There is a large number of available qualitative methods for data collection such as community groups forums, focus group interviews (FGI), individual interviews, participant or unobtrusive observation, just to name a few. However, according to Altschuld (2010), the preferred methods used in TNA are FGI and individual interviews
which combined with other quantitative methods can yield very detailed information regarding the needs.

For example, Kumar and Altschuld (1999) analyzed a teacher education program 2 years after its conclusion to determine the long-term impact it had. For this study, individual interviews with the students, teachers, administrators, and other staff were conducted. The information was compared and complemented with quantitative methods such as the review of past performance reports. In the end, the result of this research showed that the training program was quite less effective than what the quantitative reports described, and some other positive effects that were not measured before. Also, faculty was able to learn about how students were using the course material in unintended ways.

Another point that these studies demonstrate is the need to gather information from different levels of an organization. For instance, administrators tend to be more aware of national or international initiatives, whereas operational staff is focused on getting their job done. Some topics discussed during an FGI can be completely unknown for any of the levels, however, we would be able to understand problems from a different perspective if we are able to adapt the questions to fit the current audience.

**Steps for Face-to-Face or virtual Focus Group Interview**

Altschuld (2010) proposes a 6 steps process to conduct a successful FGI:

1. Decide to use the technique: We can determine if FGI is a good data collection method for us to use by answering questions like “Would FGI produce the information needed and is it worth the cost?”, “Who should be involved, and would they be available for the meeting?”, “Will questions require thoughtful, in-depth
answers rather than simple ones?”. For this matter, literature review is suggested to find out if FGI have been conducted in the analyzed area before, what did they ask, and what results did they get with that.

2. Select the individuals for the FGI: We should assess if different levels in the organization have different perspectives. Also, depending on the organizational culture, it could be beneficial not to mix different levels in a single FGI. Some questions we need to take into consideration for this step are “From which group we can get relevant information?”, “How many groups can we interview with the resources available?”, “How can we foment honest answers in the group?”. In a TNA, issues may arise about the management, personal relations, and other unanticipated problems. In this case, we would need to ensure anonymity, and any other form of protection for the people involved.

3. Attend details and arrangements to make a successful FGI: There are some important points we need to consider planning an FGI.
   a. Establish criteria to select participants
   b. Define the mechanisms to be used for contacting the participants
   c. Plan a time and location to have the meeting
   d. Having a second person to take notes can help the interviewer to focus on leading the discussion.

4. Determine FGI questions: A warm-up or ice-breaking question is suggested to help the group relax. Also, it is important to keep in mind that we need to hear an opinion from everyone in the group, so for an 8-person group, we could expect to take around 20 minutes per question. Some recommended questions can be:
a. What examples of the problem comes to your mind?

b. From your perspective, can you describe the severity of the issue?

c. What factors could be leading or contributing to the issue?

d. What indicator of the problem can you identify, and how can they be measured?

5. Conduct the interview: The author suggests taking into consideration some important point during the FGI:

   a. The facilitator should be familiar with the questions and the issue being analyzed

   b. Try not to guide the answers. There are no correct answers to questions

   c. If the answers diverge from the central topic, allow it to see where the conversation leads.

   d. Try to encourage those who give short answers to drill more into it. Similarly, for those who go too long, try to make them summarize.

6. Analyze and report the results: The most important activity during the analysis of the data is to collate and put together thoughts and ideas in a coherent way. It is useful to have in mind what information have other methods discovered. This process starts with the variables that underline the data and moves towards a smaller set of overarching explanatory themes as described by figure 5.
Individual interviews in TNA

Interviews can serve three main purposes in a TNA (Altschuld, 2010). First, they are used as a guidance for developing and implementing surveys. Second, they can be used as a standalone source of information within the several methods used for data collection during a TNA. They are not used as a complement for any other quantitative method, but as a critical input to understand the problem presented. Third, interviews can be used to aid in the interpretation of other data retrieved and analyzed with quantitative methods.

To implement an individual interview, similar steps as presented for FGI and be followed. However, it is important to understand that the cost of performing extensive interviews in several levels of the organizations can escalate quickly. In order to perform an interview, it is suggested to record, then transcribe the interview before doing an analysis procedure.

Another important difference with an FGI is that the amount of questions that can be asked in an individual interview is higher and we can follow up on specific answers.
much easier. Finally, as well as in an FGI, carefully structuring the interviews is critical to the success of the method (McGoldrick & Tobey 2016).

Quantitative data collection methods
Quantitative methods provide hard data, usually presented as statistics, numbers, or frequency. The complexity of the analysis required to draw statistically valid conclusions, such as testing hypothesis, or generalizing beyond the provided sample or data, can vary depending on the objective of the analysis and the methods used to collect the data. Despite the fact that these methods yield relatively trustworthy information, many errors can occur during the interpretation of the results, trying to understand the causes, or planning for future policies or standards. In this section, we will enumerate some of the most used quantitative methods in TNA, such as extant data, job task analysis, assessments and tests, and surveys (McGoldrick & Tobey, 2016).

Extant data
The information that comes from existing records, reports or databases form part of extant data. This is mainly used during the organizational scan to identify business needs and in performance gap assessment.

There are several advantages that extant data provide:

- Hard data and measures were already gathered by others and summarized in a consistent way.
- Provide the means to analyze trends and patterns over the time.
- If measurements are consistent, it provides reliable data.
- We do not need to worry about employee confidentiality and anonymity because the data is used in aggregate form.

Some disadvantages for this method could be listed as:
- It may have been collected for different purposes other than TNA, so we need to infer training issues from the data.
- We cannot control the methods or processes used to gather the information.
- It can be hard to obtain because other people control the data, and it may involve sensitive information for the organization, so we would need permission to use it.

**Job task analysis**

Put in a simple way, a job task analysis (JTA) is a method used to determine what activities are included in a particular job and how exactly it is supposed to be done. It is used in several areas of an organization, such as helping HR management in developing position descriptions, hiring employees, setting staffing standards, setting the basis for developing training, and planning career development (Wolfe et al., 1991).

When a job is not being done as it is expected, it is identified as a performance issue. However, this issue is not always a problem of training. Before a JTA is performed, we should do a root cause analysis and determine if the problem can be attributed to a lack of knowledge or training. Once the problem has been identified as a training problem, JTA information is essential in the design of potential solutions because it ensures that training efforts are focused on the main activities of a job.

The main steps suggested to perform a JTA are presented by Wolfe et al. (1991):

1. **Develop a task inventory:** This is an organized list of duty and task statements that make up a job. Developing a task inventory can be done by analyzing job-related documentation, interviewing expert performers or subject matter experts (SME), and observing expert performers do the job.
2. **Validate the task inventory:** Once an initial draft has been developed, it is necessary to validate it. This can be done by organizing a panel of SME’s to review the tasks identified and discuss over them.

3. **Prioritize the tasks:** Task should be ranked depending on their difficulty, importance, and frequency of performance. This ranking helps determining which activities should be included in the training design, and what tasks should be considered for further analysis.

4. **Identify training applications:** The top ranked activities should be reviewed to determine the best way to provide training on them. For example, some activities would be more suited for on-the-job training, while others could need a classroom approach.

5. **Report the results:** The results of the analysis should be compiled into a report that includes the validated task inventory, the prioritization of tasks, the suggestion on training applications for the top activities, and the suggestion for further task analysis.

Assessments and tests

These methods are used to measure what employees know, what they can do, or what they believe in relation to the tasks or duties that are being examined. The main ways of performing an assessment are using verbal or written responses to a series of questions, analysis of performance of a job skill while being observed, or analyzing work results, products or outputs against quality criteria (McGoldrick & Tobey, 2016).

Despite being a reliable way of obtaining hard and objective data on the actual job performance of employees, there are some disadvantages that should be considered. During assessments, we are not always sure about why a participant performed in a
certain way. For example, some employees may freeze during examination due to anxiety.

Another problem is the time constraints that we have to perform the analysis and the commitment employees may have for completing the assessments provided. These issues require good planning and close relationship with the business partners to encourage their team to complete the assessments and not to be afraid of consequences for performance issues found during them.

Surveys

Finally, one of the most used data collection methods is the use of surveys, whether is paper and pencil or electronic questionnaires that ask a series of focused questions. The main reason why it is preferred as a data collection method is its low cost and the facility and quickness for employees to answer. On the other hand, the main concerns regarding its implementation revolve around the correct wording on questions to avoid bias in the answers and choosing the right scale to use in each of the questions (McGoldrick & Tobey 2016).

Altschuld (2010), has identified 7 principles for TNA surveys design process based on the authors experience in multiple needs assessments:

1. Select contents for the survey: Contents in surveys can vary depending on the objective we set for the method. While the main focus tends to be training and performance issues, we could also include questions regarding environmental issues as well. We are suggested to use scaled questions to get information like importance, satisfaction, and actual behavior; but we also could include open ended questions to get some qualitative data from the survey. Finally, questions
can be grouped into labeled clusters that could be then the focus of individual or group interviews.

2. Try to include multiple levels of the organization: Depending on the type or organization, we could have 2 or 3 relevant levels. First, direct recipients of the services. Second, services providers such as teachers or health care providers; for some TNAs, level 2 is the focus of the research and we suppose that level 1 needs are understood. An important concern that Holton, Bates and Naquin (2000) remark regarding this level is that what employees identify as a need could be wants rather than realistic needs. Finally, level 3 refers to administrators and how they perceive the problem. It is important to understand their point of view but including them in the analysis towards the end could be beneficial for the project to prevent the analysis to appear top-down and discourage lower levels participation. When multiple levels are included in the analysis, the cost of retrieving and the complexity of the data increases, so it should be done in an organized way and specific goals should be set for each step of the analysis.

3. Employ multiple methods: As discussed earlier, the implementation of multiple data collection methods can help in the understanding of previously retrieved data or aid in the design of further collection methods. It is important to have this in mind when planning a survey and consider how it could interact with other methods in the TNA.

4. Vary instrumentation to fit the characteristics of each group: In surveys, even the order of the questions or the wording used in them can lead to different results depending on the group answering. For example, we might use different wording
in a survey targeted to students and teachers; while we would refer to the overall academic success when asking teachers about it, students would be more interested in the question if it refers to their personal academic success.

5. Consider using 2 or more scales for items in a survey: Surveys is a perfect method to implement multiple scales for a single item. With the use of more than one scale, the information gathered in the survey is magnified. An example for this principle is using 3 scales to rank a topic or service regarding the extent to which it is important to students, how satisfied are them with the service, and the frequency in which the service is used. This kind of questions needs a little more planning and experience when designing the survey. Also, some scales may require the addition of a “Not Applicable” or “Do not know” option to give a neutral response.

6. Consider including questions about barriers and solutions: In spite of training being the main focus of the analysis, the survey could include questions regarding barriers in the organization affecting the performance, and employees preferred ways to implement solutions.

7. Consider using open-ended questions in surveys: There are several benefits we could get from adding open-ended questions in surveys. For example, giving illustrations of problems identified by employees, describing potential solutions, saying if a survey was meaningful to them, and describing barriers to improvement. Well-formed open questions can lead to meaningful answers that could lead to unexpected results of the need to further analyze a topic. It is suggested adding between 2 and 4 open-ended questions, but there should be a focus on the scaled items.
Qualitative data analysis

The overall process for qualitative data analysis can be described as a concurrent flow of 3 main activities: data reduction, data display, and conclusion drawing or verification (Miles & Huberman, 1994).

Data reduction is the process of selecting, focusing, simplifying and transforming the data gathered from the different collection methods used. The authors consider this process to start even during the initiation of the project and its planning. The reason is that decisions are made using available information. For example, choosing a conceptual framework to work with, or deciding which collection methods are best suited for the project. The process is then applied to the data collection, and it continues until the final report is completed. The main objective of this activity is to organize, discard, sharpen, and focus the data in so that conclusions can be drawn and verified.

The second activity in the flow is data display. This flow involves the way information is compressed and organized to make easier the task of inferring conclusions from it. In the past, most of the qualitative data gathered was presented in large texts in the form of field notes created during information gathering. However, this way of presenting the data goes against the human nature of simplifying information and categorizing similar items; this led researches to jump into hasty or partial conclusion. Preferred ways of displaying data are charts, graphs, matrices, or diagrams. These tools allow data to be assembled in a compact way so that people can quickly draw conclusions based on the whole set of information. This activity has much relation with data reduction because it is needed to design a display. For example, deciding which columns and scales to use for a chart is a process that requires sorting, discarding and organizing data.
Finally, the last main activity is conclusion drawing and verification. Usually, researchers start to draw conclusions at the beginning of the data collection stage. However, these conclusions are not well defined and can be vague. During the whole data collection process and analysis, conclusions start to be grounded with facts or they can be modified or even discarded entirely. The other part of the problem is the verification of conclusions. There are several ways to verify conclusions, the least complex involves reviewing again the data gathered trying to find patterns not discovered before and create solid arguments to defend the conclusion. Another plausible way is to gather a panel of experts to discuss on the findings and compare them with previous experiences and researches. Also, extensive efforts can be done to try replicating the findings of the research in some other area or location. Without demonstrating the validity of conclusions, we are left with just “interesting stories about what happened, of unknown truth or utility” (Miles & Huberman, 1994).

![Components of data analysis](image-url)
Causal analysis

Once we have enough information about the needs which are going to be addressed by the organization, we should analyze the data and determine what is causing the problems and how we could prioritize what needs should be resolved first.

One of the main objectives of doing this kind of analysis is to be able to explain to other stakeholders the reason for the actions we are recommending after doing the TNA. Also, this process may lead to determine that training is not the path we should take to resolve the issues in performance and focus the resources in other activities to reduce the gap identified at the beginning.

There are several ways to conduct a causal analysis and depending on the complexity of the issue and the information available to us, we could choose between several methods such as fault tree analysis or cause consequence analysis. However, Altschuld (2010) suggested using the fishbone diagram as a starting point because of its simplicity and effectiveness.

The fishbone diagram (also known as Ishikawa diagram) is a graphic method that help us find the possible causes of an issue (Markovitz, 2020). This diagram helps us think backwards to understand how we got to the point that the problem is severe enough that we have to fix it. Even though its main purpose is quality control, it is more well known to a wider audience than the rest of methods for causal analysis.

The several factors identified are organized in logical groups. The problem or need is placed at the head of the diagram and the factors are organized in lines (bones) that come from a spine or backbone, thus giving it the shape of a fishbone (view figure 7). The classic fishbone diagram has 6 categories: equipment, process, people, measurement,
materials, and environment. However, depending on the kind of issue being analyzed, we could have a different number of categories and they could be different from the six mentioned before.

Figure 6: The fishbone diagram

Altschuld (2010) suggested that this analysis should be done by a group involved in the project to have different points of view for each issue. Based on the data gathered, people brainstorm reasons they think could be causing issue and organize them in the categories of the diagram. Then, all the reasons are discussed for each category and they are reduced or consolidated when they are similar in nature. Finally, people should rank all the causes detected to determine which are considered the main reasons of the problem.

Another advantage we have when using the fishbone diagram is the possibility to analyze a whole process using the same methodology. In this representation, the head of the diagram remains as the main problem or issue, but we add several blocks for the
processes or events that lead to the issue. The brainstorm, categorization, and prioritization are done for each of the events, giving us possible causes to an issue in all the processes involved.

Figure 7: The fishbone diagram in flows of work

The main issue that arise when using this method in areas different to quality control, is the terminology used and how to determine the categories to be used to best fit the problem being analyzed. Another concern that we need to keep in mind is the possibility of having to create different diagrams for two groups. Sometimes, causes to an issue affecting different groups of people may not be suitable for all of them. In this case, we may have to create several diagrams to analyze the causes of a problem for a specific group of people.

After all the information gathered is analyzed, the next step in the TNA process is to identify possible training solutions for the needs that can be addressed with training
and give non-training recommendations on every other issue that is out of the scope for our area.

In order to provide effective training recommendations, we need to understand what cognitive process are involved in learning and how we can take advantage of scientifically valid research to base our design in experimental evidence concerning the learning features that yield the best results (Clark & Mayer, 2016).

Learning and technology

In recent years the number of courses and training that make use of cutting-edge technology have grown at a fast pace. However, using the latest devices or the newer platforms do not ensure that the learning experience will be better.

Throughout the history, educational technology has evolved alongside the newest inventions such as the use of motion pictures, educational radio, educational television, and programmed instruction (Cuban, 1986). For each iteration, strong claims were made for them to revolutionize the education, but the expectations were not met by any of them. The main flaw of a technology centered approach to education is that instructors expected the students to adapt to the technology and did not created a learning environment that was consistent with how people learn (Clark & Mayer, 2016).

Learning can be defined as “a change in the learner’s knowledge due to experience” (Mayer, 2011). One of the main elements of this definition is that there needs to be a change in how the learner process the information, such as facts, concepts, procedures, strategies, and beliefs. As we cannot really see a change in someone’s knowledge, these changes are seen through a change in the behavior of the person. Also, another important element of the definition is that the change occurs after an instructional
episode which become part of the learner’s experience. As instructors, our goal would be to design and create experiences that lead to the changes in learners’ behaviors consistent with the goals of the organization.

The definition for instruction is closely related to the meaning of learning we just discussed. Instruction is how a training professional manipulates the learners’ experiences to foster the desired learning (Mayer, 2011). The science of instruction is the area that studies the principles or how to design, develop, and deliver instruction. Far more than just presenting information to the learners, the training professional should also guide the learners’ cognitive processing of the course developed.

According to Mayer (2009) there are 3 major metaphors of learning that psychologist have developed during the past one hundred years:

- **Response strengthening**: This view the learner as a passive recipient of rewards or punishments, and the instructor as the provider for rewards that strengthen a response or punishment to weaken it. The main criticism for this metaphor is that despite not being wrong, it does not explain meaningful learning.

- **Information acquisition**: In this metaphor, the learner’s job is to receive information and the instructor’s role is to provide the information. This is probably the most common way of viewing learning as the learner is seen as an empty vessel in which the instructor pours information. The main flaw of this metaphor is that it is not considering that learning needs psychological engagement in order to be successful.
• **Knowledge construction**: In this metaphor, learners are not passive recipients of information, but rather active sense-makers. This is the point of view on which the instructional design should be based. The goal for instruction should be to encourage the learner to engage in appropriate cognitive processing during learning.

Knowledge construction is the most complete metaphor to explain how people learn and we should have that in mind when designing a course. However, we need to understand the various cognitive processes involved in learning to maximize the effectiveness of the learning material. Clark and Mayer (2016) stated that there are 3 main cognitive processes involved in learning:

  - **Selecting words and images** presented in the material
  - Mentally **organizing words and images** in coherent verbal and pictorial representation
  - **Integrating incoming verbal and pictorial representations** with each other and with previous experiences or existing knowledge.

Finally, Clark and Mayer (2016) say that the main challenge for instructors and learners is the reduced cognitive capacity of human beings, which means that people can generally think about only a few items at a time. This limitation creates 3 kinds of demands on cognitive processes that should be addressed to create effective instructional material:

  - **Too much extraneous processing**: The combination of extraneous and essential processes exceeds the mental capacity. To address this issue, it is recommended to use instructional methods that decrease extraneous processing, such as writing lean text and audio narrations or using audio to describe complex visuals.
• **Too much essential processing**: The essential content is so complex that it exceeds the cognitive capacity. The suggestion on this issue is to manage the complexity of the content by splitting content into smaller chunks or providing pretraining to explain concepts and facts separately.

• **Insufficient generative processing**: The learner does not engage in sufficient processing to generate meaningful learning. For this issue, the instructor would need to use techniques that promote psychological engagement in learners.

Overall, the goals for and instructor would be to design material and create a learning environment that minimizes the extraneous processing, that manages the essential processing, and foster generative processing in the learners.

**Instructional Design**

Education requires a systematic process for planning, organizing, and developing the training activities. Instruction design (ID) is considered “the art and applied science of creating an environment of learning and its materials, in a clear and effective manner, in order to assist learners in developing their ability to reach specific goalposts” (Mercadal, 2019).

An ID model requires an organized and clear design that enables learners and instructors to navigate through the system successfully (Mercadal, 2019). This becomes more important during remote learning since the instructor will not be present at every step of the process.

ID requires the use of models on which to base the development of effective learning experiences. An educator should follow one or more selected models when
creating courses and materials as they serve as a guide and a set of best practices in this process.

**Gagne’s 9 levels of learning**

This is one of the most important models for ID. Considered a behaviorist model, it is concerned about the behaviors or outcomes of the learning process. Gagne focused on 9 mental conditions needed for learning and called them “Events of Instruction”.

*Table 2: Gagné’s 9 events of instruction. Adapted from Gagné & Medsker (1996)*

<table>
<thead>
<tr>
<th>Event</th>
<th>Action</th>
<th>Mental Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gaining attention</td>
<td>Use questions, pictures or relevant scenarios</td>
<td>Reception</td>
</tr>
<tr>
<td>2. Informing learners the objective</td>
<td>Tell learners what they will be able to do after learning</td>
<td>Expectancy</td>
</tr>
<tr>
<td>3. Stimulating recall of previous knowledge</td>
<td>Ask for recall of prior relevant knowledge</td>
<td>Retrieval to working memory</td>
</tr>
<tr>
<td>4. Presenting the content</td>
<td>Structured display of contents to be learned</td>
<td>Selective perception</td>
</tr>
<tr>
<td>5. Providing learning guidance</td>
<td>Use mnemonics, elaboration, pictures, graphs</td>
<td>Semantic encoding</td>
</tr>
<tr>
<td>6. Eliciting performance</td>
<td>Ask learners to perform</td>
<td>Responding</td>
</tr>
<tr>
<td>7. Providing feedback</td>
<td>Give corrective feedback</td>
<td>Reinforcement</td>
</tr>
<tr>
<td>8. Assessing performance</td>
<td>Additional learner performance with feedback</td>
<td>Retrieval and reinforcement</td>
</tr>
<tr>
<td>9. Enhancing retention &amp; transfer</td>
<td>Ask learners to apply knowledge in real life scenarios</td>
<td>Retrieval and generalization</td>
</tr>
</tbody>
</table>

**The Gagne Brigs model**

This model follows Gagné’s postulates adding 5 more steps. It is a more complex model that includes an analysis of needs, objectives, and priorities, as well as resources, restrictions and distribution systems. Also, this model thrives to set goals and sequences for the courses and curricula.

**ASSURE model**

This model was developed by Heinich, Molenda, Russel and Smaldino (1999). It is based on the constructivism theory and it focuses on learners’ characteristics and
learning styles. It also fosters an active participation from the learner. ASSURE model consist in 6 stages:

1. Analyze learners’ characteristics: This includes general information, such as age, education level; specific characteristics like previous knowledge, skills and attitudes; and learning styles.

2. State goals and objectives for the learning process: We need to set goals to determine the results that learners should achieve at the end of the course.

3. Select media and materials: Also, we need to select which strategies and technology are going to be used during the course.

4. Utilize media and materials: The focus of this step should be to create an adequate learning environment and ensure that all media and material are used effectively.

5. Require learner participation: Foster participation by the use of interactive strategies.

6. Evaluate and revise: We should evaluate and review the implementation and results for the course. This process leads to reflection and implementation of enhancements to the learning process.

ADDIE model
This is a basic model upon which many other are based. It consists of 5 stages and each of them can be the starting point of any of the other stages after the evaluation is done. The phases stated in this model are very similar to other models as they are essential phases of ID

- Analysis: The problem is identified. The gap between the existing and desired knowledge should be assessed
- Design: Specific goals are set for the instruction and a plan is developed to meet that criteria. The design includes lesson plans, material and media selection.
- Development: Course material and content selection is done in order to meet the goals established during the design stage.
- Implementation: Is the phase where the training is carried out.
- Evaluation: This stage is divided in two parts. Formative evaluation is part of each of the other phases in which an initial evaluation is done. Summative evaluation provides measures to assess the outcomes and feedback from the courses.

![ADDIE Model for Instructional Design](image)

Despite its popularity, ADDIE model has several flaws. This is reason why many other ID model are based upon it. Some of the problems for which ADDIE model is criticized are being too systematic, too inflexible, constraining, and too time-consuming to implement (Kruse, 2002).
Conclusion

There have been several researches and projects which have tried to address the problem of determining the best way to generate a meaningful learning and accomplishing organization goals. In order to do this, there are several steps which are very similar among the different strategies and models: Analyze the situation, set goals for the training with the information retrieved, design and plan the activities, materials and media to use; implement the plan conceived; and evaluate the result of training and the feedback given.
Chapter 3: Methodology

Introduction

During this chapter, we will describe the methodology used during the project. The objective of the project is creating proposals for new training activities that will help in reducing the average amount of time employees spend without being assigned to a client project due to a lack of technical knowledge or skills. This project was developed within the backend technologies department in The Company.

After reviewing the available literature, we can conclude that a great number of models for ID require to analyze the gaps between existing and desired knowledge, as well as understanding learners’ characteristics and their environment before goals can be set for training. This issue will be addressed by conducting a TNA following the step proposed by McGoldrick & Tobey (2016).

First, we need to understand the environment in which the project is developing, the characteristics of the people involved, and other values of The Company. In order to achieve this, different data sources were used, such as historical data for the time employees spent without an assignation, the actual process followed when designing and delivering the training activities, and interviews with experts to know more about trends in and outside The Company. This covers the first two steps in the TNA process.

The next step was to assess the actual performance of employees to identify the knowledge gaps and set goals for training. Learners’ needs and learning need were identified at this point.
During the first three steps, there are several methods to gather qualitative and quantitative data which we used to get a better view of the problem at hand. The information gathered was analyzed to find patterns, determine if the problem could be solved with training, prioritize the needs identified, and determine to which extent they will be addressed. Qualitative information was used to generate hypothesis and design quantitative tools to test them.

Once the information was gathered, it was analyzed and used for the design of new training activities. During the design, Gagné’s model for instructional design was used as a basis to provide suggestions on the training activities that should be implemented, and the way current courses and activities can be enhanced to attain better results.

**Research questions**

The research spanned through the majority of the project, for which the main questions addressed were:

- What are the main issues that lead employees to be rejected for a role in a client project? And which of those issues can be addressed with training?
- What training activities could help in reducing the amount of time employees spend unassigned to a project?
- How can TNA aid in the planning and design of learning activities inside The Company?

These questions require a flexible framework for the research in order to be able to change the course of it or deepen in on an identified issue once it is discovered. Also,
we needed to gather information from several data sources, including both managers and employees to get a broader picture of the problem.

Participants

The main stakeholders for the project were the backend department manager, the PMO of the department, the person in charge of internal recruiting, and the person responsible for the professional development area. These people were the main data sources to understand the actual state of the situation, so we worked closely with them throughout the whole project. In the end, the responsible for this project and the person to whom results needed to be presented was the professional development lead.

Due to restricted availability, the department manager was not involved in most of the meetings of the project, but the PMO served as his representative and provided all the information required. The department management provided historic statistical data of the unassigned employees during the past year.

During the research, the focus for the project were the employees of the backend technologies department. Some people were identified as relevant cases for the study, interviews were performed to get more information on the issue being analyzed. Also, one project in The Company was used as a sample to implement surveys and questionnaires. For the sake of confidentiality, this project will be called Project A from this point onward. Project A consist of 250 employees working for a big telecommunications company. Even though employees in Project A were part of different departments, all of them were considered in the research to identify other possible training needs besides the technical knowledge specific to the backend department.
Research design

The focus of this project was qualitative research to identify the learning needs of the employees and use that information in the instructional design. Conventional systems analysis approaches like structured analysis or data analysis, tend to focus the hard aspects of a problem. However, these methods fail to include human factors in them (Avison et Al., 1999). For this reason, action research was chosen as a basis for the project.

According to Stringer (2014), action research is a collaborative approach to investigation that provides people with the means to take systematic action to solve a specific problem. The main objective of the research is allowing the actions taken to be based upon a better understanding of the situation. Action research allows to solve a problem collaboratively with the people involved in the operations. Action research was chosen for this project because the situation that was studied did not fit traditional research methods. Also, The Company was not interested in the creation of academic knowledge but in the implementation of the knowledge to solve a problem.

During the study, suggestions were implemented in the actual process for designing and delivering training activities. For the training activities design, instructors were given a review on Gagné’s nine events of instruction, so they tried to implement them in subsequent courses. Also, satisfaction surveys were created to measure how helpful a course or webinar was in teaching the employees new skills and knowledge. Action research methodology allowed the project to quickly learn from the actions implemented in the daily work, reflect on the knowledge gained and plan new actions to implement.
The process

Following the steps for TNA suggested by McGoldrick & Tobey (2016), the first step was to perform a scan in and outside of The Company. The main data source for this step were the managers as they are the ones who have a broader view of the organization and the common client request. Informal interviews were done to identify the main processes, values, and trends inside of The Company. For the external scan, market reports were used to understand the environment in which The Company compete and how other organizations are doing business.

The next step was to identify the business need that the project should address. For this task, the backend technologies department manager was contacted and interviewed alongside the PMO of the same department. During several meetings the main goal for the professional development area was defined as reducing the average amount of time spent by employees without assignation by 5% and this was used to set the objectives for this project.

The greatest effort for this project was done during the third step, collecting data to understand performance, learning, and learners’ needs. The first part of the research done to understand the actual performance of the backend department was to analyze the historical data for the past year. This data included statistical information about the average time employees spent without being assigned to a project and some highlights on employees who had the highest times and the ones who tend to be assigned to new projects right away.

The second part of the research included two different sets of interviews and surveys, one for finding out what were the main problems people had when trying to be
onboarded to a project; the objective of the other set was to identify and measure the main technologies, tools, and skills used in project. After conducting the first set of interviews, we noticed that a recurrent problem for many people was the use of technologies and tools that were not listed in the role description, but which were needed to complete tasks in the project. For this reason, the second set of interviews and questionnaires was developed with the intention to discover obscure or undervalued skills that could help employees perform better in client’s projects.

The data analysis was the next step in the process. However, due to the nature of the project, the analysis of the data gathered, and the research were done in an iterative way. The data retrieved from the interviews with fewer people was used to generate the surveys that would measure some patterns or findings in terms of relevance for daily work, extend to which they agree with an affirmation, or the frequency of an event.

Using the information gathered during the previous phases of the research, proposes were made in order to reach the goal set by the management. Enhancements to the actual process for preparing training courses were suggested, as well as new training activities to meet the requirements and trends emerging in the industry and identified by the upper management.

Finally, results of the research and the main suggestions would be presented to the professional development lead and the manager of the backend technologies department. During the presentation there could be some discussion regarding the findings and how the professional development area is tackling the problems. After that, a summarized report would be delivered to them and the selected activities and enhancements would be implemented.
Interviews and surveys design

Interviews were a major part of the research. They served as a critical data source for information regarding the actual state of the problem. All of the interviews were designed following Altschuld (2010) suggested steps.

The method was selected due to the fact that the issues in The Company were not evident at first glance. We needed a tool that could help in exploring different perspectives and unexplored ideas to understand the issues employees faced and how they were affected.

For each interview, several criterions were developed to select the participants. For example, the level of the employee being interviewed, or the role they had within the project. The main objective was to gather information from different points of view and to get honest answers from the employees.

Interviews started with some relaxed questions or comments to ease any tension with the person interviewed. The rest of the interview followed a predefined structure, but it was allowed to deepen on a relevant topic if it were to arise; people were also allowed to diverge from the interview just to see where the conversation could lead.

With the information gathered in the interviews, common patterns were identified. The most recurrent ideas were the main focus for the analysis. However, if a rare but important idea was touched by only one interview, it would also require some more investigation and analysis.

This information also served as a basis to develop surveys that were sent to a larger amount of people. The goal of the surveys was to measure to which extend the
ideas or issues retrieved were relevant to the rest of the employees, and to validate hypothesis formed during the analysis of the interviews.

Most of the items in the surveys came from the results of the interviews done. However, some open questions were added to allow people express their opinion and try and see if we missed any important issue during the initial interviews.

For the surveys, a multi scale evaluation was done to measure several aspects of the idea or issue. For example, the frequency of an event or problem, the impact on the performance, and the knowledge level employees had to work on that item. The use of more than one scale for each of the items in a survey helps to magnify the amount of data gathered Altschuld (2010).

During the design of each of the surveys, there was a process of validation with the lead of professional development and other stakeholders to fit the best way possible the intended audience for it. Things like the vocabulary used and avoiding biases in the questions were the main concerns during the validation of each of the surveys.
Chapter 4: Data analysis

Introduction

Results of the first 3 steps of the TNA are analyzed in this chapter. For the external and internal scans, the manager for the backend technologies department was interviewed. Also, articles about recent trends in technology, and public reports from The Company and its competition were analyzed.

For the next step, determining the business need, the PMO for the backend technologies department shared statistical information about the employee's time not assigned to a project. Finally, learning and learners needs where analyzed by conduction two sets of interviews and questionnaires, the first of which were conducted with 10 people within the largest project in the company (Project A) and the latter were sent to the 250 employees assigned to Project A, from which 200 people answered the surveys.

Internal and external scans

The main focus for the internal and external scans were the trends in technologies that affect the backend technologies department. According to several websites focused on trends for software development, one of the main trends that is growing in all kinds of industries is the use of microservices. “The two most important topics when it comes to microservices are scalability and performance” (Gajda, 2020). This implies that most companies are interested in having fast and reliable systems for which more resources can be allocated in specific modules to cope with higher demand from the users. This architecture contrasts with the typical monolithic architecture were every functionality was embedded in a single system, which in case of failure would affect all functionalities.
The Software House, a digital company focused on providing agile development services, presented a report called State of Microservices 2020 in which they share the results of several surveys conducted with 650 developers around the world regarding the impact microservices are having in the industry. In this report, they state that only 34% of the developers have been using microservices for more than 3 years, and only 7% of them have been using them for more than 5 years. This tells us that the trend is relatively new, but it is starting to grow rapidly. Also, developers were asked about the impact this architecture is having in solving performance and scalability issues, working efficiently, teamwork, set up of new projects, and the maintenance and debugging of live projects. The two topics which were better rated were solving performance and scalability issues, followed by enabling teamwork.

The manager of the backend technologies department was also asked about the main trends within the projects on which the Company is working. His answer was that the main focus most of the projects have regarding the backend technologies is the use of microservices. At this moment, 10 of the projects in which the backend technologies department have employees assigned are focusing in developing or maintaining systems based in microservices architecture.

The Company have also published several articles in public forums talking about the importance of microservices in today’s systems and what services it provides to enhance their development and maintenance.

This information is congruent with the external trends so this would be one of the main focus for the professional development. More information would need to be gathered.
to assess the actual performance of the employees and how training could help improve that situation.

Business need

According to the manager of the backend technologies department and the PMO, the main goal for this project and for the professional development area should be to reduce the amount of time employees spend not being assigned to a project. In this regard, historical data was requested to understand the situation.

The data provided by the Backend technologies department was a log of the unassigned people within the department during the first half of 2019. During this period, 26 employees where not assigned to a project for different spans of time. The average time unassigned is 34.15 days, with a standard deviation of 36.09. The largest time unassigned during this period was 133 days and all 5 employees who spent more than 70 days unassigned where fired. Without counting the employees who were fired during this period, the average for 20 employees is 16.95 days.

Other important data retrieved from this log is the reason for employees to be unassigned: performance, project budget and project end. Analyzing the data segregated by reason, we are able to see big differences between them. For employees who were removed from the projects due to performance issues, the average time spent unassigned is 64.4 days, for project budget is 12, and for project end, 19.4.

The first interpretation we can give for this data is that the main problem is the performance within the project, but we do not have enough data to get a statistical valid conclusion. More data would be needed to confirm this assumption.
However, this information gives us enough reasons to work on improving the performance of employees once they are assigned to a project. We would need to be cautious about the performance issues for the employees and try to prevent employees from being removed from a project.

**Performance gap, learning and learners needs**

To understand how employees were performing in their projects, a series of interviews were conducted with 10 people in the largest project for this location, which consisted of 250 people in total. Within these 10 employees, 6 were part of the backend technologies department and 4 were part of other departments. The intention of having different departments involved in the research was trying to identify common issues for all departments and issues that only they may have experienced, that would be useful for us to act proactively and try to avoid it.

Here we will analyze some of the most relevant points discussed during the interviews (For the interview questions view Appendix A).

The first question regarding what employees liked about their projects showed that people tend to be happier in the project when they get the chance to learn and do something new or something they have not experienced yet. In this question we got answers like “I like that this is something new for me”, “I liked a lot when I was given a problem to solve. I was working with two managers and I liked building a new solution with them. Being able to think and solve problems is what I like the most”.

For this question only one person answered in a different way. He said that the most important thing that make him like the job is the flexibility that he has to do his tasks. “The tasks can be done at any time of the day if you are able to deliver the products in
the target date.” This may imply a different nature of the job this person is doing or that unlike other people, this employee was not performing new activities in his job.

The second question was about what employees disliked about their jobs. In this point opinions were divided into two main groups: those who disliked doing monotonous tasks and those more concerned with the pressure exerted by the managers which led people to work extra hours outside their usual schedule.

Doing monotonous tasks could cause some attrition on employees as they may get bored of the job. Employees expressed their concern regarding not being able to develop new functionalities. “I do not like that I am not programming at all. I am just fixing issues everywhere and this is not challenging for me” Not practicing coding for long periods of time could hinder the ability of employees to answer technical questions during interviews for their next assignment. Activities could be implemented to stimulate employees who tend to do tedious tasks; this would also help them keep their skills sharp for their next assignments.

The other issue expressed by the employees was the pressure exerted by the managers. “I do not like having to work 3 or 4 hours more in a day, but I understand it depends on how the project develops. The amount of work was huge for 2 weeks, but after that, everything settled down”, “At some point, everyone said their requirements were the priority. Working on everything at the same time made me feel like I was not doing progress in any of the tasks”. This kind of answers could mean many different things. People may not be able to complete their tasks in time due to a lack in technical knowledge or employees may be lacking soft skills to manage and prioritize tasks. This situation would have to be analyzed deeper to understand the root cause of the issue.
The following questions focused on the tasks assigned to the employees, how clear they tend to be, the difficulty level perceived, how important they are for the project, and if workload was distributed correctly among all the team. For these questions, most of the people said the tasks were well defined, that the difficulty level was good for their level or easier than that, everyone perceived their tasks to be important for the project, and the workload was well distributed within the team. As the seniority level of the employee increased, tasks tended to be more ambiguous and acceptance criteria was not well defined. 2 people working on the same area said their tasks were not clear and felt like the workload was heavier for them than for the rest of the team.

The next question was very important for the research. People were asked if they thought they would have development opportunities within the project. The same people who were doing tedious repetitive tasks said they did not see many growth opportunities within the project. “Regarding innovation, I do not see many opportunities. We are the workforce, we may find week spots, but we will not be the ones solving the issues”. People who answered similarly may be willing to quit the project sooner than others, so they should be prepared when the time comes to start doing technical interviews for new projects.

On the other hand, people who seek professional development within the project would benefit from having aids that allows them to be prepared for new challenges within the project. “Right now, they are using old technologies, but there are several proposes to migrate some systems to newer frameworks. We would developer further if we go ahead with the migration to newer technologies”.

56
The following questions were about the supervisors and their relationship with them. Everyone interviewed said that the managers were well prepared to complete their job; the communication between them and the employees was good and fluid; and most of them recognized the achievements in the project. People who did not feel know if managers recognized achievements were unaware of it because at this point, they still have not accomplished any major goal in the project.

Knowing what problems employees detected within their projects was important. There were many problems identified, like the fact that client systems tend to fail a lot, missing documentation for the systems causing delays in development and maintenance tasks. However, the answer that was most repeated was the difficulty to communicate with team members working from offshore in a different shift. “The time difference causes that a whole day needs to pass before an issue can be solved. If we had someone with more seniority on this side, we would be able to deliver more quickly”. Employees may not be used to work with people on a different time zone, this might be solved by providing some guidelines for this work structure and some suggestions. All this could be part of a course.

In order to solve the problems, people suggested having a manager or more people on onshore side to be able to complete tasks more easily. Also, they would like to try some tools for organizing tasks and share them with the rest of the team, so they are able to continue where other employee left.

Another important issue that one of the employees reported was the necessity of working with a set of tools that were not specified in the role description, but that were required to complete some tasks. “I was requested to work on a tool which I was not
familiar. It seems like every other team in the project is using that as well, but for them other people take care of that”. This answer is interesting because despite being the only one complaining about it, other employees may have the same issue later. If we were to take a proactive approach to this issue, we would train people on this set of tools so they can raise their hand and take on new tasks, providing more value to the client. There might be more tools, skills or software which are not well known and that are not listed in the role description but that would help employees have a better performance in the projects.

During the development of this phase, the world was suffering from the pandemic caused by Covid-19. For this reason, managers were interested in knowing how this situation was affecting employees’ performance in the project. After knowing the results of the interviews conducted, the managers of Project A decided to send a survey (See appendix B) to everyone in the project to measure overall satisfaction in the project and try to identify any attrition and act consequently. Questions in this survey used a Likert scale where 1 was completely disagree and 5 completely agree.

Due to confidentiality concerns, the complete results were not shared for this research, but some insights were given by the financial manager of Project A. For this survey, 200 out of 250 people answered. Around 80% of the people are feeling good in a personal scope, answers were mostly 4’s and 5’s. Just 14 people in the project answered 1’s and 2’s. The survey was anonymous but everyone in the project was invited to talk with the managers if they were having any kind of problem to see if there was something The Company could do to help them. In a similar way, most people said they were comfortable with the support The Company has provided during this time.
The main issue found in this survey was the amount of pressure employees felt in the project. This means that performance issues could be caused by the lack of time and priority management skills of the employees. These are some soft skills in for which the professional development area could provide courses and talks so that employees could share their experiences with others.

After analyzing the first set of interviews and survey, we were able to understand some of the major issues that employees had doing their job. Most of them were focused on soft skills, like time and priority management, or working under pressure. Even though these insights give valuable information about which skill could help employees perform better, at this point we have not gathered information about technical skills trending within projects which could help employees be more effective and be able to take on task that were out of their scope before.

In order to accomplish this goal, another set of interviews were conducted with people with more experience within the Company. The main focus for this interview was finding out what technical knowledge was essential for most roles in a project and which most time are overlooked in the role description used by the recruitment team uses to fill vacancies.

The participants for these interviews were employees who have been working in The Company for at least two years and who have the level of a team lead. Five employees were interviewed, all of them were part of the Backend Technologies department. As the interviews were focused towards technical skills, we had to exclude employees from different departments as the technology stack used by other technologies could be highly different.
First, employees were asked to name a few technologies they have used in previous projects and that were not listed in the required knowledge for the role. People named several obscure technologies that companies decided to try in a couple of systems but were not convinced enough to implement the same in more systems. Also, some of the technologies used were specific to the industry or activity of the client. For this kind of technologies, documentation tend to be difficult to find outside the organization and it is harder to find subject matter experts who could provide training for other employees. Also, clients tend to have documentation and training on said technologies already prepared for the onboarding process of the employees. “In the last project I was involved, the client had a weird way of working on older systems and deploying new versions. The system was developed within that organization many years ago and it was only used by them”.

There would be no point in developing training courses for this kind of technologies as clients already put much effort in preparing new resources, so we tried to guide the conversation to technologies employees were expected to know already. In this case, most of the answers we got from the employees were related to how systems or services were managed and deployed within the clients’ infrastructure.

Knowing how to debug an application, understand in which point of the deployment process a system could be failing, or the use of monitoring tools for managing the services and resources managed in a system were the main subjects discovered in these conversations. “Managers expect us to know how to find errors within a log file, getting information of a deployment, and being able to seamlessly deploy new versions of the systems. Most of the time this is not listed in the role description”
Some of the most common tools used by employees on a daily basis are Unix command line tools, scripting tools to automate processes, the basic use of database and querying information. These tools have been used in software development for a long time and people are expected to learn how to use them as they learn how to code. However, knowing the best practices and the correct use of these tools could highly increase the performance of employees. This could be an opportunity to create training activities. The main challenge for this would be finding the right level of complexity for the courses, as we would need to determine which are the most useful characteristics and tools which employees tend to ignore.

Another topic raising in popularity is the use of orchestrating systems which are used to handle the deployments and resources used in a system. With the rise in use of micro services, the management complexity was increased as we would have a standalone deployment with multiple configurations for each service deployed. Many clients have started using this kind of systems in newer deployments, however within some clients there is a trend to start migrating older systems to micro services architecture.

Being one of the most important trends in the latest years, clients expect our employees to be already familiar with this kind of systems and to know how to set up new projects, troubleshoot and maintain existing systems. As with the tools previously mentioned, the correct use of the tools and knowing some tricks could help employees achieve the best performance.

To round up the second set of interviews, the employees were asked what were the main traits that make a candidate stand out from the rest. Most of the answers for this
question were related to soft skills rather than technical skills. “I tend to look out for leadership abilities as they are most likely to grow in the role than those who does not have them”. Team leads seem to believe that technical skills are easier to be taught than soft skills. “I still think that the most important skill candidates need is good English language knowledge. As it is the main language in which teams and clients communicate it is essential to get a complete understanding of requirements and tasks”.

Gathering all this information and opinions from several employees at different career levels help us understand what skills employees need to perform well in a project. It seems people tend to put more emphasis on soft skills than on technical skills. During the first set of interviews employees were more worried about the pressure they were subject or the communication with the rest of their team; and during the second set of interviews, team leads mentioned that soft skills were what make a candidate stand out from the rest. Knowing this, it is evident why the Company has invested so much resources into soft skills development using both learning platforms and on-site activities or programs to develop language and leadership skills.

**Improving actual trainings**

Before we started thinking about new training activities, we would need to analyze the activities we are already carrying out. Understanding the impact training activities have on the employees help us measure how successful activities are. There would be no point in giving a large number of courses throughout the year if they are not well received by employees or if they are not really helping employees perform better.

Most of the training activities which are given by the department have similar characteristic. One of the main concerns for these activities is allowing the greatest
number of employees participate even if they are not in the same physical location as the presenter. For this reason, almost all activities are held remotely using teleconference software. This allow people to take classes on different technologies, held conversation clubs, listen to someone sharing relevant experiences, among other activities.

When analyzing the actual process for giving a training course or webinar we came to know that there is no standard process implemented to measure the impact or the satisfaction with the course. Actually, control is only done through the inscription form where employees register for the course. Even though this information could help us understand the interest employees have on certain topics, at this moment there would be no way to measure the impact or satisfaction with the course after it was completed.

The first proposal done regarding the training activities was to send out a satisfaction survey once the course have finished to measure how well prepared the presenter was, the perceived relevance of the topics reviewed, the confidence employees have to implement the acquired skills in a real project, among some other indicators. This information would be useful to evaluate the presenters, find out improvement opportunities, and determine who impactful the activity has been in the employees' job.

As this proposal implied no real change in the way activities were prepared and the schedule planned for them, the proposal was implemented right away. A standard set of questions were designed for a survey which would be sent after the course was given. The main goal of this questions was to address multiple characteristics of the courses given, like the instructor preparation for the course, the relevance of the topic in the daily job of the attendants, the quality of the course material provided, and the confidence people have to implement the newly acquired knowledge in a real project.
The first attempts of this initiative had troubles with the response rate, for a course where 35 employees registered, only 11 of them answered the survey sent to their emails. However, as this activity becomes a standard in all courses given by the department, it is expected that response rates will increase.

Potential training solutions

The last step in this process was developing proposes for new training activities we could implement in the Backend technologies department of The Company. Taking the insights learned during the interviews and surveys, we were able to understand what the main concerns for employees, leaders and managers were, and we would be able to design activities to address them.

Based on the data analyzed during this study we see that the skills that recruiters and team leads seek in an employee are mainly leadership and communication skills as technical skills are seen as skills that can be taught more easily.

The Company has invested a considerable amount of money in tools and programs to develop communication skills across the organization. Online tools help employees learn and perfect their skills in foreign languages. Also, the backend technologies department has implemented several training activities focused on developing proficiency in English, like conversation clubs with weekly sessions in which employees learn formal communication skill in a practical way.

Regarding these activities, the proposed improvement is to implement the same evaluation process, similar to the evaluation implemented with the technical training courses. The difference with these activities is that the conversation clubs are meant to be a continuous activity carried out throughout the whole year. In this case, we should
define an evaluation period after which the survey should be sent to the participants. The initial proposal would be to set evaluation periods of 3 months, having 4 evaluations per year.

The other main skill seek out by team leads and recruiters is leadership. The Company has implemented a global program which thrives to develop leaders within the organization. This program’s focus audience are employees who are proposed for management roles within projects or within the organization. This means that most of the employees are left out of the main activities within the program. Other training activities are available in the online learning platform used by The Company, but most of the leadership courses of the program have a tuition fee which drives away most employees looking to develop that kind of skills.

The proposal to develop leadership skills within the organization would be to take the knowledge provided in the Company’s global leadership program and share it with the rest of employees that are interested in developing their leadership skills. This would require someone, who has already participated in the program, to share the main insights and help other employees understand the core concepts through examples or other activities. This could be part of the training courses given within the year, having two or three runs each year to allow employees participate if they were not able to do so during the first run of the course.

These leadership courses would be subject of evaluation as well to understand the impact it is having with the employees. Also, there would be a strong need to keep the course material fresh and updated to provide everyone new knowledge or experiences even if they have taken the course in previous years.
Finally, we would still need to pay attention to the main technical skills projects are demanding so that employees can create value to the clients since the beginning of their assignment. People should be able to create high quality solutions in an efficient way and understanding the core concepts on which the technology is based is paramount to do so.

Based on the interviews with the team leads we concluded that the main technology that is driving the Backend technologies department are the microservices. We have identified three main dimensions of microservices development and maintenance where we can focus the training efforts. The programming language used, the framework on which the microservice is built, and the container or system in which the service is deployed and managed.

First, the base programming language in which the system is developed is the core part where the business logic is implemented. The importance of this knowledge lies on the ability of the programmers to create robust systems that provide the expected results each time and reduce the amount of errors that occur during the system operation. Several courses are given throughout the year to teach employees the best practices to create code and ways of coding that prevent the occurrence of errors. The only suggestion on this kind of courses would be to evaluate the results and to focus on maintaining the employees up to date with the latest version of the language.

Next, there are several frameworks used to develop microservices. The main goal of the frameworks is to provide a basis on which to build the business logic for the systems. In this way, the framework is responsible of managing the machine resources and the process flow so that programmers can focus on providing the expected behavior
in the service. There are core concepts of each framework which employees need to know to make good use of each of them. Understanding how a framework works is crucial for developers to use the available components at their fullest and prevent unexpected behaviors in an application. Courses for these technical skills have been given within the Company as well, the main concern with these courses would be their complexity level. The proposal for training activities on frameworks would be to at least have two different complexity levels, the basic one in which people learn how the components are used to create an application, and an advanced level where people get to know how the components work within the framework to make the most out of each one. Also, the courses should be focused on the use of the frameworks in the development of microservices.

The last dimension we mentioned is the container or system where the service is deployed. This is the most neglected part of the development process, so efforts should be made to develop training activities that help employees know the trending systems and how to use them properly. The proposal for this part is to create a training course focused on the preparation and deployment of a microservice in one of the most used systems in the market. This would be focused on the actual process to deploy a service and how to use the tools available within the system to troubleshoot it, give maintenance, and deploy new versions of a service. Training activities should simulate the way microservices are deployed and maintained in a real project so that employees are able to support the client in ways other than just writing code.

Finally, the most important suggestion we would need to keep in mind is to remember that we are dealing with adult learning in any of the training activities that would
be implemented. As Mukerjee (2019) suggested, we need to use more frequently hands-on training in the form of simulations, special projects, and roles rotation. Training activities should be designed with this in mind, trying to implement project simulations so employees could learn by doing.

**Table 3: Training solutions proposals**

<table>
<thead>
<tr>
<th>Area</th>
<th>Actual state</th>
<th>Proposed improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process evaluation</td>
<td>Not implemented at the moment</td>
<td>Implement satisfaction surveys after the course completion. Evaluate the instructor preparation before the lecture, the quality of the material used during the course, the employee's satisfaction with the course, and the impact the course had on their job.</td>
</tr>
<tr>
<td>Soft skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leadership</td>
<td>Sporadic workshops to develop leadership skills</td>
<td>Develop courses where people enrolled in the Company's global leadership program share the knowledge with the rest of the department.</td>
</tr>
<tr>
<td>English communication</td>
<td>Several conversation clubs going on with no evaluation</td>
<td>Implement a similar evaluation process with time frames of 3 months</td>
</tr>
<tr>
<td>Technical skills</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Programming language</td>
<td>Several courses for beginners and for intermediate levels. No evaluation performed right now</td>
<td>Implement the evaluation process proposed and focus on the use of the languages in the creation of mS. Introduce courses for other programming languages focused on mS development.</td>
</tr>
<tr>
<td>Frameworks</td>
<td>A couple of courses focused on one of the main frameworks used to develop mS. The complexity level tend to be low</td>
<td>Implement the evaluation process proposed and focus on the use of the languages in the creation of mS. Introduce courses for other frameworks used by clients. Introduce intermediate level courses to explain concepts that are more complex.</td>
</tr>
<tr>
<td>Deployment environment</td>
<td>One course planned to explain the basic concepts in the deployment of mS in the most used platform</td>
<td>Implement the evaluation process proposed. Develop courses of different complexity levels to explain the basics and then deepen in the knowledge.</td>
</tr>
</tbody>
</table>
Chapter 5: Discussion and conclusions

Introduction

Software development is one the most rapid changing jobs in the market right now. Technology evolves at huge steps every year and it is compulsory to be up to date with the latest trends to provide clients with the high-quality solutions they expect from The Company. For this reason, the professional development area of the Backend technologies department has the important task to prepare employees for any project or requirement a client could have and allow employees to develop their knowledge and skills within the organization providing both the client and The Company more value.

The main problem the Backend technologies department had was the amount of time employees spend without being assigned to a client’s project. The only assets the Company has are its employees, and as the Company still pays employees their full salary even though they are not charging hours for any client project, the operational efficiency is primordial to maintain a steady economic growth for both the department and the whole organization.

Objectives conclusion

The main objective for this study was to provide training suggestion based on investigation with the final goal of reducing the amount of time spend by the employees without being assigned to a project.

With the implementation of a training needs analysis within the organization and the Backend technologies department, we were able to understand some key points about the characteristics team leads and recruiters think that make an employee stand
out when looking for a candidate for a role. The main conclusions extracted from the interviews with the team leads are:

- Soft skills are more important than technical skills during the recruitment process.
- Technical skills are considered easier to be taught once the person is assigned to a role.
- The most important skills for an employee to have are communication skills and leadership skills.

These points are not only important during the recruitment process. Helping employees develop soft skills would allow them to perform better at their job and would give them more visibility within the project, opening more opportunities for their professional development.

During the interviews with the team members, and in the survey sent to the employees assigned to the biggest project of the Company, most of them expressed their concern regarding the pressure imposed by the managers, not being able to prioritize many tasks assigned to them, and the continuous attrition caused by doing monotonous tasks during large periods of time. Soft skills can help employees reduce the burden caused by these problems. They would be able to communicate their discomfort with the amount of work and pressure and take action to lead innovative proposals to automate or improve on the tedious tasks.

However, soft skills are not the only dimension of the job, employees must also develop technical skills to be more efficient and productive in their daily activities. Some tasks could be tedious if one does not know the right tool to use to solve a problem, or pressure could be increasing on us if we are not able to deliver technical requirements
due to the lack of knowledge. There are several points on which technical knowledge can improve significantly the quality of the work delivered by the employee and make the tasks assigned to them more enjoyable.

Once an employee is assigned to a project, the Company should not stop taking care of their professional development. Poor performance could make an employee be discouraged about their role and to start looking for different opportunities where their skills could be put at a better use. In the best case possible, employees would quit or be removed from their role within a project and find another role within the organization. However, most of the time, employees who are removed from their roles tend to struggle in finding a new position quickly. In the worst case, the employee quits the Company completely leaving a vacancy that needs to be occupied as soon as possible, and the new employee needs to get trained for doing the tasks left by the previous person, but people require time to get up to speed with the other members of the team. In general, what this means is a lot of money for the Company as it would need to invest in recruitment and training.

Helping employees develop technical skills that would help them do a better job is really important for The Company as it prevents some of the attrition that employees could experience. Alongside soft skills, the Company should help employees remain updated with the latest trend in technology.

Based on the interviews, the most important technical knowledge for a backend software developer is the use of microservices. As the main trend in the market, most companies have started the transition towards microservices architecture within their core
systems. Their reliability, portability and scalability have made microservices the main choice for most companies.

In order to make employees proficient in the development and maintenance of microservices, there are three main parts we need to address within the technical training:

- The correct use of the base programming language in which the business logic is developed.
- Knowledge of the frameworks on which the microservices are built on.
- The deployment process and maintenance tools used to ensure the correct function of the microservices in a productive environment.

All these points could be covered with training courses, project simulations and other kinds of hand-on training. Interactive activities in which the employees learn by doing are best suited for adult learning and would be most beneficial for most of the employees.

Courses and other training activities would have to be evaluated continuously in order to identify potential improvements and correct flaws within them. Employees should be asked about how well they are understanding the concepts in order to apply the knowledge in a real project. The main goal of the courses should be that employees develop the abilities to provide clients with value and allow them to move forward in their professional careers and gain a sense of accomplishment for the job they do.

The implementation of the proposed training activities is out of the scope of this project and would be managed as a separate effort. So, the evaluation of the impact this investigation and proposals will have to wait until the implementation of the proposes is done.
Discussion and next steps

The main challenge faced during the project was the availability of information and data. The only person who is allowed to have all the information about the unassigned employees is the department manager. To be able to use the information in this project, data had to be extracted and masked from private reports to be compliant with all the data privacy policies. Also, within the Backend technologies department, there is a strong lack of evaluation in the processes that are already in place. This makes difficult to evaluate the impact any innovation project could have. The main problem with this is the fact that employees responsible for managing the different areas of the department do it just partially while also having roles within client projects. However, a standard evaluation processes could be implemented for the professional development area to understand the actual impact of the activities being held.

Also, the strong concern of the Company with the data privacy limited greatly the amount of information we could get from employees and projects. This would have to be considered for future projects when defining the evaluation criteria and the input that would be needed for its completion.

Despite all the challenges faced, this project demonstrated the importance of understanding the concerns of the employees, their challenges and ideas. A training needs assessment helped us explore many different facets of the organization and understand the main issues that could be addressed with training. Training activities should be designed based on the necessities observed and should be help the organization reach the business goals set.
Having said that, the next step for this project would be to implement the training activities proposed as well as the evaluation process designed for the professional development area. The training activities would be implemented at the start of the next fiscal year, in September, and course evaluation will be held after the completion of each course. There will be strategic meetings at the end of each quarter to analyze the training activities implemented and to plan the activities that would be held next.

Finally, the process followed to perform the training needs assessment should be executed at least once a year to identify possible changes in the business strategy, the trends in technology, and the needs of the employees. This will help employees achieve the professional development they deserve and help the Company create more value for their clients.
References


Appendix A: Performance Interviews

1. What do you like about the job you do in the project?

2. What do you dislike about it?

3. Do you understand the tasks and goals assigned to you?

4. What is the difficulty level you perceive in the tasks assigned to you?

5. How important do you think your job is for the project?

6. How is the workload distributed among the team?

7. What opportunities do you see for professional development within the project?

8. How is the relationship between you and your manager?

9. How does your managers react to your achievements in the project?

10. How do you evaluate the skills and capacities of your managers?

11. How is your relationship with the rest of your team?

12. What problems do you detect in the project?

13. How would you solve those problems?
Appendix B: Project Satisfaction Survey

1. How have you felt in a personal scope during this contingency?
2. How have you felt in a family scope during this contingency?
3. What is the level of impact Covid-19 has had in your health?
4. What is the level of stress you are feeling in the project?
5. Have you had infrastructure issues?
6. Have you felt support coming from The Company to help you complete your tasks?
7. Have you felt support coming from Project A to help you complete your tasks?
8. Have you felt support coming from your local managers to help you complete your tasks?
9. How good have you balanced your personal life with the job during this time?
Appendix C: Course evaluation survey

For the following questions, select how much you agree with the statements.

Scale used:

A. Strongly disagree
B. Disagree
C. Neutral
D. Agree
E. Strongly agree

Regarding the sessions given by <Instructor’s name>:

1. Was the instructor well prepared for the lecture?
2. Did the instructor care for the students and their learning?
3. Did the instructor complete the course according to the initial plan?
4. Was the course material relevant and with an adequate level for the course?
5. Did the teaching techniques aid in my learning?

In regard to the course as a whole:

6. Did the course increase your interest in the technology/area?
7. Are you confident enough to apply the acquired knowledge in a real project?
8. Did your understanding of the topic increased thanks to this course?
9. Was this course better than others in which you have participated?

Open questions:

10. What made this course better or worse than other courses?
11. Are you near your roll-off date or unassigned at this moment?
12. What is your recommendation to improve the course?