



**Activity Modeling in practice:
a case-based guide to human-centered software engineering**

PROJETO DE MESTRADO

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MESTRADO EM ENGENHARIA INFORMÁTICA



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i | Abstract

The purpose of this study was to identify whether activity modeling framework supports problem analysis and provides a traceable and tangible connection from the problem identification up to solution modeling. Methodology validation relied on a real problem from a Portuguese teaching syndicate (ASPE), regarding courses development and management.

The study was carried out with a perspective to elaborate a complete tutorial of how to apply activity modeling framework to a real world problem. Within each step of activity modeling, we provided a summary elucidation of the relevant elements required to perform it, pointed out some improvements and applied it to ASPE's real problem.

It was found that activity modeling potentiates well structured problem analysis as well as provides a guiding thread between problem and solution modeling. It was concluded that activity-based task modeling is key to shorten the gap between problem and solution. The results revealed that the solution obtained using activity modeling framework solved the core concerns of our customer and allowed them to enhance the quality of their courses development and management.

The principal conclusion was that activity modeling is a properly defined methodology that supports software engineers in problem analysis, keeping a traceable guide among problem and solution.

Keywords: activity modeling, problem, analysis, solution.

ii | Acknowledgments

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1 | Introduction

Motivation

Since it begun, software engineering methodologies are constantly in evolution. Year after year, new methodologies, new approaches, new structures are introduced. However, within the current days, many software developers tend to forget the most important aspect: end users and what they want. It is common practice, among software engineers, to think about the problem with a solution in their minds. When approaching a problem, their first thoughts are what technology, what structure, what programming language will they use for the solution, etc. These aspects are relevant for the solution but they should not be the initial concerns and they should always derive from proper problem analysis.

Structured problem analysis is key to achieve a proper solution (^[27]Yourdon and Constantine, 1979). Without well grounded knowledges about the problem, even the brightest software engineer will not be able to come up with the adequate solution. A human-centered software engineering approach is crucial to understand all the interveners of the system/process as-is and how it is done.

Our goal within this project is to study a methodology that focus on providing, to the end user, a solution to the problem that regards not only on the technology used and the functionalities it has, but also on how and why it supports the process as-is problem(s) as well as how the solution interface supports the interveners needs.

In 2006, Engineer Larry Constantine introduced a methodology activity modeling which focus on the integration of Activity Theory and Usage-Centered Design, with the main goal to establish a structured methodology for problem and solution analysis. It also encourages participatory design strategy, i.e., it promotes interveners to be involved in the process analysis.

Within this work, we merge efforts with a Portuguese teaching syndicate (our customer), analysing their structure resorting on activity modeling methodologies and presenting solutions to their real issue, inherent to courses development and management.

During this work, we apply, validate and build a complete guide of how to properly use activity modeling as well as iterate some of its techniques.

Approach

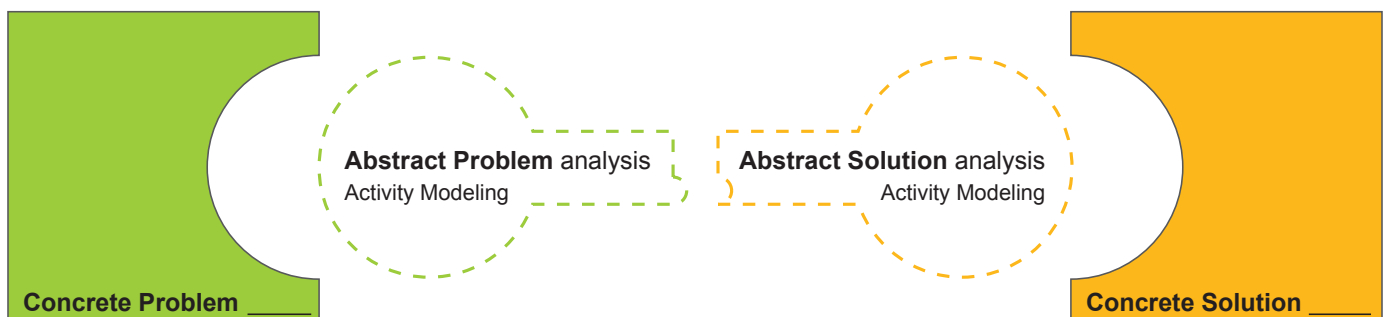


Figure 1. Project structure.

Accordingly with the structure above (Figure 1), the first instance of this project regards on the identification of our customer background and an initial concrete analysis of their process. After being introduced with our customer's structure and problem, we identified our customer's business goals, to achieve with the solution.

Nextly, resorting on activity modeling framework, we abstract the our customer's problem to identify the activities, tasks and external actions that compose it as well as understand how the interveners use tools and artifacts within it.

After problem abstraction, we achieve an overall look on the problem, serving as input for the following steps regarding the abstract solution. The output of the previous step will serve as the starting point for the development of the concrete solution, the last step of our project's approach.

Structure

Accordingly with the approach mentioned above, our project starts with a chapter dedicated to identify our customer's background, concretely analyse their process and define the business goals to achieve with this partnership.

Problem abstract analysis is the following chapter. It starts with a concise definition of the activity modeling background followed by a resume of which steps compose the methodology framework. Within this chapter we apply each step of activity modeling, providing a explanation for each one of them and the proper application to our customer real problem.

All the information identified in the earlier chapter serves as input for the fourth chapter, were it is established the solution strategy, as well as applied each of it's steps in order to effectively develop an adequate solution.

Fifth chapter sums up the achieved results followed by future iterations, defined under chapter six. The following and last chapter covers the conclusions of this project with an overview of activity modeling methodology application and the solution evaluation.

Abbreviations

ASPE - Associação Sindical de Professores e Educadores

CCPFC - Conselho Científico e Pedagógico de Formação Contínua

CFS - Centro de Formação do ASPE

CMS - Content Management System

DB - Database

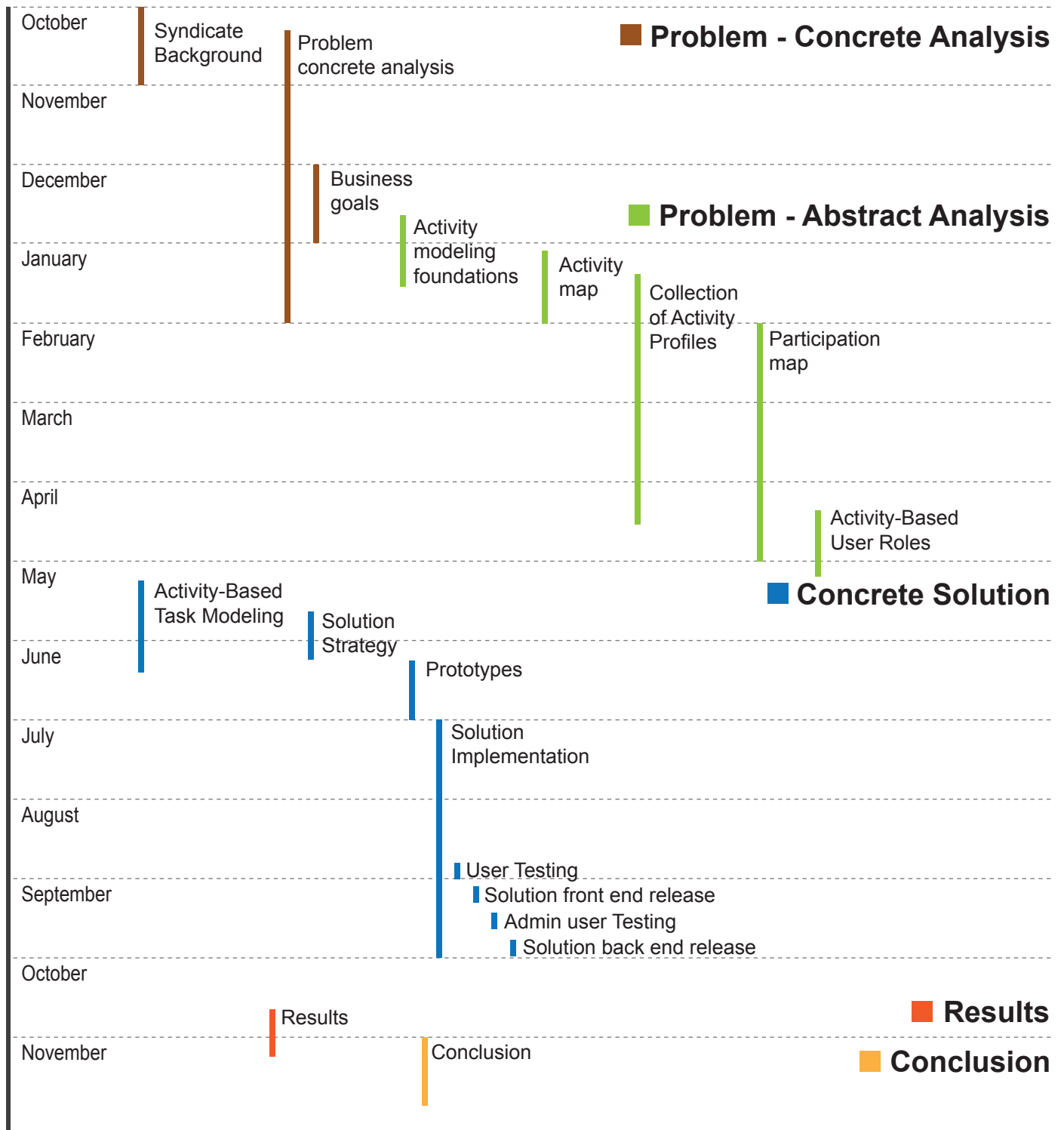
HCI - Humam Computer Interaction

KPI - Key Performance Indicators

RAM - Região Autónoma da Madeira

Workplan

This project followed the schedules shown below. Its analysis should have inconsideration that this project was developed in a working student perspective and this did not allow us to work full days, throughout the 14 months of its duration.



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2 | Problem - Concrete Analysis

Background

In order to effectively test activity modeling methodology, we merged efforts with a Portuguese syndicate, ASPE (Associação Sindical de Professores e Educadores), which can be translated as Syndicate Association of Teachers and Educators.

For privacy reasons, the name of our customer is fictional. Despite that, all the analysis we present during this work is from a real teaching syndicate.

ASPE is a nonpartisan and totally independent syndicate. Their leaders see syndicalism in a logic of service, working daily to meet the needs of educators and teachers of all levels and degrees of education. Their main goal is to unite the teaching class and give them back their dignity and projection they are entitled. To support daily activities, the syndicate is structure in three departments:

- Legal Department
- Pedagogical Department
- Courses Department

Within each one of these departments their members offer personalized care in first hand to all the associated members, although never disregarding the other educators and teachers. As is common sense, the syndicate provides feedback firstly to his members and only then to other elements, if the information does not require consultation of the legal department which is an exclusive service for members. The two main departments are the legal and courses departments. Within these, ASPE serves a high number of educators and teachers daily. However, between them there is a significant difference of the amount of interveners since the legal department is exclusive for members while the courses department is open to all the teaching community - educators and teachers.

The continuous growth of this syndicalist union led to some unadapted processes, in the way that they could be more effective using simpler processes and some other techniques that can be supported using the latest technologies. Leaner processes would allow ASPE to continue growing and support even more educators and teachers.

The syndicate has is headquarters in Porto and the continuous growth allow them to expand their branch to Aveiro, Baião, Barcelos, Braga, Guimarães, Leiria, Madeira, Póvoa de Varzim, Santarém, Valença and Viana do Castelo.

For this project, we merged efforts with the leaders of ASPE Madeira. After some meetings we reached to an understanding about what area should we embrace for this project.

Our customer is already well known by the high quality of courses organized throughout the year. However, within the hard context of economical crisis that Portugal is currently facing, too many teachers are flooded with excessive work responsibilities and started disregarding the need to update their knowledge. Their tight schedules let out of their minds that a teacher is obliged to do fifty hours of formation per evaluative cycle.

Having these items concerns, it was decided that the higher problem ASPE would like to address is the process inherent to courses development and management.

After various meetings with the team members of ASPE Madeira, we realized that the actual process has a lot of dependency between each step. Therefore, we decided to follow the idea presented by Brian Hayes “You cannot think outside the box when you are trying to represent a box” ([5] Constantine & Lockwood, 2005) and with that ideology guide, we explain below the process as it is, for each step and concrete problems found, if applicable.

Organization Note: The steps of the process below are define with the following structure:

Step “X”. “Name of the step” “(interveners)” “Observations and Problems found”.

Step 1. Outline courses plan; (syndicate staff)

The initial step to develop courses, is planning what courses to develop. To support decision making, ASPE relies on statistics of enrollments from previously developed courses, as well as inquiries gathered from the teaching community.

Our customer conveyed to us that there are some issues regarding the statistical documents. They are made and updated manually using Excel and the main concern is that, due to time constraints, sometimes these documents are not always up to date.

Despite that, they have been planning courses with this methodology, providing a good courses plan to the community.

Step 2. Create advertisement of courses plan; (syndicate staff)

The first step of this process (step 1), produces a draft of the courses plan, composed by all the necessary information but without any graphical attention. This step regards graphical presentation enhancement and is only performed by a specific member of the team.

Step 3. Create/edit enrollments form; (syndicate staff)

To this point, our customer offers their clients the possibility to enroll in courses using an online platform. This platform relies on Google for a large group of functionalities. Enrollments forms are created and edited using Google Forms. The main issue that concerns our customer is the limited customization available within this service. These constraints acted until now as a barrier to achieve easier and error free enrollments forms. Further down, we point out some issues directly related with the lack of customization.

Step 4. Customize enrollments form link; (syndicate staff)

To access the forms previously mentioned, Google Forms has embedded functionalities that provide an URL. However, it is too large and very difficult to distribute to clients. To overcome this constraint, ASPE team uses another functionality called Google URL Shortener, allowing them to create shorter URLs.

Initial link example: <https://docs.google.com/spreadsheets/viewform?formkey=dHEzRXc4UUNpRGVfX1piN0xoVWdDWIE6MA>

Shrunken link example: goo.gl/GviW4

Despite this, every time ASPE advertises courses with the shrunken URL to allow access to the enrollments form to new courses, many of their clients complain that they cannot access it. After some time our customer acknowledged that the main problem with the shorten URLs is that applicants disregard that the link is case sensitive. This actually resulted in a large number of calls for help.

Step 5. Advertise courses plan; (syndicate staff)

Courses under enrollments are advertised using three different methodologies, namely:

- broadcasting using the syndicate contacts database;
- courier to schools and teaching delegations;
- within the national website.

However, each one of these approaches have problems. Since our customer uses a standard gmail account, email broadcasting is hard due to the limitation on the number of email messages it can send per day. Courier advertisement is very time consuming to prepare and is a paid service. Regarding the national website, its back-end platform is badly developed and to insert advertising elements is very time consuming.

Step 6. Make enrollment in course(s); (Educators and Teachers interested on the courses: from now on, referred as applicants)

Within course development, our customer goal is to provide to their clients a simple platform to perform enrollments. As we mentioned before, Google Forms limited customization turned it into a hard task. We present bellow some examples of the current form and point out the most relevant constraints after.



Figure 2. Small email field.



Figure 3. Larger email field.

Ação(ões) de formação: *
Indique as formações nas quais se pretende inscrever seleccionando a opção "Efetuar inscrição". Assinale com "Não efetuar inscrição" os cursos nos quais não se pretende inscrever. Para mais informações consulte o Plano de Formação RUMOS de setembro a dezembro de 2012 em <http://goo.gl/1zMzF>.

	Efetuar inscrição	Não efetuar inscrição
<p>Ação: Plataforma Moodle no processo de Ensino/Aprendizagem Formador: Duarte Nóbrega Local: Escola Básica e Secundária Gonçalves Zarco Duração: 35 horas • 27 de outubro de 2012, das 9 às 14h; • 3, 10, 17 e 24 de novembro de 2012, das 9 às 14h; • 1 e 8 de dezembro 2012, das 9 às 14h. Destinatários: Acreditada pelo Conselho Científico e Pedagógico de Formação Contínua com 1,4 créditos para Professores dos Ensinos Básico e Secundário e Professores de Educação Especial. Inscrições até 14 de outubro de 2012</p>	<input type="radio"/>	<input type="radio"/>
<p>Ação: Práticas de Supervisão Pedagógica Formador: Rómulo Neves Local: Escola Básica dos 2.º e 3.º Ciclos Dr. Eduardo Brazão de Castro Duração: 25 horas • 27 de outubro de 2012, das 9 às 14h; • 3, 10 e 17 de novembro de 2012, das 9 às 14h; • 1 de dezembro 2012, das 9 às 14h Destinatários: Acreditada pelo Conselho Científico e Pedagógico de Formação Contínua com 1 crédito para Educadores de Infância e Professores dos Ensinos Básico e Secundário. Inscrições até 14 de outubro de 2012</p>	<input type="radio"/>	<input type="radio"/>

Guidelines of how to make the enrollment

do not enroll in this specific course

enroll in this specific course

Details about the course

Figure 4. Enrollments form - available courses to enroll.

From the examples shown above, as well as field by field analysis of the enrollments form, we were able to identify a vast group of issues, which we will enumerate below:

- Online enrollments form is too large and applicants need to scroll a lot to see all the information. Enhancing this issue is the need to show course details within the form.
- The form is organized in such a way that users are asked to introduce all of their personal data before even choosing or seeing the list of courses available. Therefore, if users do not check previously if there is a course they want to enroll, they may fill their data in vain.
- Without scrolling, users cannot see if there is any course they intend to enroll;
- None of the fields have validation, apart from the required field validation. However, this validation is very simple to overcome. Adding a single character, even if it has no meaning, fields get validated;
- Applicants that already made courses with ASPE need to insert all their data again when enrolling to a new course;
- Form does not have support documentation. These help mechanisms are included as tips across the form (for an example see Figure 4);
- Google Forms does not allow managers to insert pictures in the form;
- Google Forms offers two type of text fields. One is too small (see Figure 2) to fit an email and the other (currently in use) is too large (Figure 3). Although it confuses users, due to its oversized appearance, ASPE team uses it because users can at least see what they wrote.
- Another issue directly related by the lack of customization, is the inability to set default option values. Consulting Figure 4, this affirmation becomes clearer. Users are obliged to select, for each course, if they want or not to enroll on it.
- Still regarding the example shown in Figure 4, users tend to select only the radio box from the course(s) they intend to enroll. Leaving fields to be filled out and trying to submit it, automatically generates an error and many users needed to contact the syndicate in order to effectively see what was the problem with their enrollment.
- After submitting the form, users receive an information that the enrollment was made successfully. However, they do not have any mechanism that allows them to save a confirmation of the enrollment, edit any enrollment detail, or even cancel it;

Step 7. Manage Enrollments; (syndicate staff)

Managing enrollments refers to consulting enrollments per course and providing clearance to make enrolls, in other words, open or close the enrollments form. Since the form allows applicants to enroll in more than one course and does not have any mechanism to establish priorities, its not possible to know how many applicants are enrolled exclusively in a specific course.

Regarding the clearance to enroll, the platform does not have any mechanism to schedule a date to close enrollments which obliges staff members to do it manually.

Step 8. Select applicants; (syndicate staff)

This step is the core step within which applicants are selected using predefined criteria. According with the syndicalist union team, Google Forms platform is not strong enough to deal with large amount of data generated by the enrollments. Therefore, this step is made outside this platform using Excel to perform some of the following tasks.

Tasks to select applicants:

- Download enrollments file in excel format from Google Forms;

- Sort enrollments for each course. This occurs because the enrollments are stored, in Google Forms, all in the same sheet.
- Organize applicants selection excel document, for each course. Within the file, it is created four sheets referent to: general enrollments; selected applicants; substitutes; quitters;
- Order applicants according with the predefined criteria:
 - 1st Priority: Members of ASPE;
 - 2nd Priority: Applicants that have not done any course in the present year;
 - 3rd Priority: Applicants that have done one or more courses in the present year;
- Confirm criteria for each applicant. This tasks its very time consuming because, in order to confirm the information, our customer team members need to consult courses database (external database) to check each applicant criteria.
- Select applicants to the course(s). The selection process is normally done for 3 or more courses at the same time and courses generally are coincident. It frequently occurs that applicants selected in a prior state of verification, are selected to more than one course. These cases are verified manually having in consideration that a member can be in two courses, if and only if, he can be present in both at least for 1/3 of the total amount of hours of the course. This is a demanding step in terms of attention as well as time consumption.

Step 9. Inform applicants about selection status; (syndicate staff)

Inform the applicants if they were selected or not to attend the course they enrolled. At this instance there are two types of applicants:

- Selected - selected to participate on the course;
- Non selected/substitute - not selected to participate on the course at first instance.

Applicants are informed by email and SMS to their mobile phone. The main problem with this step is that to send SMS to every applicant is very time consuming. To avoid costs, applicants with TMN network are informed using ASPE TMN phone and the same principle is followed for applicants with Vodafone numbers.

Step 10. Confirm interest in course via email, phone or SMS. (selected applicants)

Each applicant is responsible to confirm his interest on attending the course they were selected. The issue regarding this step is that many of the selected applicants forget to confirm their interest and the syndicate team needs to contact each one of them to gather that information. This is a frequent problem.

Step 11. Manage substitute applicants (syndicate staff)

Managing substitutes is directly related to the confirmation of interest by the selected applicants. If one of them does not confirm his place on the course, an availability is created. This allows the syndicate team to contact the first substitute from the list. The main issue regarding this aspect is that teachers are very hard to contact due to their job policies. Other considerations are the problems found previously during step 6, which refers to applicants selection. To select a substitute, before contacting him, it is necessary to check if he is not selected to another course concurrent in schedule. This verification is made manually and when managing multiple course at once, this task becomes daunting and very hard to perform without any mistake.

Step 12. Manage selected applicants confirmations (syndicate staff)

Within step 9, selected applicants are notified that they are obliged to inform if they are

interested on attending the course until a specific date and time. Confirmations mainly come through email and to respond to all of them is very time consuming. Organization wise, the confirmations are stored in the selection file.

Selected applicants who do not inform their interested on attending the course, are penalized in a future selection. This information is stored in a excel file, gathering all the defaulters cases. The main problem with this is to update it. Since the selection file and defaulters file are not connected, updating needs to be done manually.

Step 13. Manage selected applicants documentation (syndicate staff)

As previously mentioned, selected applicants are informed via email that they are selected for the course. On that email is also referred that they are obliged to deliver to ASPE some documentation until a certain time. Documentation is mainly delivered by email and our customer team needs to confirm if it is correct and respond to the email which is very time consuming.

Selected applicants who confirm their interest to attend the course but do not deliver their documentation until the scheduled time are excluded from the course and added to the defaulters database. As explained in the previous step, the need to manually update this database is an issue.

Step 14. Create enrollment form in paper for each selected applicant (syndicate staff)

Although ASPE has their enrollments to the courses based on an online platform, due to bureaucratic obligations, each applicants must have an enrollment form in paper signed like their national identification card. To overcome this situation, syndicate team creates individual enrollment forms in paper to each one of the selected applicants, using the data they inserted while enrolling in the course.

At the beginning of this analysis, each enrollment form in paper was made one by one, using copy and paste. This strategy was very poor and obliged them to spend approximately 3 minutes for each selected applicant, which for a course of 25 members represented 75 minutes. However, a few weeks after we begun this analysis, they started to use mail merge functionality within Publisher and the time to perform this step was significantly reduced to 20 minutes.

Despite the improvement, according with ASPE team, this methodology is not perfect because the template model is changeable and after some tests we were able to check that many errors were being made throughout the interaction. Also the time reduction is only fully achieved when it is done by a specific element of the team.

Step 15. Remind learners about course schedule (syndicate staff)

In a perspective of providing learners a good support, ASPE has rooted the importance of reminding them the schedule of the course, two days before the start.

ASPE has rooted in their work philosophy that learners are pleased when they feel a relation of proximity with the course organizer. One of the actions to enforce that link is remembering learners about the course schedule, place and other relevant aspects, two days before it starts. This information is sent via SMS. The only problem is the time consumption.

Step 16. Prepare bureaucratic document for selected applicants (syndicate staff)

To develop courses, ASPE needs to follow certain bureaucratic aspects. Selected applicants need to sign a course contract to officialize their status of learner within that specific course. Although ASPE already has a predefined contract model, there is the need

to update the data for the specific course and print it for all the learners. According with the contract, it is also appended a course program that needs to be updated for each course and printed for each learner.

All of this documentation is then placed inside course folders already prepared for the effect and that will be used while opening the course.

Course folder documentation:

- Course contract
- Course program
- ASPE card*
- ASPE pamphlet*

* Documents that are equal to any course.

Step 17. Prepare bureaucratic document for formator (syndicate staff)

Still within the same bureaucratic obligations inherent to course development, formators have a group of documents to fill. At first instance, our customer team prepares the documentation and after the conclusion of the course, formator are responsible to fill out the documents and deliver them to ASPE. The documents that need to be filled are:

- Curricular Form
- Summary sheet
- Final registry of attendance and evaluation
- Final registry of learners accreditation
- Learners evaluation
- Occurrences registry
- Physical infrastructures
- Course evaluation by the formator

There is a template for each one of the documents listed above. This template is a PDF file with embedded forms, allowing ASPE team members to fill its general information (headings) only one time and they are automatically replicated for all the remaining documents. The template also allows the formator to fill all the documents electronically. However, these templates are very hard to change when there is the need to do it.

Apart from the documents already mentioned, ASPE also has a template for the formator contract, which is also an obligation for each course. They need to be prepared with the specific data. For the course opening, only the contract and the summary sheets are printed to deliver to the formator.

Step 18. Open course (syndicate staff)

This step regards the personal contact with the selected applicants in the first day of the course. This is crucial to the process because it is when the syndicate team has the ability to transmit the message of ASPE. It is also where all the bureaucratic needs are obliged. At this instance, selected applicant are required to sign their enrollment forms in paper and fill out the course contract.

The problems found in this step is that it takes at least 30 minutes to explain all the procedures and for applicants to fill the required documentation. These 30 minutes represent course time that is spent for bureaucratic needs, instead of the course itself. This timestamp is a medium value within which selected applicants fill the course contract and sign the enrollment form. Some of this time is also used to present the formator and briefly advertise the syndicate. Within this time, one member of the syndicate can even solve some other issues such as incorrect documentation to replace or other issues easily fixed in person with a specific selected applicant.

Step 19. Send bureaucratic documentation to the formator (syndicate staff)

At the end of the course the remaining documentation is sent to the formator to be filled by him. Sometimes this documentation is sent during or even before the course starts.

Step 20. Request a declaration of presence in the course (applicants or formator)

Most of the courses are developed outside working hours but, sometimes, applicants may need a declaration of presence in the course. For that effect they should submit to ASPE a

request via email. The declaration is made in cooperation with the formator to validate the hours that the specific applicant was present. The final document is digitalized and sent via email for the applicant.

Step 21. Prepare documents to close the course (syndicate staff)

Selected applicants courses and formator feedback help our customer to increment the quality of the courses they develop. The best way ASPE has to know if the course and formator matched the selected applicants expectances is through an evaluation form. This document is already built as a PDF template, with a form embedded on the headings. This allows ASPE to change it effectively according with the course intended. Another important aspect is to gather information about which courses should be developed, by educational area. Using a general form, selected applicants can provide their opinion. These documents follow the bureaucratic obligations required to course development.

The problems found on these documents were:

- Form template to evaluate the course and formator is hard to change.
- The survey of course needs has a final part that allows applicants, that do not receive ASPE courses information, to fill their contacts data and start receiving courses information. Oftentimes as the beginning of an issue, applicants tend to fill out their data despite they already receive the syndicate courses information. When updating contacts database this can result in duplicated contacts.

Step 22. Close course (syndicate staff)

Closing the course is not only a way to enhance the proximity with the selected applicants but also to gather feedback from them, as explained in the previous step.

Step 23. Organize course folder (syndicate staff)

Despite all the efforts to have the documentation before the beginning of the course, it is rarely possible to achieve this. Therefore, keeping the folder organized throughout the course development is crucial to identify missing elements. This step is done five times in the all process:

- Before opening the course: this represents the first main organization. With the folder properly organized, ASPE is able to gather information about what documents are missing. Using this information, the team member who opens the course (step 18) can talk personally with applicants and quickly solve those issues.
- After opening the course: It is common that applicants deliver missing documents on the first day of the course. Beyond that, all the bureaucratic documents that the selected applicants need to fill on the first day are organized and checked at this instance. This organization is crucial to update the selection file were we identify whether documents were delivered or not.
- Before closing the course: Selected applicants who have documents to deliver after beginning the course, can deliver it to the formator or directly to ASPE. The step when a member of ASPE team closes the course is a good opportunity to remind learners about missing document. Having that in consideration, performing a recheck of the documentation is common practice to provide a good input to the step regarding the closure of the course.
- After closing the course: At this time the organization is mostly done to confirm if the documentation is all as it should. The output of this provides input to certificates emission. Although generally it does not affect the creation of certifies, applicants can only receive their certify when their documentation is complete.

- When the formator delivers bureaucratic documentation: This verification is only regarding the documentation delivered by the formator.

Step 24. Analyse course and formator evaluation and surveys of courses needs per educational area. (syndicate staff)

As we pointed previously in step 21, selected applicants feedback is very important. However, there is no way to perform an automatic analysis to both of the enquiries (course and formator evaluation; courses needs per educational area). The manual analysis is a very time consuming task but it is important to ensure the quality of courses developed.

Step 25. Fill out and deliver applicants evaluation and all the other bureaucratic documents (formator)

After the end of a course, its formator, has one month to deliver all the documents to ASPE. This is made via email or personally. When delivered via email, the documents are final when the formator signs them accordingly with their national identification card.

Step 26. Make certificates and inform selected applicants and formator (syndicate staff)

The certificate is very important for the applicant. Remembering, selected applicants are educators and teachers who are subjected to evaluation every year. The courses they take are a part of the evaluation. Therefore, this step is very important to be performed with the highest level of correctness. The certificate for the formator follows the same principle.

At the beginning of this analysis, ASPE team made each certificate manually. This strategy was very poor and obliged them to spend approximately 7 minutes for each learner which for a course of 25 members represents 175 minutes. However a few months before they started to use mail merge within Publisher and the time required to perform this step was significantly reduced to 30 minutes.

Despite de improvement, according with ASPE team this methodology is not yet perfect because the template model is changeable and with some test we were able to verify that many errors were being made throughout the interaction. Also the time reduction is only achieved if it is done by one specific element of the team.

Step 27. Update databases (syndicate staff)

Short resources forced ASPE to make the best with what they have in hand. Therefore data is dispersed among three databases, which we explain bellow:

- Contacts database - ASPE stores all their clients email contacts using their gmail account contacts core functionalities. The main issue is that it is not specifically suited for the context within which our customer operates. Example: For each course the syndicate team introduces the contacts of the applicants that are not present on the database, allowing them to receive in first hand courses advertising. But, the problem is that, the syndicate team needs to introduce each contact one by one because if there is a duplicate contact since this database do not warns to it and creates a duplicate entry.
- Courses database - this database is based in Joomla and gathers the information about applicants selected to courses, when and which courses were them. The main problem is that it was made a few years ago and is very outdated. Although it offers indispensable information to the syndicate, it does not have all the required features to support our customer. Also within this database is placed all the information about ASPE members.
- Defaulters database - The information about courses defaulters is stored in an excel file per each civil year. The main problem is that it is very time consuming to compare selection files with this database and also its update process is manual.

The larger issue we found regarding the databases listed above is that they are outdated and despite their common data there is no connection between them.

Aiming towards an effective definition of business goals, we will use an approach with high proven success. **SMART criteria** which are still today under research to identify its author(s), it is a methodology that guides people and organizations to set their goals in an effective manner. From the point of view of business goal definitions, SMART criteria are also referred as Key Performance Indicators (KPIs) ^[14] Morrison, 2010; ^[24] Wikipedia, 2013).

To develop SMART business goals we used the following guidelines:

S pecific	Defining a specific goal instead of a general one allows interveners to know exactly what they want to accomplish, why is it important, who is involved, where it happens and which are the requirements and constraints.
M easurable	To successfully achieve the goals, their definition needs to provide a measuring unit, allowing developers to track their progress. A measurable goal should be able to answer questions such as: How much? How many? How will we know when it is accomplished?
A ttainable	Keep the goals realistic and attainable. An attainable goal should be able to answer to the question: How can the goal be accomplished?
R elevant	Choose goals that matter. Relevant goals drive the organization forward and should be able to answer affirmatively to the following questions: Does it seem worthwhile? Is this the right time? Does this match our needs? Are you the right team? Is this acceptable for correction?
T ime-bound	Commitment to a deadline helps a team focus their efforts on completion of the goal. This rubric is intended to prevent goals from being overtaken by the day-to-day crisis that invariably arise in an organization. A time-bound goal is intended to establish a sense of urgency. Usually answer the questions: When? What can we do 6 weeks from now? What can we do today?

One of the main services ASPE offers to the teaching community is high quality courses. Throughout the past two years, courses department, referred in its main language as “Centro de Formação do ASPE” (CFA), developed 70 courses with an average of 52 enrollments per course.

In a universe of approximately 5500 educators and teachers, based on the education network of Região Autónoma da Madeira (RAM), our customer had 3661 enrollments which represent more than 50% of the total amount of teachers. However we can not disregard that, within the global number of enrollments from the past two years, repetition may have occurred on the educator/teacher/applicant.

However, syndicate leaders believe that with an even more organized process they could develop even more courses, as well as increase their quality. The goal they would like to achieve is a reduction in 30 percentage points of the time spent to perform tasks inherent to courses management. What is highly relevant about this goal is the possibilities it opens. Achieving the goal, i.e., spending less time

to manage each course, will allow our customer to develop more courses for the teaching community and focus on enhancing all the other services they provide to their clients. This comes in encounter with our customer corporative goal: Support the highest number of teachers and educators with rigorous information and quality services.

Within the main goal, ASPE has the intrinsic desire to increase their formative offer. However, nowadays, some factors are threatening the growth:

- With the new statute/constitution (Estatuto da Carreira Docente - ECD) which regulates teaching profession in RAM, teachers and educators are obliged to do 50 hours of formation per each evaluative cycle. Earlier statutes defined that they were obliged to do 25 hours per scholar year. Analysing this aspects, an evaluative cycle represent the time of an echelon, then, for example teachers and educators from an echelon with 4 years, are only obliged to do half the hours of formation per scholar year than before.
- During this analysis, Portugal is facing an economical crisis and this aspect is a constrain to have in consideration while developing courses with costs to the teacher/educator. Their tight budget could have a strong impact on the decision about enrolling and attending a course or not.
- ASPE has a very committed team with which they have supported many teachers. However, an important aspect to have in consider is the volatile nature of ASPE's team members since they normally change in every scholar year. This happens because the team is composed by one employee and two teachers who belong to a school but are referenced to work on the syndicate. One of the teachers works 100% on the syndicate while the other works 75% on the syndicate and the remaining 25% in his school of origin. Apart from these three elements and providing a lot of help, ASPE has one another element within an occupational unemployment program. Exemplifying the volatile nature of the team, the employee mentioned previously will only be in the team until march 2013. Even worse is the possibility to have the team reduced to 2 elements when the school year (2013/2014) starts, i.e., the number of referenced teachers is also dependent of approval.

To reach the goal, it is crucial to keep in mind these constraints in order to overcome them in the best possible manner. As we mentioned initial, in order to know if the goal is achieved, we need to have measures that will allow us to quantify our solution. Therefore, we identify bellow a group of measures that will serve as a mechanism to evaluate if the goal is close to achieve, achieved or even over achieved.

Measures, also referred as Key Performance Indicators:

- time spent to perform each step;
- number of courses per year;
- number of enrollments per course;
- number of accesses to courses information;

To accomplish the goal we are optimists that some of the current steps, described before within the problem concrete analysis (2.1), can be optimized. For example:

Step 8. Select applicants

Applicants selection is made in an excel file along with external databases to validate the information provided by each applicant. This verification is done manually, one applicant a a time. If ASPE had a management tool with all the data gathered in the same platform, they would be more efficient and the time spent to perform this step would be largely reduced.

Step 9. Inform applicants about selection status

Nowadays, applicants are informed via email and SMS if they were selected or not to attend the course they enrolled. Email messages and SMS follow the same structure for every course but

until know they are not predefined in any way. Sending email messages and SMS is very time consuming, specially considering the time to write them and make sure it is simple and correct .The average number of applicants per course is 52. So for each course, ASPE team members need to dial 52 numbers manually on their company phones to inform applicants status via SMS.

We believe that a platform or process change that helps to streamline this step would be an asset to the fulfilment of the overall objective.

Step 26. Make certificates and inform selected applicants and formator

During this analysis, this step has been altered by ASPE's team. With a simple change, previously described on the concrete analysis of the problem, they were able to reduced the time spent to perform this step in 90%. We are aiming to use ideas like these simple mechanisms and build a strong platform focused on efficiency.

Step 27. Update databases

Currently, ASPE has three databases: contacts, courses and defaulters database. However, these databases, which share many information details, are not connected. Merging their information into a generic database would reduce the time required to update three different sources of information. In a higher state of centralization, database information update may even be automatically. Using ideas such as these, we are sure that a huge part of the time spent to update databases would be extinguished, which supports ours and our customer higher goal.

In order to reach the main goal successfully, we also identified a group of sub goals that are directly tied with it, such as:

- Manage courses in a more effective manner;
- Offer an appropriate platform to enroll in courses;
- Increase the number of applicants per course;
- Have an extendable platform for all the services of ASPE;

We intend to meet the objectives set out above by the end of August 2013, being aware that we are facing a challenging problem with a short deadline. Deadline date, where we need to deliver the solution to our customer, is defined for the beginning of 2013/2014 school year.

Outside the scope of this partnership there is still a great challenging goal. As explained before, ASPE is composed by several branches in mainland Portugal and Madeira. Within this study, the suggested implementation will be tested in the employment context of the branch located in Madeira Island. The success rate of the solution produced at the end of this master thesis will have a huge weight to the unification of platforms used among all ASPE's delegations.

This also serves as a requirement to the solution, since it implies platform extension. We will develop the solution thinking not only on the problem we are addressing today, but also other problems that our customer may face and desires to solve resorting to the outcome of our work, the solution platform. As our customer confided, their overall main goal is to have all their services completely integrated in the same platform, supporting a close communication with their clients as well as shortening the gap between their delegations, working virtually closer and closer without the constraints of the physical distance.

To ensure an effective analysis to the problem we will explain next how activity modeling supports problems analysis, how it should be applied and the outcome it produces.

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3 | Problem - Abstract Analysis

The most diverse methodologies and tools to assist software development have not been able to halt the constant failures in the area of software development. One of the main handicaps is that software developers are still developing system with an incomplete way of thinking. Normally is granted higher or exclusive priority to structure and functionalities of the system, disregarding what users see and how they interact with it, i.e., the user interface. Various model driven approaches surged in the last years as methodologies to support problem analysis and ensure a better result/solution. One of these methodologies, activity modeling, was introduced by engineer Larry Constantine in the seminal article “Human Activity Modeling: Toward a Pragmatic Integration of Activity Theory and Usage-Centered Design” ([3]Constantine, 2008).

Activity Modeling

Merging two well know methodologies used in software development, activity theory and usage-centered design, activity modeling aims to create a modeling language grounded in a consistent and coherent vocabulary of well defined concepts. Linking task modeling based on essential use cases and activity theory, this model tries to overcome the recognized limitations of both models.

Activity theory originate from the sociocultural tradition in Russian psychology. Firstly introduced by psychologists Rubinstein, Leontiev and Vigotsky in the early part of the last century it has been providing key contributions to research in Human Computer Interaction (HCI) and interface design. Its original perspective regards that a human activity is performed by agents (referred as subjects) motivated toward solution of problem or by a purpose (object or motive) mediated by tools (artifacts) yielding evolutionarily a result (outcome). In the 1980s, Yrjö Engeström incremented the original perspective adding three elements. Community, roles and rules were then integrated to activity theory implying that all activities take place in a social context with differentiated responsibilities, constrained by procedural factors and its social-cultural environment.

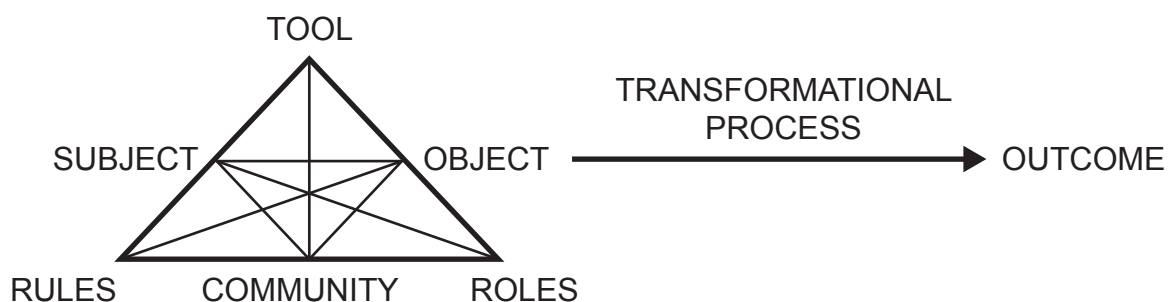


Figure 5 - The structure of human activity (adapted from Engeström, 1999).

Activity theory provide designers and organized and consistent way to investigate, describe and understand the larger context of an activity considering the tools and artifacts involved. However, inaccessible or imprecise expressions and vague formulations express in lacks of rigor in activity theory ([9] Kaptelinin, 2012).

Introduced by Larry Constantine and Lucy Lockwood in the early 1990s, usage-centered design is focused on creating tools to enhance the efficiency and dependability of user performance. Especially for software developers, different meanings surrounding the concept of usability makes it confuse, mostly, with user-centered design concept. In contrast to user-centered design, usage-centered design is not centered on users *per se*. It is a structured process to design a user interface with a solid interconnected foundation of user roles, tasks and interface contents. In other words,

usage-centered design is a process driven to transform abstract analysis diagrams into a concrete, efficient and well designed user interface ([2] Constantine, 1996; [5] Constantine & Lockwood, 2005).

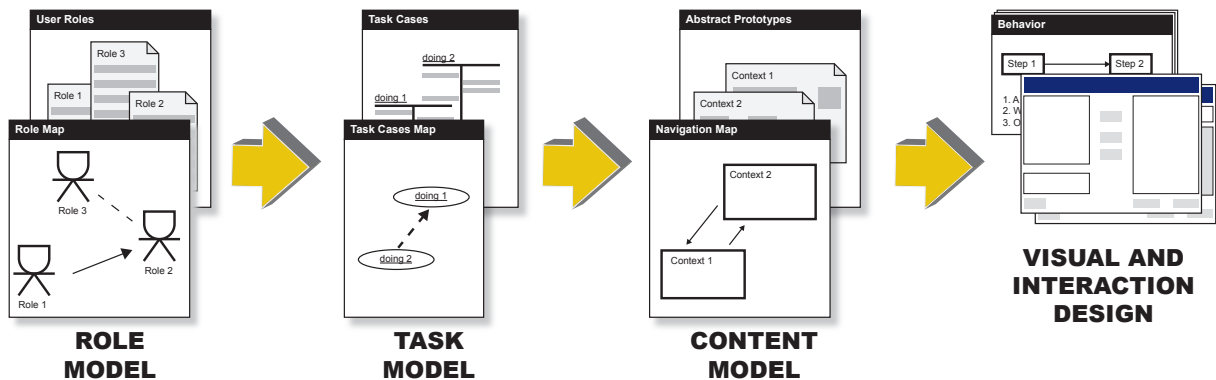


Figure 6 - Logical dependency of models in usage-centered design.

More details about Activity Theory and Usage-centered design can be found in:

- “Users, Roles, and Personas” ([5] Constantine & Lockwood, 2005).
- “Human Activity Modeling: Toward a Pragmatic Integration of Activity Theory with Usage-Centered Design” ([3]Constantine, 2008)
- “The Encyclopedia of Human-computer Interaction, 2nd Ed.” ([9] Kaptelinin, 2012)
- Usage-Centered Software Engineering: New Models, Methods, and Metrics ([2]Constantine, 1996)

Within the technical paper “Activity Modeling: Toward a Pragmatic Integration of Activity Theory with Usage-Centered Design”, stemming to the union between both methodologies briefly explain before, Professor Larry Constantine produced the following schema, which we will explain step by step whenever we apply each one them.

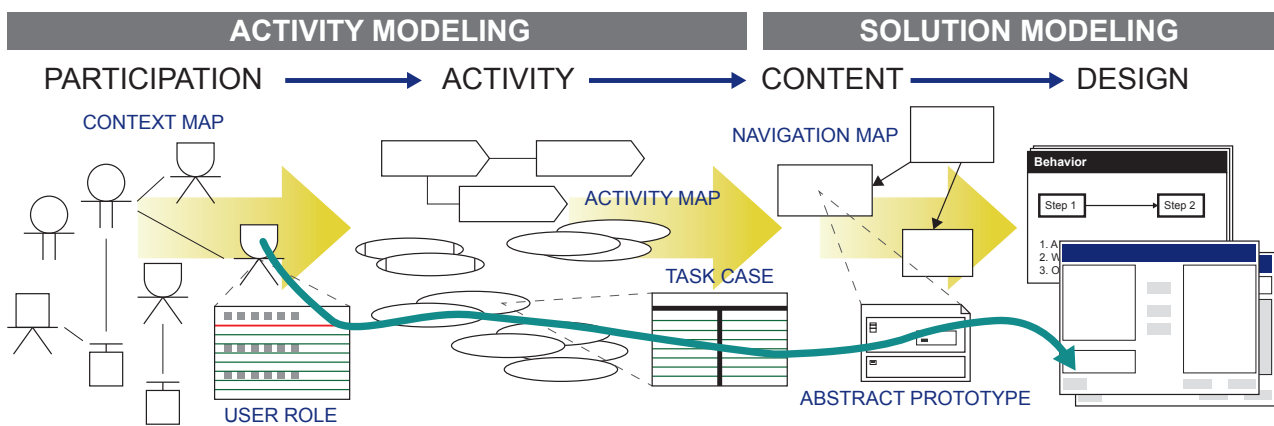


Figure 7. Logical overview of usage-centered design with activity modeling.

Our goal for this project goes beyond solving a problem. We established to this master thesis two fundamental objectives. Provide, within the defined dead line, adequate and well design solution to our customer is the first goal. Secondly, but with the same level of importance, we intend to test and create a guide for how to apply activity modeling.

To ensure we achieve a proper guide for activity modeling, we will use textual elements from the author, enhancing, if necessary, the simplicity using different forms of presentation. The idea behind this decision is that since we are building a simple and straightforward guide for activity modeling, when the author textual elements are the simplest way to explain, just leave it untouched.

Activity Modeling incorporated into usage-centered design ⁽³⁾Constantine, 2008).

To incorporate systematic activity modeling into usage-centered design Constantine made the following additions and alterations:

An **Activity Model** defines and describes activities and their interrelationships.

The **Role Profile** that describes user roles is modified to connect roles explicitly to the activities within which the roles are embedded.

The **Task Model** is elaborated to incorporate actions in relation to other participants and artifacts and to connect task cases explicitly to activities.

Activity-Based Task Modeling

Task cases (essential use cases) as employed in usage-centered design **represent the second level of the activity hierarchy.**

A task model based on task cases provides a fine-grained view of user intentions and interactions within an activity.

The task model is extended to integrate with the activity model in two ways: by connecting tasks to the activities within which they are embedded and by elaborating the task model to incorporate non-interactive actions.

The activity model itself includes three parts:

Activity Map that identifies relevant activities and their interrelationships (including, optionally, the aggregation of task cases into activities);

Collection of Activity Profiles describing the salient aspects of the relevant activities;

Participation Map showing the involvement of actors with the system, with other artifacts, and with other participants.

Activity-Based User Roles

From an activity theory perspective, user roles are played by Actors within activities. User roles are connected to activity theory by modifying the Role Profile to include information about activities. The content of this revised Role Profile is organized under three headings:

Activity refers to the activity within which the role is played. If the activity is defined elsewhere by an Activity Profile, then it can be referred to by name. Otherwise it is briefly described in terms of purpose, place (physical and social context) and time, and participation, including salient artifacts.

Background refers to the background characteristics of the performers of the role in terms of experience, training, education, system knowledge and domain knowledge, distribution of performance skills, and orientation or attitudes of performers.

Characteristics refers to performance characteristics, such as frequency, regularity, intensity, complexity, and predictability of performance. In some cases this may overlap with or repeat aspects of the Activity Profile, particularly if there is only one Role for a single Actor in the activity.

A fourth rubric, Design, serves as a holding place for evident design implications for effective support of the role.

3.1

Activity Model | Activity Map - theoretical background

An Activity Map represents activities relevant to the design problem and the interrelationships among them. Activities that include interaction with the system, are the most relevant and referred as proximate activities. Activities that do not involve system interaction may in some cases impact design and be relevant for defining and understanding the context of use. If, for example, actors are involved in activities with other participants that compete for their time and attention, this has implications for presentation and interaction design. In such cases, the ability to suspend or interrupt interaction at any arbitrary point might be required, and presentation design may need to make it easy for actors to recognize where they are and where they left off in process.

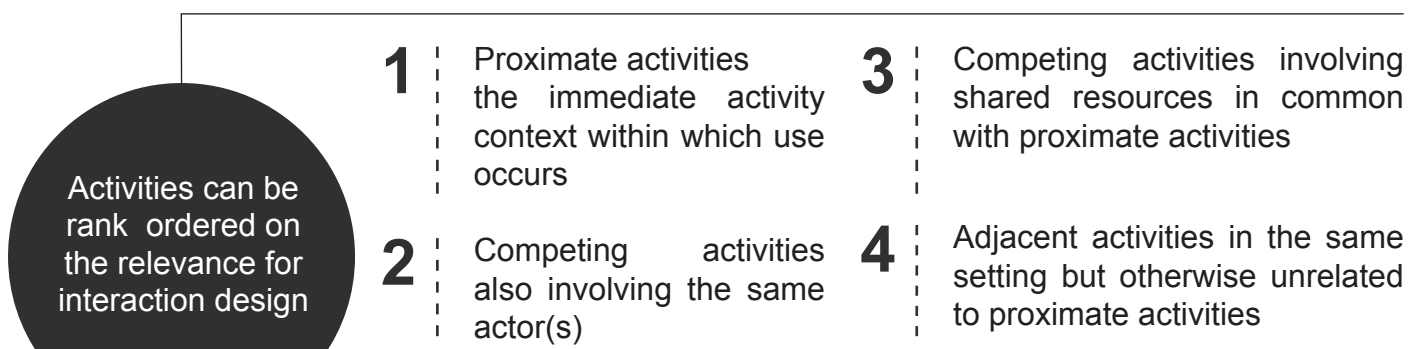
Activities that are connected in time can be related in a number of different ways. For example, an activity can compete with another activity because it shares common participants or resources. Even in a more indirect way, an activity can be affected by an adjacent activity with which it has no relationship other than occurring within the same conditions.

While modeling Activity Map, when considering which activities to create, or even which to include in another activity, analysts should take in consideration: Does it make a demonstrable difference or have an arguable impact on the design? **The objective is to model what matters** ⁽³⁾Constantine, 2008).

Relationship Qualifier	Explanation*
contains	[includes] activity is composed of other sub-activities
coordinated	[synchronized] activities are coordinated/synchronized by some means
concurrent	activities occur over common time span, not further qualified
synchronized	[coordinated]
unsynchronized	independent, concurrent but not coordinated
interleaved	alternating
consecutive	sequential activities, not further qualified
precedes	strictly sequential
overlaps	activity finishes after another starts
competing	activities conflict or interfere, not further qualified
common participants	participant(s) (optionally identified) overlap
shared artifacts	some resources (optionally identified) are shared
adjacent	activities occur within same setting (place and time)

* Alternate terms are shown in brackets

Table 1. Relationship between activities.



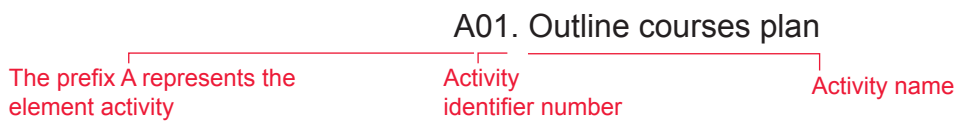
3.1.1

Activity Model | Activity Map - modeling the problem as-is

Within the concrete analysis of the problem, each part of the process was referred as step. Beginning abstraction, according with activity modeling nomenclature, each step will be referred as **activity**.

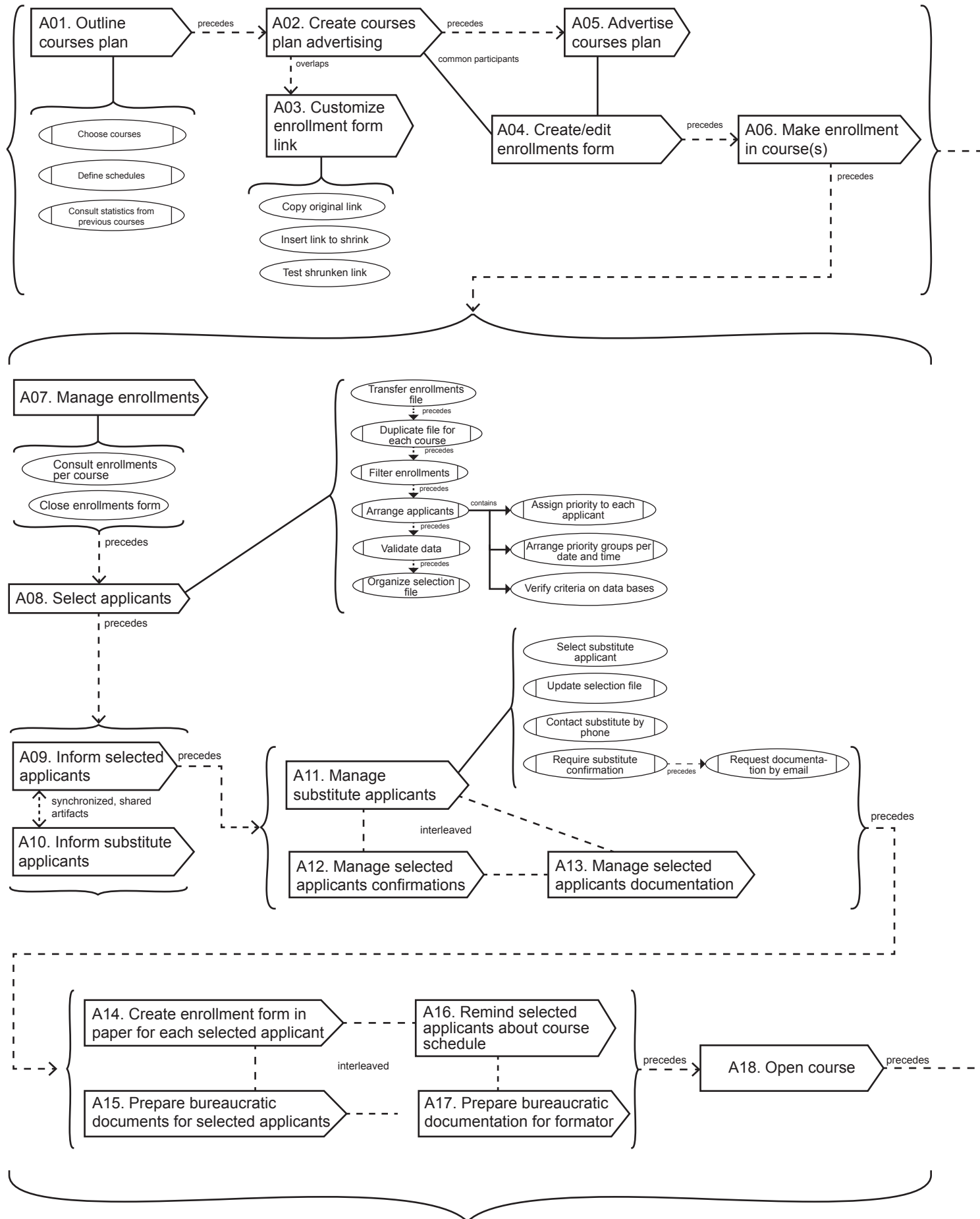
As we have seen before, the process is a group of steps with relations among them which can be seen through an activity map. At this instance, the intent is to provide an overview of the activities involved in the process using an **activity catalog** (^[4]Constantine, 2008). It contains the activities of the process but do not include information about artifacts or relations among them.

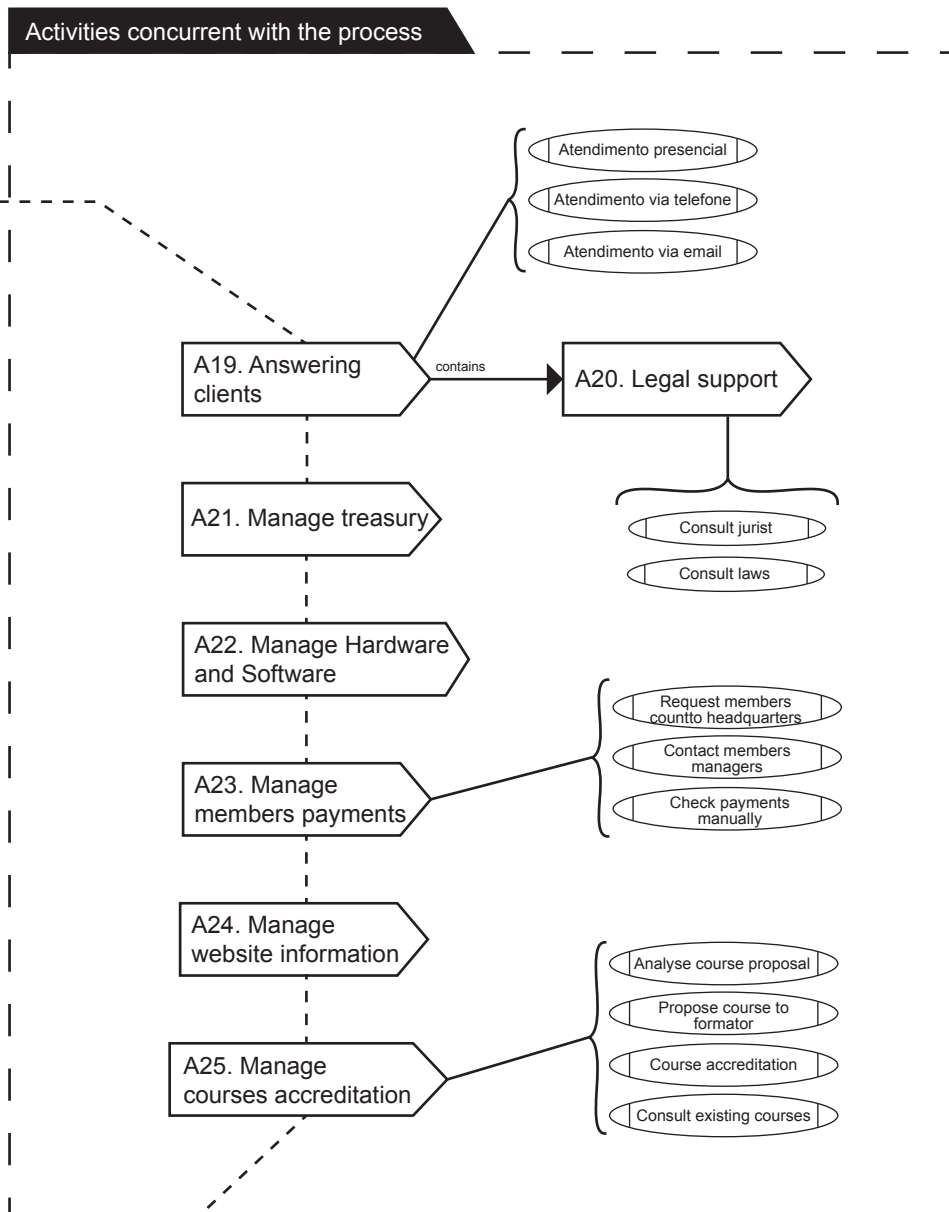
Note: an activity catalog is composed by a group of activities and each activity is identified using the following structure:



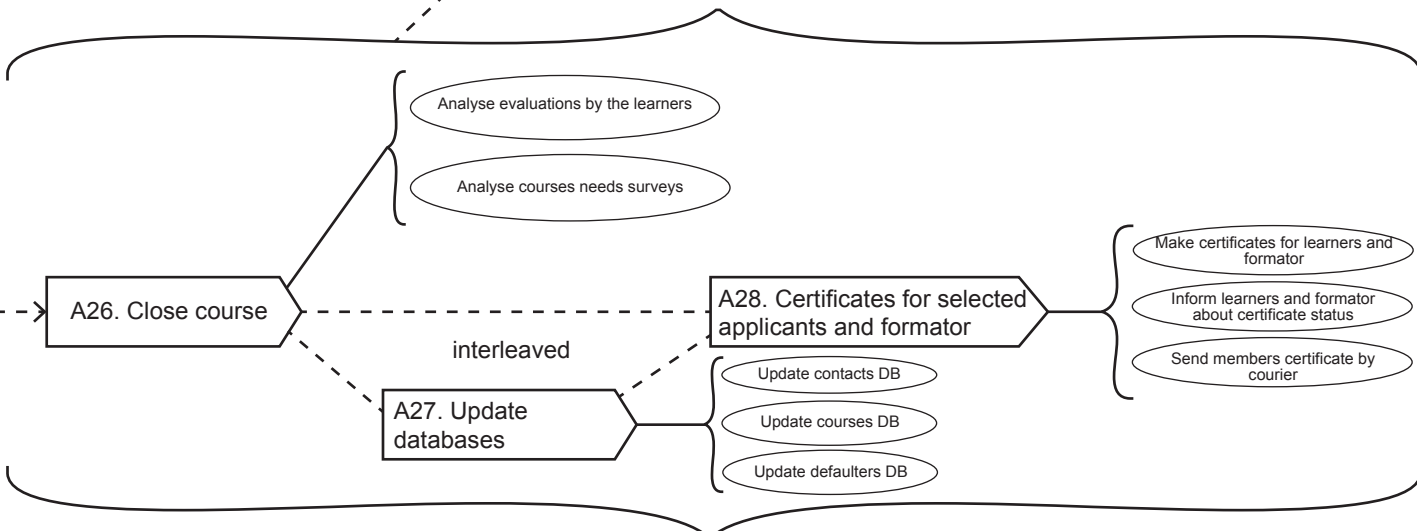
- A01. Outline courses plan
- A02. Create advertising of courses plan
- A03. Customize enrollments form link
- A04. Create/edit enrollments form
- A05. Advertise courses plan
- A06. Make enrollment in course(s)
- A07. Manage enrollments
- A08. Select applicants
- A09. Inform selected applicants
- A10. Inform non selected applicants
- A11. Manage substitute applicants
- A12. Manage selected applicants confirmations
- A13. Manage selected applicants documentation
- A14. Create enrollment form in paper for each selected applicant
- A15. Prepare bureaucratic documents for selected applicants
- A16. Remind selected applicants about course schedule
- A17. Prepare bureaucratic documentation for formator
- A18. Open course
- A19. Clients and Members support*
- A20. Legal support*
- A21. Manage treasury*
- A22. Manage hardware and software*
- A23. Manage members payments*
- A24. Manage website information*
- A25. Manage courses accreditation*
- A26. Close course
- A27. Update databases
- A28. Certificates for selected applicants and formator

* Activities concurrent with the process but not a part of the process itself.





competing,
common participants,
shared artifacts



3.1.2

Activity Model | Collection of Activity Profiles

An Activity Profile is not intended to capture in fullest detail everything known or knowable about an activity but rather to organize in compact form the salient aspects of an activity that are most likely to be relevant to shape the user interface design ⁽⁴⁾Constantine, 2008).

Purpose

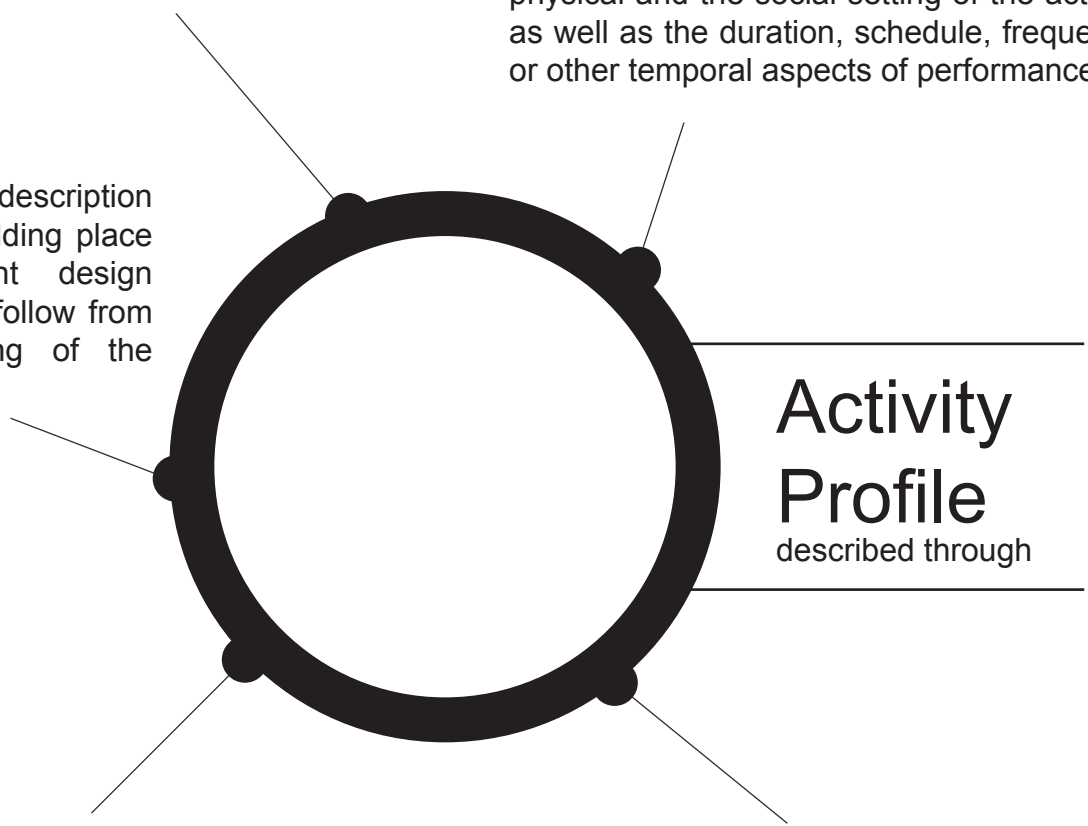
motives or objectives for the activity, what is all about. An activity can have more than one purposes depending on the purpose related to each different participant.

Place and Time

where, when, and under what conditions the activity takes place, which can include physical and the social setting of the activity as well as the duration, schedule, frequency or other temporal aspects of performance.

Product

not part of activity description but serves as holding place for any evident design implications that follow from the understanding of the activity.



Activity Profile

described through

Participation

who is engaged in the activity and the artifacts with which they are involved. Participants include actors engaged with the system of reference along with the roles they play as well as other players not engaged with the system. Artifacts include the physical and conceptual tools employed in the activity. Interactions among participants, between participants and artifacts as well as division of responsibilities among participants fall under this rubric. Participation can also be defined by reference to a Participation Map.

Performance

characteristics manner or style in which the activity is performed including coordination and relation to other identified activities. Formal or informal rules that shape and govern the performance of the activity may also fall under this rubric. Relationships with other activities can also be defined by reference to an Activity Map.

Activity Profiles - modeling the problem as-is

A01. Outline courses plan

Purpose: Lay out a plan of courses that meet the formation needs of teachers and educators. Create a draft of the plan containing the information about its formator, description, schedule, place to develop, teachers and educators groups addressed and price, if applicable.

Place and Time: Base activity for the entire process. Usually performed in the normal work context when the need of formation among the teaching class is noticed. The background knowledge on this matter is also an important aspect to when this activity takes place. Normally it is developed with an average of 6 times per year, depending on the needs. This activity is spread over time due to the need to contact external interveners which are: the responsible for the place where courses will be developed^(*) and the formator^(**). Overall this activity should not cover more than 120 minutes asynchronously.

^(*) ASPE does not own facilities to develop courses. So, for each course is established a renting contract or protocol with schools or other spaces.

^(**) All the formators who work with ASPE are external.

Participation: Firstly discussed with all team members using statistical elements as number of enrolls per course, number of substitutes per course, number of enrolls per educational area and survey of courses needs per educational area. Afterwards, the team leader refines and produces a draft version of the courses plan.

Performance: ASPE Leader is the moderator of this activity which often occurs within short deadlines. The outcome of this activity is the input of A02.

A02. Create advertising of courses plan

Purpose: Provide to the teaching community an attractive courses plan, well defined and with all the relevant information. Create adequate advertising elements for all the platforms used to advertise courses.

Place and Time: Carried out, at least, as many times as the number of times A01 is performed. Commonly is required to create sub courses plans targeting specific teachers. For example: If the number of enrollments for a course, destined to history teachers, is too low at a certain date, courses plan is custom adjusted to highlight course addressed to history teachers and re advertise it among them. With an average time cost of 2 hours, it is performed within the normal context of work, having as the highest constrain, constant interruption.

Participation: Performed exclusively by the IT Manager using design tools as Illustrator, Photoshop and InDesign as well as other tools that help him achieve good quality advertisements. After this, other team elements confirm the courses plan, verifying all the inserted details.

Performance: Starts by consulting previous graphical elements, analysing possible reuse and/or as a source of inspiration, complemented with web search to get creative ideas. Performed within a thin deadline and usually under pressure to finish the activity as soon as possible.

A03. Customize enrollments form link

Purpose: Simplify the URL that allows access to online enrollments form.

Place and Time: Done within the time schedule of A02 in normal work context. Enrollment forms are typically reused as well as the shorten links. In these cases, this activity is performed only to confirm the correctness of the link.

Participation: Using Google URL Shortener platform, it is totally performed by the IT Manager.

Performance: Although inserted in the thin time schedule of A02, it is a simple activity which allows it to be performed very quickly without any significant performance constraints.

Product: Google URL Shortener is extremely limited in terms of management and link customization.

A04. Create/edit enrollments form

Purpose: Update or create a new enrollments form according with the courses plan to be advertised. Insert courses to advertise in the enrollments form. Include all the relevant information about the courses.

Place and Time: Initiated after A03 in the normal office environment. Done as many times as the number of courses, in no more than 15 minutes per course. Although enrollment forms can be created from scratch, typically they are reused. In those cases, this activity is performed only to update the information and check its correctness.

Participation: Mainly done by the IT Manager. Confirmation is done by another element(s) of the team. All of this is done using Google Forms core functionalities.

Performance: Despite the simplicity of this activity, it is under a short deadline. Our customer confided that they already had some incorrect data inserted.

Product: Google Forms is very limited in terms of customization. Despite that, editing it is very simple.

A05. Advertise courses plan

Purpose: Publicize ASPE courses appropriately, for the maximum number of teachers and educators.

Place and Time: Advertise the courses plan for all the contacts in the courses database and on the general website, at least one time. Although the estimated total time cost is 60 minutes, this activity is performed generally in two days. This happens because gmail has a limit of email messages that can be sent daily. Due to this constraint, to minimize the time delay, ASPE team, uses two email accounts to advertise their courses. Occasionally, the courses plan can be advertised more than one time. This occurs, normally, when the number of enrollments is below the expectations, as we mentioned in A02.

Participation: The outcome of A02 is the input to this activity. Any team member is able to advertise via email. General website advertising is exclusively made by the IT Manager.

Performance: The IT Manager places, as a draft within the email account, the information to be sent via email. While he updates the information on the website, another element(s) of the team advertises the courses via email. The correctness of the information is checked by any team member. Alterations regarding the graphical aspects are done exclusively by the IT Manager.

A06. Make enrollment in course(s)

Purpose: Enroll rapidly and effectively in the courses ASPE has available.

Place and Time: It is possible to perform this activity, i.e., enroll in courses, from anywhere with internet access. This activity takes in average 5 minutes and can be reduced according to the dexterity of the user. On the last two years, this activity was performed with success 3661 times. The number of unsuccessful performances is not possible to acquire.

Participation: Mainly performed by each teacher. However ASPE team members can do enrollments for applicants, if solicited.

Performance: Any teacher who wants to apply/enroll to the course needs to access the enrollments form using the short URL provided in the courses plan advertisement. After accessing the online form, he is responsible for the correct insertion of the required information. After filling up the form they just need to submit it and it is automatically stored on the google forms back office table associated with the form. At this instance, applicants receive an information about the successful enrollment but do not receive any email confirmation.

Product: Provide an online platform to all the teachers and educators with which they are able to enroll rapidly and effectively in ASPE courses. Include validation mechanisms in the enrollments form to ensure data correctness. We were not able to quantify the number of applicants that were not able to do this activity properly. Despite that, ASPE informed us that quite often they receive calls asking for help.

A07. Manage enrollments

Purpose: Verify the number of enrollments per course. Open/Close the enrollments form.

Place and Time: This activity can be performed in less than 3 minutes from any point with internet access.

Participation: Any team member can perform this activity.

Performance: There is no problems with the performance of this activity, unless the internet connection is not available.

A08. Select applicants

Purpose: Select applicants with high level of correctness.

Place and Time: This activity is performed for every course after the end of their enrollments. In a somehow isolated state within the normal context of work, this activity has a cost of 40 minutes to select. The time given is considering that the selection process is made manually and exclusively for one course. However, most times, courses selection process is made for 3 or more courses at the same time. Through observation, we were able to identify that applicants selection for 4 courses took 6 hours. The main identified issue was the verification of duplicates applicants between courses, properly selected applicants and the preparation of course selection files so they can be used properly throughout the remaining activities of the process.

Participation: Performed exclusively by the IT Manager.

Performance: Firstly, the IT Manager accesses the online platform where the enrollments data is stored and exports it as an excel file. With that, he starts selecting the applicants. Inserted information by the applicants is verified with ASPE databases and filtered according with the established criteria. Afterwards, applicants are selected according with the priority and the maximum number of applicants per course. This activity is crucial to develop courses and is made always with high attention. The participant is under an extreme pressure to do this perfectly and as soon as possible. All the documentation produced in this activity serves as inputs for the remaining activities within the process. IT Manager handles large groups of information which, in some cases, produced errors. By far, this is the most daunting and demanding activity of the process.

A09. Inform selected applicants

Purpose: Efficiently notify via email and SMS all the selected applicants. Explain through the information, all the steps they need to accomplish in order to be able to attend the course.

Place and Time: Whenever ASPE develops a course, after selecting applicants (A08), their policy is to inform selected applicants about their selection status using artifacts present on the normal context of labour, such as mobile phones and computers. Forty minutes is the average time needed to create the email and SMS, confirm the information with another team member, insert the contacts and send it. This time depends if it is an isolated course selection or multiple courses selection. If ASPE is selecting multiple courses, after the first email and SMS is done, it is used for the remaining courses.

Participation: Any team element can perform this activity. The element or elements who perform this task using, concurrently with the normal activities of the syndicate, computer(s) to send email messages and two mobile phones to send text messages. Using two mobile phones from different operators allows ASPE to reduce costs per message. The main constraint is that these phones are not exclusive for this activity and can be in use for any other concurrent activities.

Performance: Initiated after finishing A08, one member of ASPE team writes the email with all the information regarding the steps applicants need to accomplish to validate or cancel their selection. To ensure data correctness, before sending notification email messages or SMS, a different team member checks and validates its content. Coordinated with the IT manager, the final step is to get the contacts and send mails and text messages to all the selected applicants. Regarding text messages, with the actual communication packages, SMS messages between the same operator are free of charge. So, to ensure cost free text messages, applicants with TMN operator are informed using the office TMN mobile phone and the same approach for applicants with Vodafone. All of this is performed concurrently with the unpredictable activities that ASPE has, such as answering the phone. ASPE has as its internal policy, the requirement to inform selected applicants within two days after the end of enrollments. Therefore, it is required to perform this activity as fast as possible.

A10. Inform substitute applicants

Purpose: Efficiently notify via email and SMS all the substitute applicants. Explain through the information, all the steps they need to accomplish in order to be able to attend the course.

Place and Time: Whenever ASPE develops a course, after selecting applicants (A08), their policy is to inform substitute applicants about their selection status using artifacts present on the normal context of labour, such as mobile phones and computers. Forty minutes is the average time needed to create the email and SMS, confirm the information with another team member, insert the contacts and send it. This time depends if it is an isolated course selection or multiple courses selection. If ASPE is selecting multiple courses, after the first email and SMS is done, it is used for the remaining courses.

Participation: Any team element can perform this activity. The element or elements who perform this task using, concurrently with the normal activities of the syndicate, computer(s) to send email messages and two mobile phones to send text messages. Using two mobile phones from different operators allows ASPE to reduce costs per message. The main constraint is that these phones are not exclusive for this activity and can be in use for any other concurrent activities.

Performance: Initiated after finishing A08, one member of ASPE team writes the email with all the information regarding the steps applicants need to accomplish to validate or cancel their

selection. To ensure data correctness, before sending notification email messages or SMS, a different team member checks and validates its content. Coordinated with the IT manager, the final step is to get the contacts and send mails and text messages to all the selected applicants. Regarding text messages, with the actual communication packages, SMS messages between the same operator are free of charge. So, to ensure cost free text messages, applicants with TMN operator are informed using the office TMN mobile phone and the same approach for applicants with Vodafone. All of this is performed concurrently with the unpredictable activities that ASPE has, such as answering the phone. ASPE has as its internal policy, the requirement to inform selected applicants within two days after the end of enrollments. Therefore, it is required to perform this activity as fast as possible.

A11. Manage substitute applicants

Purpose: Select substitute applicants efficiently

Place and Time: Within the normal context of work, and whenever a selected applicants drops out and a spot in the courses is available, this actions takes place. It is common for selected applicants to drop out due to the most variable situations and therefore this is a common activity for almost every course. The duration required to select a substitute is highly variable because their selection is made via phone and usually it is hard to contact applicants due to their work policies. For example: If they are in a class they normally will not be able to answer their phone. Due to this constraint, this action can take 5 to 30 or more minutes.

Participation: Any team element can perform this activity.

Performance: When a selected element drops out, in order to select a substitute, the first element of the list is contacted. ASPE team contacts the substitute in place to be selected at least three times. After three unanswered calls, the applicant immediately after on the list is contacted until one of them picks up and confirm their interest on attending the course. Sometimes this activity is perform calmly but when the need to select substitutes happens very closely to the date scheduled for the course to begin, it is made under a high level of pressure.

A12. Manage selected applicants confirmations

Purpose: Control with high rigor of certainty selected applicants confirmations. Update applicants state as confirmed or dropped out in the course selection file, accordingly with their confirmations.

Place and Time: Within the information provided to selected applicants in A09, it is explicit that they are obliged to inform ASPE if they confirm they will attend the course or not. For example, a course composed by 25 learners, represents that ASPE will receive 25 confirmations via email, phone, or even personally. All this information is managed under this activity and it normally takes no further than 5 minutes for each confirmation. This is an average time duration, having in consideration the time needed to respond to one email. Obviously if the confirmation is made in person, the time is no more than 1 minute.

Participation: Any team element can perform this activity. Since this is doable by every elements, it normally creates concurrency problems while handling course selection files in Excel.

Performance: Applicants selection per course is made within A08 which outcomes a selection file in Excel. Inside its structure is also inserted a mechanism to manage confirmations. So for each confirmation this file is accessed and updated. Although typically done in concurrency with other activities, normally it is not suggested to a higher level of pressure. This only differs when the number of courses in management is superior to one which originates a number

of confirmations that can go up to 50, 100 or 150 (six courses with 25 learners). Frequently, management is made regarding 4 or more courses within the same time frame.

A13. Manage selected applicants documentation

Purpose: Control with high rigor of certainty the documents submitted from each selected applicant.

Place and Time: Within the information provided to the selected applicants while performing A09, it is explicit that they are obliged to submit to ASPE certain documents (normally two documents) in order to be able to attend the course. For example, a course composed by 25 selected applicants, represents that ASPE will receive at least 50 documents confirmations via email, fax, or in person. This information is managed under this activity and it normally takes no more than 10 minutes per each confirmations. This is an average time duration having in consideration the time needed to check the documents, update the management file and respond to one email. If the documentation is delivered in hands, the time required is no more than 3 minute.

Participation: Any team element performs this activity. As this is doable by every elements, it normally creates concurrency problems while handling course selection files in Excel.

Performance: Inside courses selection file, there is a mechanism to manage documents delivered by applicants. So for each document ASPE receives, this file is accessed and updated. Although typically done in concurrency with other activities, normally it is not under pressure. This only differs when the number of courses in management is superior to one which originates a number of documents that can go up to 100, 200 or 300 (six courses with 25 learners with 2 documents per learner). Frequently, management is made regarding 4 or more courses within the same time frame.

A14. Create enrollment form in paper for each learner

Purpose: ASPE is legally obliged to have enrollments form in paper properly signed by each selected applicant. Copy the information in Excel for a file for each selected applicant with the data they previously introduced.

Place and Time: On the normal context of the office, before the beginning of each course with a frequency of one time per course, it requires a time effort of 45 minutes to create, verify and print 25 enrollment forms.

Participation: At first instance, it is exclusively done by the IT Manager and in a second phase by him or another element of the team, using Publisher and Excel using mail merge functionality.

Performance: Drop outs to courses unfortunately happen and sometimes within a few days to the course beginning. Having that in consideration, this activity is done usually only 2 days before the course starts. Firstly the source of data stored in an Excel file needs to be adjusted to fit properly the template done in Publisher. Then, using mail merge functionalities it is established a connection among data source and Publisher template. After this, IT Manager finalizes the document and checks all the enrollment forms per each selected applicant. Before printing it is made a doubled verification by another element of the team using final Publisher file. After verifications, forms are printed. When done on the right time, this activity is not subjected to a large amount of pressure. However if it is done too close to the course beginning date, some pressure is added.

Product: Although mail merge tool has brought a significant reduction on the amount of time to perform this activity, it is still not perfectly suited for ASPE. Without considering the IT Manager, this tool is not so easy to use by the elements of ASPE's team, specially if the template requires

to alterations.

A15. Prepare bureaucratic documents to selected applicants

Purpose: Prepare all the necessary documents to deliver to applicants when the course starts. Create a course folder to deliver to each learners.

Place and Time: The documents that compose the courses folder are done under this activity. However, they are not done from root. There is a template for each and every document and the work within this activity is to update each document according with the course information, confirm and print it. This is done one time before the beginning of each course and has an average time cost of 45 minutes.

Participation: All the team elements are involved in different parts of this activity. Its output is the courses folder. This is composed by a group of documents with different team members responsible by their execution.

List of documents that compose courses folder:

- Courses contract: any team member is able to do the changes needed on this document;
- Courses program: The information that composes this documents derives from the activity A25 which is made exclusively by the responsible of ASPE. The current activity can be made by any of the team elements under the supervision of the IT Manager and team leader.
- ASPE pamphlet: This document is ready to print and any changes are exclusively made by the IT Manager; Under this activity the only thing necessary is to print one copy for each learner which can be done by any team member.
- ASPE card: These office cards are already printed and the only task to do within this activity is to place it inside the course folder;

Performance: Normally this activity is performed under a calm environment, unless if any of the concurrent tasks is under pressure.

A16. Remind members about course schedule

Purpose: Remind all the learners, via text message, about course schedule and place where it will be developed.

Place and Time: Performed one time per each course, usually between one or two days before the date scheduled to start the course. The time spent on this activity depends mainly if the mobiles phones used to inform selected applicants are available or not. In normal context it does not take more that 20 minutes per course.

Participation: Any team element is able to perform this activity. It is always done in cooperation with the IT Manager who organized the course selection file where all the mobile phone numbers from the learners are placed.

Performance: As mentioned on A10, ASPE has two mobile phones from different operators. With the current communication packages, SMS between the same operator are free of charge. So, to ensure cost free text messages, selected applicants with TMN operator are informed using the office TMN mobile phone and Vodafone mobile phone is used to inform applicants with Vodafone. This activity is performed normally under a calm environment, unless if the mobile phones are being used for any concurrent activities or if any one of the concurrent activities is under pressure.

A17. Prepare bureaucratic documentation for formators

Purpose: Prepare all the necessary documents for the formator.

Place and Time: All the required documents for formators are already pre prepared. Therefore, within this activity it is only necessary to update every document according with the course information, confirm and send or print. This is done normally before the beginning of each course and has an average time cost of 15 minutes.

Participation: All the elements of the team are involved in different parts of the process. This is composed by a group of documents with different team members responsible by their execution.

List of documents for one formator:

- Courses contract: any team member is able to do the changes needed on this document. However it is signed and under the supervision by the responsible of ASPE;
- Courses program: This document is done under A15 by the interveners already referred. Normally while printing this document for each learner the team member performing the activity already prints an extra copy to help the development of this activity.
- Various documents in PDF: Within this PDF template is embedded a form which allows a smart filling. Ex.: If the user changes the header in one page he automatically changes the header of all the other pages in the document. The template, in PDF, is composed by the following documents: Curricular form; Summary sheet; Final registry of evaluation and attendances; Final registry of learners creditation; Learners evaluation; Occurrences registry; Physical Infrastructures; Course evaluation by the formator. Any team member can adjust these documents.

Performance: Normally this activity is performed under a calm environment, unless if any of the concurrent tasks is under pressure.

A18. Open course

Purpose: Guide selected applicants throughout the filling of bureaucratic documents created in A15. Establish a personal contact with applicants.

Place and Time: Performed outside the normal context of work, on the place where the course is developed. Within this time, selected applicants fill out the required documentation, check and sign the course enrollments form in paper. This activity takes an average time of 30 minutes.

Participation: One of the members of ASPE, all the selected applicants and course formator.

Performance: Normally initiated by one of the team members, giving a brief description of the syndicate and the formator. Afterwards he provides to the applicants some information about the bureaucratic documents they need to fill and delivers the course folder to each applicant. Within the documentation, it is included the enrollment form in paper. This document obliges the team member to call each applicant to deliver personally his form. This component is the most time consuming. While applicants fill the documents, formator's documentation is delivered. This activity is always made under the pressure to perform it better and the fastest way possible. Sometimes, the same team member also needs to open two courses consecutively which enhances the need to be fast.

A19. Clients and Members support

Purpose: Provide a quality public attendance to all the teachers and educators.

Place and Time: Teacher and educators attendance is available, on the headquarters of ASPE Madeira, Mondays to Fridays from 10 to 13 hours and 14:15 to 18 hours.

Participation: Every team member can be involved in this activity. Within the team, some members are specialized in juridical support while others are more focused on courses management. According with the question, participants change.

Performance: This activity is highly changeable. One day ASPE has only 2 or 3 elements to attend and another day has 10 or more. Furthermore each attendance is personalized, each problem is different and sometimes complex problems can even take a team member one or two hours to properly elucidate the client.

Product: Although this activity does not belong 100% to the process inherent to courses development it is highly concurrent. This activity is one of the main causes of interruptions on the concurrent activities so it is highly relevant to have it in consideration.

A20. Legal support

Purpose: provide legal support to every associate of ASPE.

Place and Time: Mondays to Fridays from 10 to 13 hours and 14:15 to 18 hours, on the headquarters of ASPE Madeira, associates can ask for legal support. It is not possible to quantify the number of legal help requests per day.

Participation: ASPE Leader and ASPE Employee provide legal support according with the knowledge they have. Specific questions are forwarded to and answered by the legal department.

Performance: This activity is a component of A19 and whenever it happens, all the other activities are paused in order to solve this as soon as possible. Specific questions are forwarded to the legal department which is responsible to follow up the case and give an answer with all the legal foundations.

Product: this activity has priority over any other else. So, whenever this happens, all the concurrent activities stay in standby.

A21. Manage treasury

Purpose: Organize the treasury and manage ASPE Madeira financial resources.

Place and Time: Under the normal context of work, this activity is performed 1 or 2 times per month requiring one complete working day.

Participation: Performed exclusively by the IT Manager using a spreadsheet in excel as the organization method.

Performance: When the concurrent activities are calmer, this activity is initiated. It represents organizing all the documents per date and the type of transaction. After that, documentation is stored in folders and categorized in the organization file in Excel.

A22. Manage Hardware and Software

Purpose: Ensure the proper functioning of the electronic equipment. Solve software and hardware issues.

Place and Time: Its not possible to quantify the amount of time spent on this activity.

Participation: Exclusively made by the IT Manager.

Performance: Electronic constraints tend to appear on the times where the volume of work is higher. When that is the case, it is given top priority to fix those issues in order to have them solved quickly and allow the team members to perform their work effectively. When this activity occurs concurrently with other under the responsibility of the IT Manager, all the other activities paused.

A23. Manage members payments

Purpose: Verify and maintain organized the monthly payments regarding members quota.

Place and Time: Within the normal context of work, with an average of one time per each two months. Normally represents a time cost of one week in total, although the work is highly partitioned. This occurs mainly due to the need of answers from external interveners, schools or teaching delegations.

Participation: Exclusively made by the employees of ASPE Madeira, using the normal configuration of work, documentation provided by the national financial department of ASPE and the internal members database of ASPE Madeira.

Performance: Using the documents provided by the financial department, members are validated manually with the internal database. According with the cases identified, the responsible for this work contacts the entities responsible for the payments of members monthly quota - schools and delegations. This step has an immense time cost because it is not controllable by ASPE and they can only wait (pause the activity) until they have an answer by the external interveners. All these internal steps associated with this activity are done in concurrency with other activities of the process.

A24. Manage website information

Purpose: Update national website information regarding courses to develop by ASPE Madeira.

Place and Time: Whenever A02 is finished, this activity starts. In the normal context of work, we identified that the update process took 90 minutes. This time was calculated during an update of three courses.

Participation: Done exclusively by the IT Manager using his normal work configuration with recourse to the advertise material done under A02.

Product: The update process on the national website is highly frustrating to do. Its poor implementation does not allow the participants to be effective, quite the opposite. As countermeasure the IT Manager which is also the exclusive participant on the activity that serves as input to this one (A02), opted to prepare the publicity for the website using properly designed images. With this measure, he is able to reduced the amount of time needed to perform this activity. However it is not a perfect structure.

A25. Manage Course accreditation

Purpose: Manage the accreditation of courses for ASPE Madeira.

Place and Time: Within the normal context of work, whenever there is the need to embrace different courses. Other situation when this activity takes place is at the reaccreditation of courses which happens when the validation date expires. In terms of time, the reaccreditation is very simple and only takes the time of a click on the online platform from CCPFC (Conselho Científico e Pedagógico de Formação Contínua). The process of accreditation for a new course is far more complex and requires at least one work day.

Participation: Performed exclusively by the ASPE team leader using mainly the platform of

CCPFC. Formator who propose or are proposed to the course are also interveners in this activity although they do not interact with the platform above mentioned.

Performance: The process of reaccreditation is quite simple and with a simple click the interveners are able to accomplish it. Accreditation of a new course has a high level of complexity. The creation of a new course can be considered through a proposal form the formator to ASPE or the inverse way. After this, formator is responsible to deliver to ASPE a description of the course according with the proper form. ASPE leader, then is able to analyse, rectify with the formator, and send it to be accredited by CCPFC. This is very demanding and due to its importance, it is made very calmly to ensure a higher level of correctness. Despite this, the concurrent activities represent a tense constrain which challenges the ability to perform this activity in a calm environment.

A26. Close course

Purpose: Gather information about the course development and the courses needs in RAM, from the perspective of the selected applicants. Explain the procedures until the delivery of the certificate.

Place and Time: performed outside of the normal context of work, whenever a course ends. This activity takes at least 20 minutes.

Participation: One member of ASPE performs this activity. This is perform by anyone of the elements of the team. The documentation inherent to this activity are:

- Course evaluation: Inquiry about the course and formator. It has a space open to critics and opinions.
- Courses needs in RAM: Survey about the formation needs per each area of education.

Performance: Within this activity, ASPE member delivers to applicants all the required documents explained before. After being properly filled by each applicants he gathers the documents and explains the procedures ASPE follows until the delivery of the certificate.

A27. Update databases

Purpose: Update the following databases (DB): contacts DB, courses DB and defaulters DB.

Place and Time: Carried out under the normal context of labour, with periodicity equal to the number of courses developed. The estimated time cost depends on the database under actualization, as shown bellow:

- Contacts database: Keeping updated applicants contacts is a challenge. When applicants enroll in ASPE courses, they are manually introduced on the DB. The main constrain is checking if the element contact information is already introduced previously, to avoid duplications. Updating this database regarding a course with 25 elements has a time cost of at least 45 minutes.

Courses database: In this DB, courses are created in a simply way and then applicants who compose the course class, are individually associated to the course. To connect the learners to the course class, each learner profile needs to be updated. Applicants who have done a course before, already are introduced on the DB and the process is only based on confirming and changing a small amount of data if needed at all. Applicants who attended a course for the first time are not introduced in the DB so in order to associate them with the course, is required to create his profile. Introducing a course with 25 elements represents an average time cost of 60 minutes. This time can be reduced if, for example, 15 of the 25 learners are already introduced on the DB.

- Defaulters database: Maintaining the information as sharp as possible does not take a lot of time. An average time of 15 minutes represents all the update process of this DB. The number of entries on this DB is short because defaulters do not happen on each course. Although every time it occurs is highly relevant to keep it updated in order to be fair and transparent.

Participation: Any element of ASPE can perform this activity. However any procedural doubts are forwarded to the IT Manager.

The three distinct database represent the objects of interaction on this activity. Contacts DB is based over gmail account. Courses database is an internal Joomla database. Defaulters DB is a simple control sheet in Excel.

Performance: This activity is performed after the conclusion of a course or a group of courses. Typically is not subjected to pressure because it is performed when the concurrent activities are calm. Keeping contacts database current is a work of patience because for each contact is required to confirm first if he is already introduced or not and only after create a new contact or update an existing one. There is no way to update it all at once. When managing courses database, the main concept is connecting the learners profile with the course according with the class they were in. The goal is to have always the information as current as possible. For that, when connecting learners to the course their profile data is updated or created. Also within this activity falls down the actualization of the defaulters database which is done normally after A28. In sum this activity is highly relevant because all the three different databases serve many of the activities that compose the process.

A28. Certificates for selected applicants and formator

Purpose: Create certificates for applicants and formator.

Place and Time: Within the normal context of work, since the start of this project, this activity suffer an important alteration. Using mail merge functionalities within Publisher, the average time was reduced in 90%.

Participation: Despite the relevant time reduction to perform this activity, only one member is able to perform this activity, namely the IT Manager.

Performance: This activity is done after the formator delivers course evaluation. Firstly the source of data stored in an Excel file needs to be adjusted to fit properly the template one in Publisher using the tool mail merge. Then, the IT Manager, establishes the connection among data source and Publisher template. After this he finalizes the document and checks all the certificates. Before printing is made a double check by another element of the team using final Publisher file. After verifications, certificates are printed. Normally this activity is not subjected to a large amount of pressure.

Within this step we identified and described each activity resorting on activity profiles. As noticed, one aspect gathered along this description was the interveners and artifacts per activity. However its hard to identify clearly the number of interveners and artifacts and with which activities they are involved. Therefore we will present after a participation inventory we this becomes easier to see.

Participation Inventory represents an overall identification of the interveners (Actors, User Roles, Players, Artifacts and System Actors) included in the process. Before each intervener, we present how it is reflected within participation map models followed by their identification. At the end of this analysis, before presenting each participation map per activity, we enlighten its modeling conventions ([³Constantine, 2008; [⁴Constantine, 2008).



Actors

- ASPE Madeira Leader
- IT Manager
- ASPE Employee



User Roles

- R01. Courses Manager
- R02. Designer
- R03. Information Manager
- R04. Systems Administrator
- R05. Applicant
- R06. Clients Support Manager
- R07. Legal Support Manager
- R08. Treasury Manager



Players

- P01. Professors or Educators
- P02. Substitute Applicants
- P03. Selected Applicants
- P04. Formator
- P05. ASPE Members
- P06. Lawyer

Within the first iteration of our analysis, we added a player called “Learner”. We identified this player as a selected applicants who properly fulfilled the required steps. However, after validation with our customer, he cleared us that the nomenclature they use and will continue to use, to refer teachers who attend courses, is selected applicant.



Artifacts

- Ar01. Online Platform of CCPFC
- Ar02. Course selection file
- Ar03. Courses enrollments resume
- Ar04. Courses Plan draft
- Ar05. Courses Plan advertise
- Ar06. Website
- Ar07. Enrollments Form
- Ar08. Original link to enrollments form
- Ar09. Shrunken link to enrollments form
- Ar10. Contacts DB
- Ar11. Email
- Ar12. Phone, SMS
- Ar13. Fax
- Ar14. Enrollment Form template to print
- Ar15. Selected Applicants course contract
- Ar16. Course Program
- Ar17. ASPE Panflet
- Ar18. ASPE Card
- Ar19. Formator course contract
- Ar20. Applicants documentation
- Ar21. Course Folder
- Ar22. Formator documentation
- Ar23. Course Evaluation Form
- Ar24. Courses needs enquiry
- Ar25. Courses DB
- Ar26. Defaulters DB
- Ar27. Contacts DB
- Ar28. Selected applicants data
- Ar29. Selected applicants Certificates
- Ar30. Formator Certificate
- Ar31. Legislation
- Ar32. Treasury Documents
- Ar33. Online account information
- Ar34. Members payments documentation
- Ar35. New course documentation



System Actors

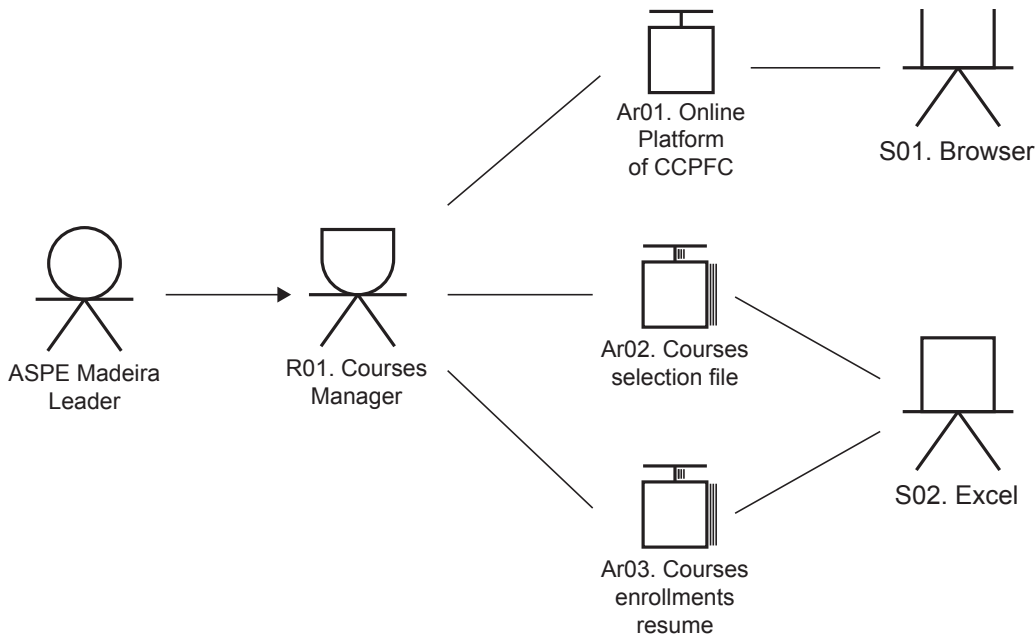
- S01. Browser
- S02. Excel
- S03. Google Forms
- S04. Google URLShortener
- S05. Verification Tools
- S06. Illustrator
- S07. Gmail
- S08. ASPE website
- S09. Courses DB
- S10. Defaulters DB
- S11. Members DB
- S12. Publisher
- S13. Word
- S14. PDF Reader
- S15. Joomla
- S16. CCPFC website

Participation Map modeling conventions

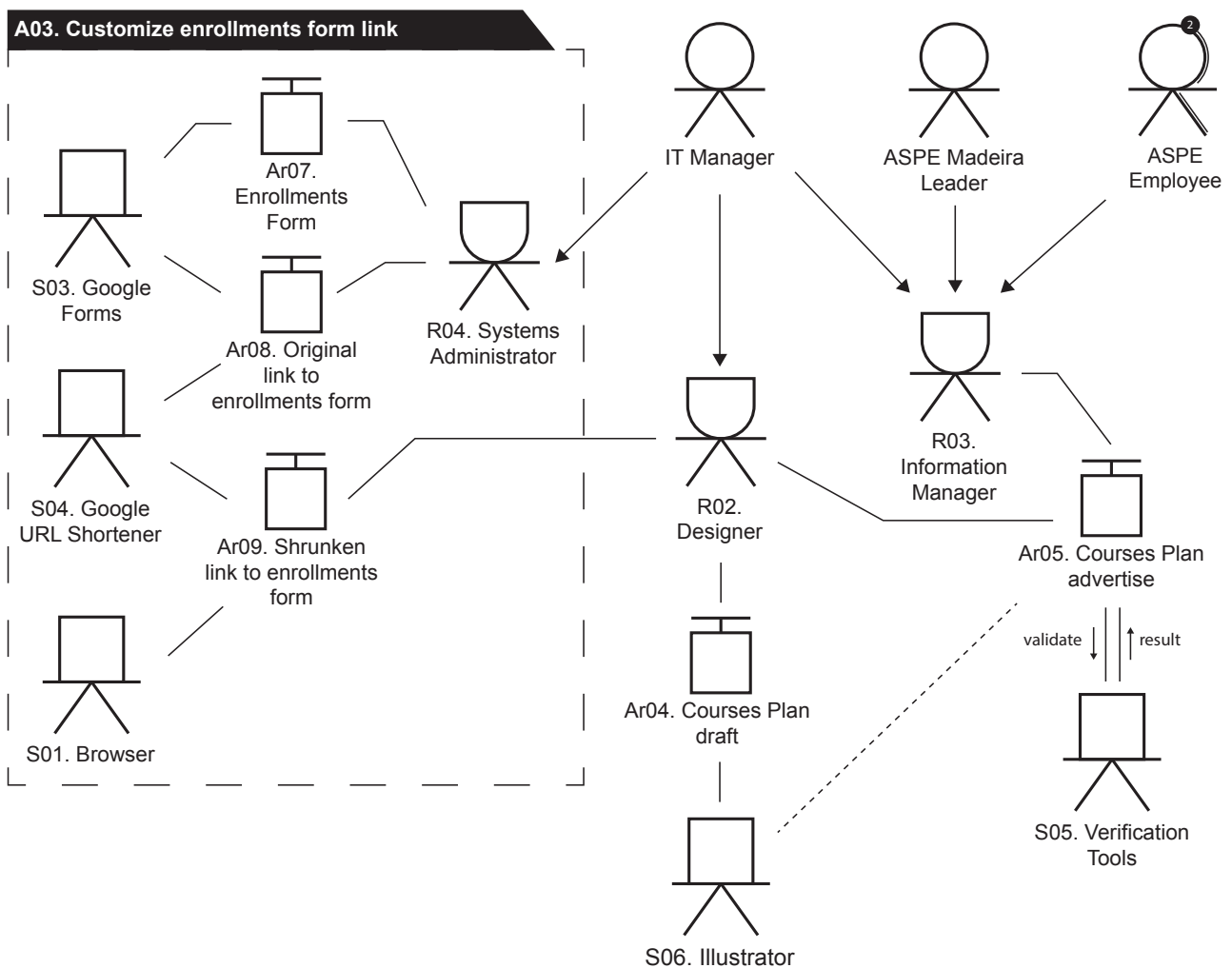
- plays (role)
- interacts with (artifact) or any non-directional
- uses (artifact) or any unidirectional
- competition/conflict any bidirectional
- any weak/secondary unidirectional
- any weak/secondary bidirectional
- any weak/secondary non-directional
- information/material flow

Participation Map per activity

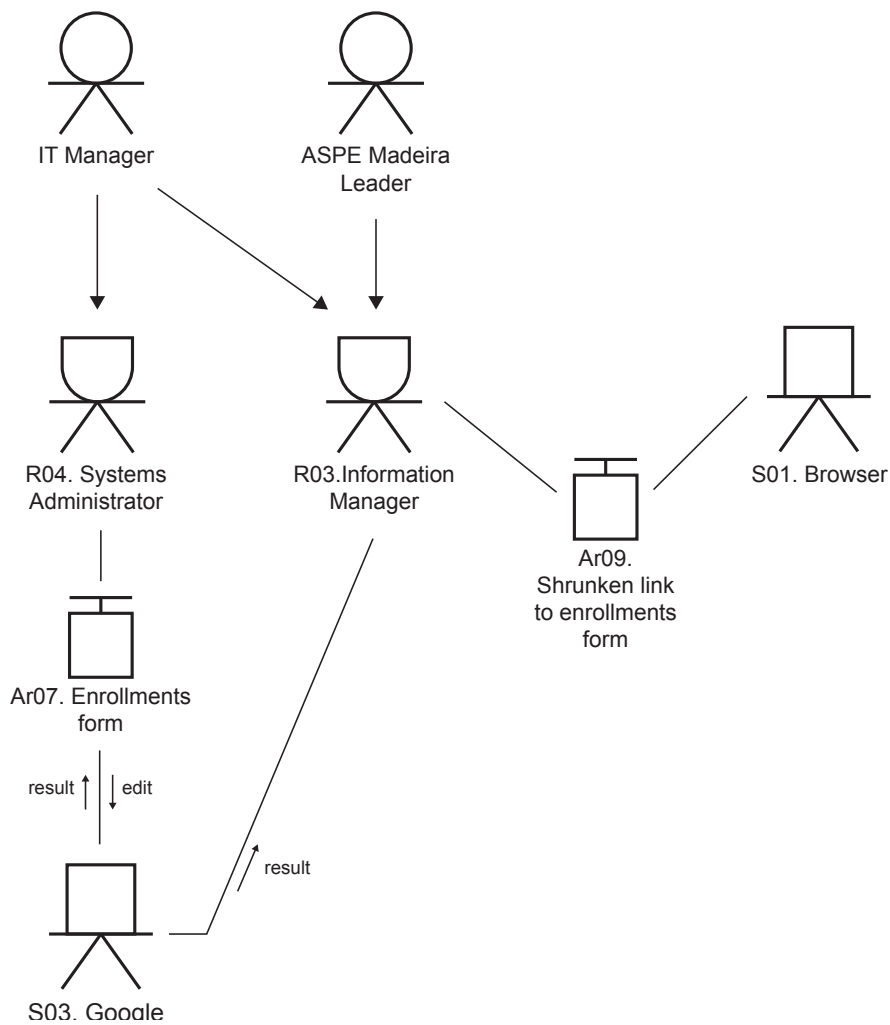
A01: Outline courses plan



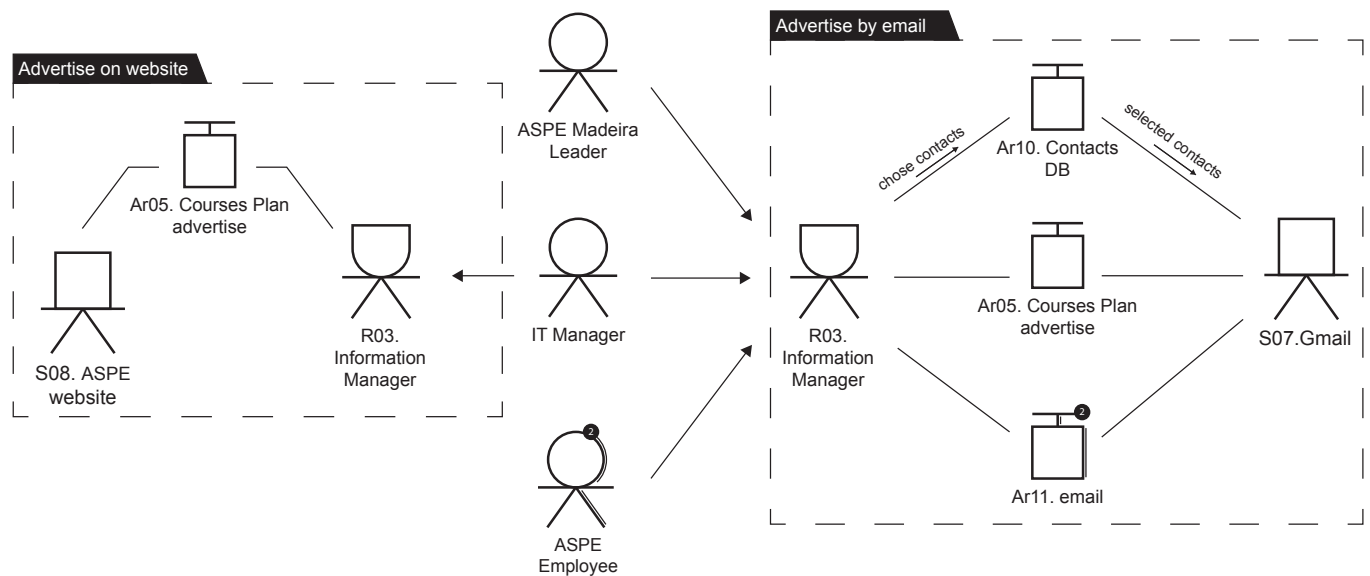
A02: Create advertising of courses & A03: Customize enrollment form link



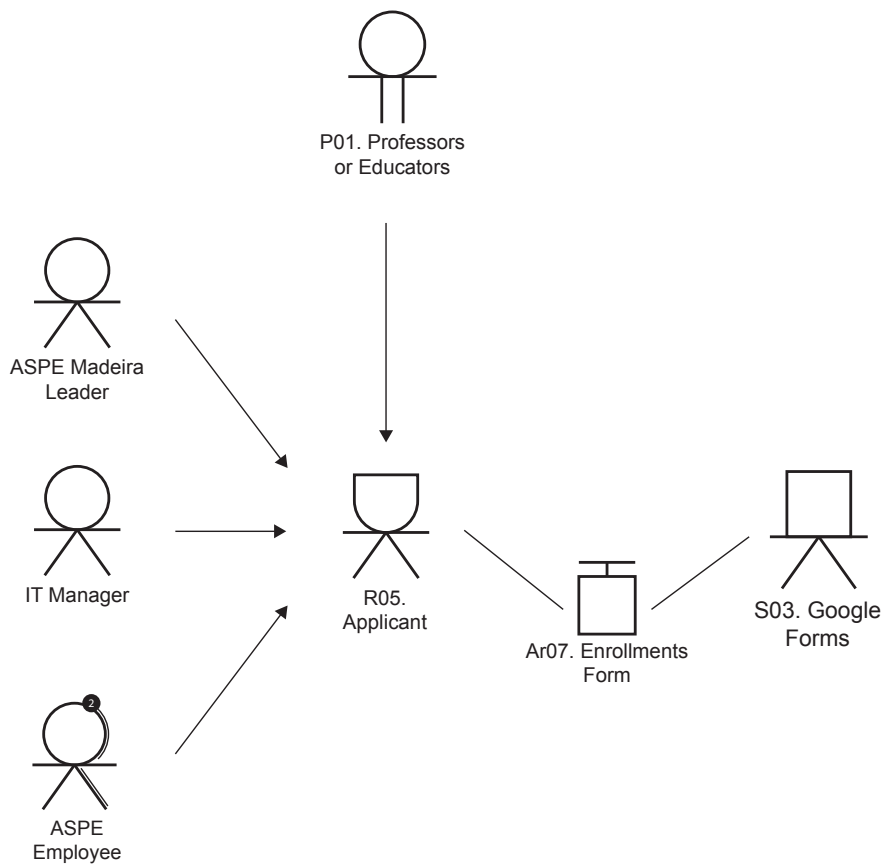
A04: Create/edit enrollments form



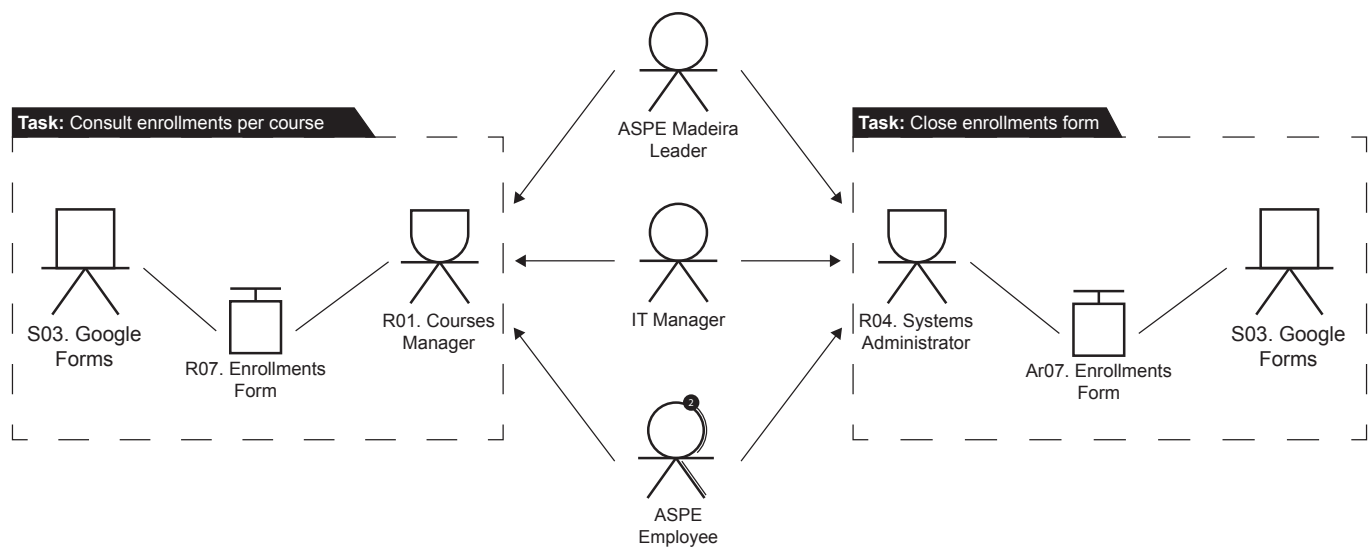
A05: Advertise courses plan



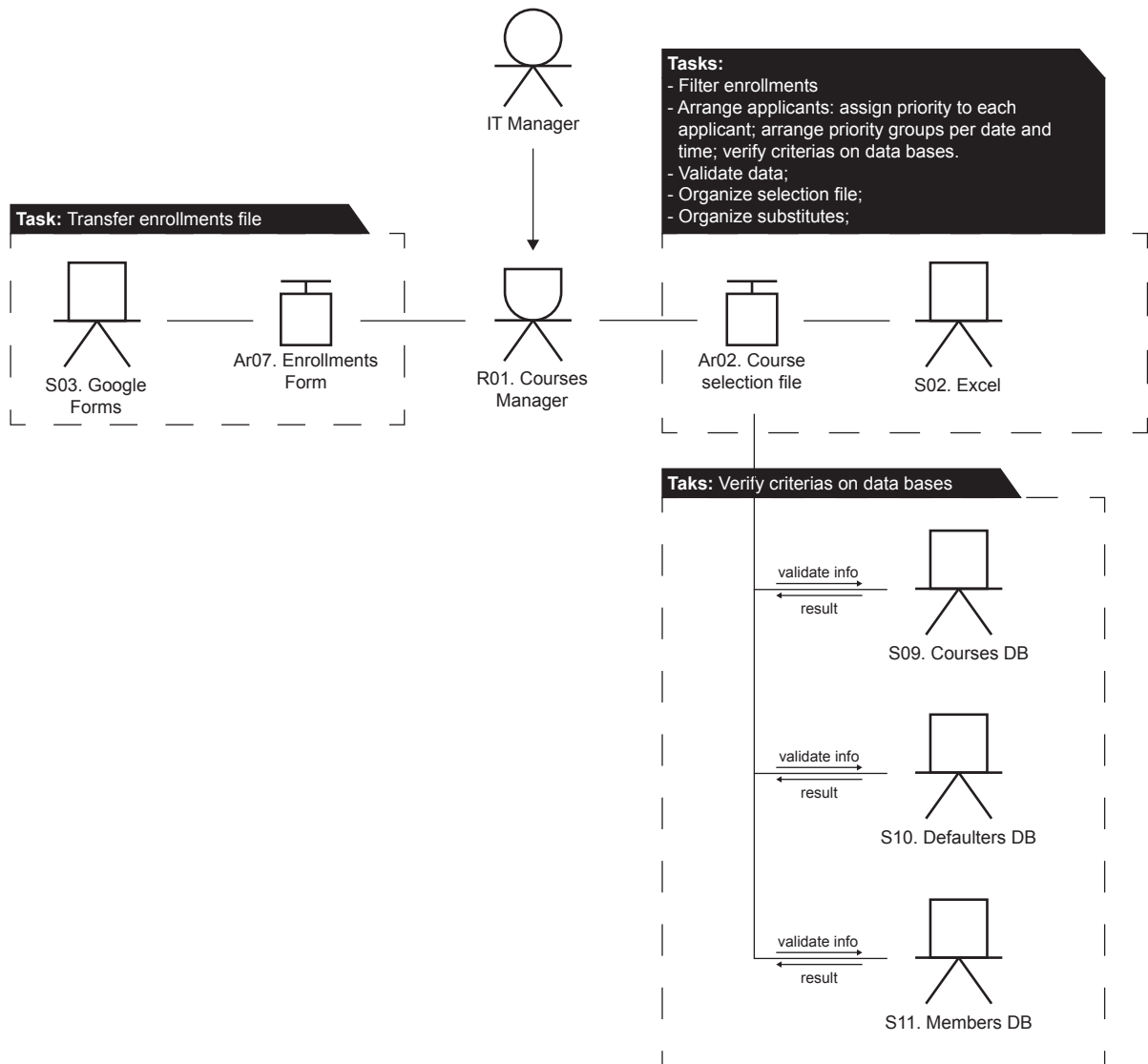
A06: Make enrollment in course(s)



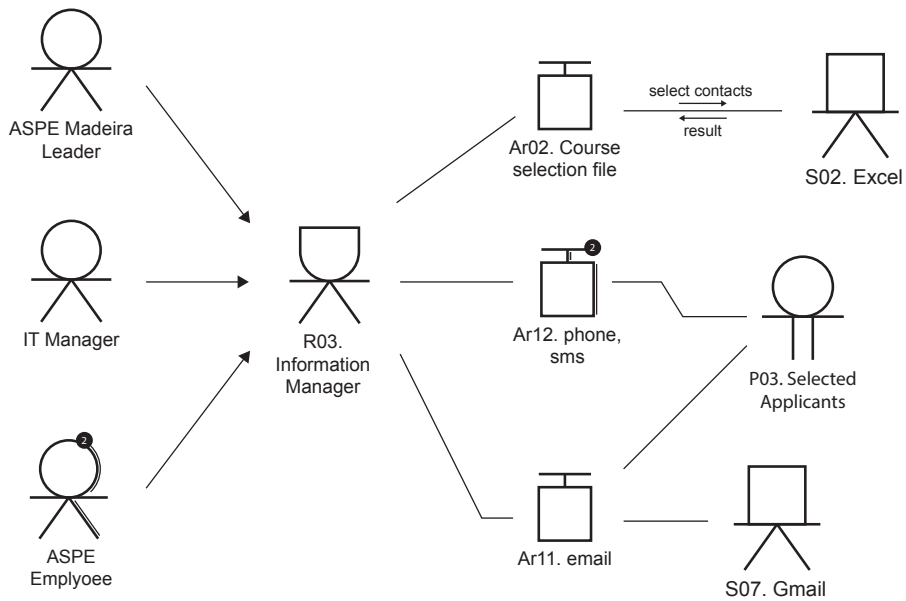
A07: Manage enrollments



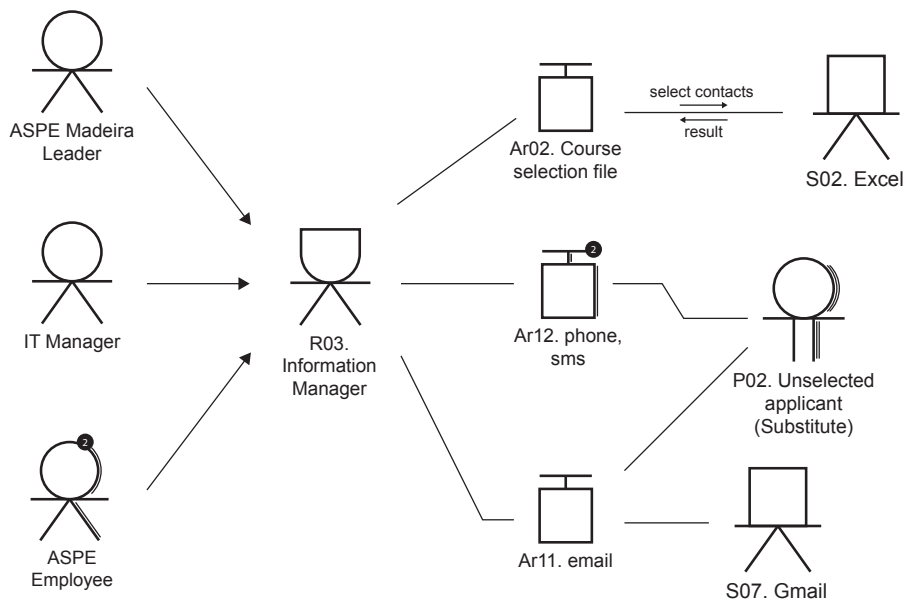
A08: Select Applicants



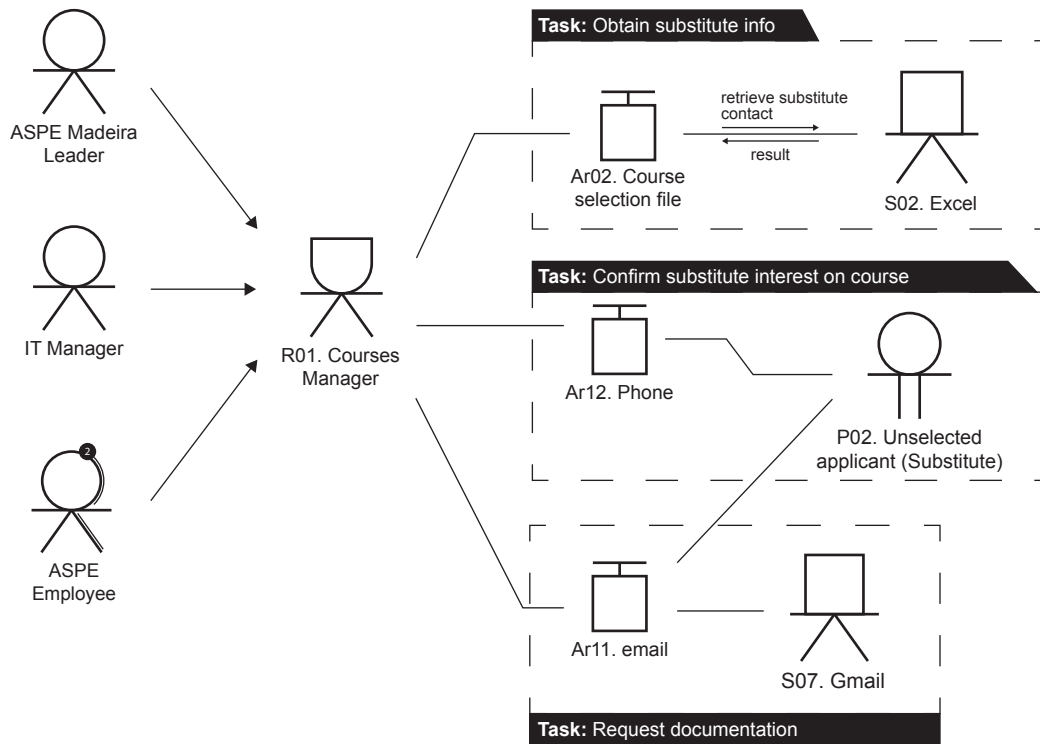
A09: Inform selected applicants



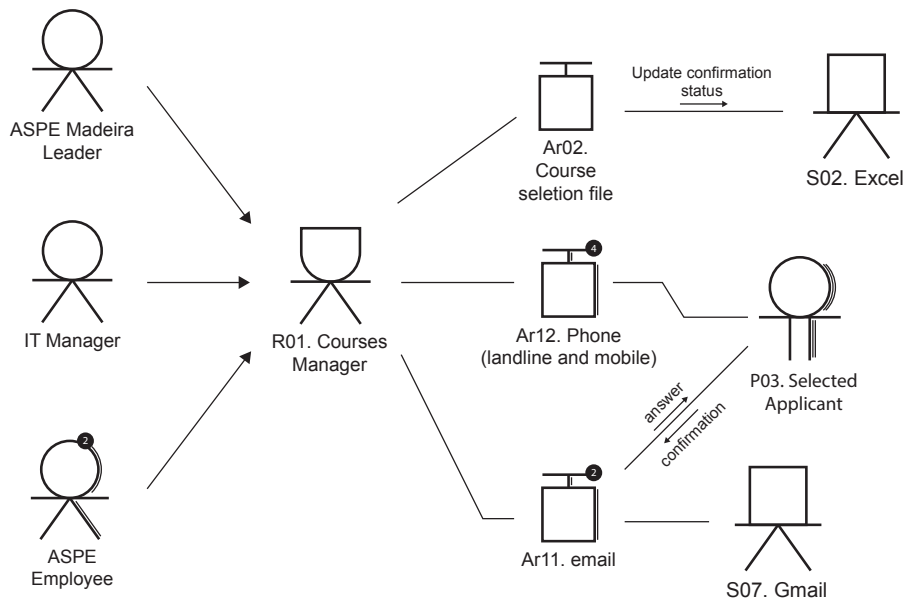
A10: Inform unselected applicants



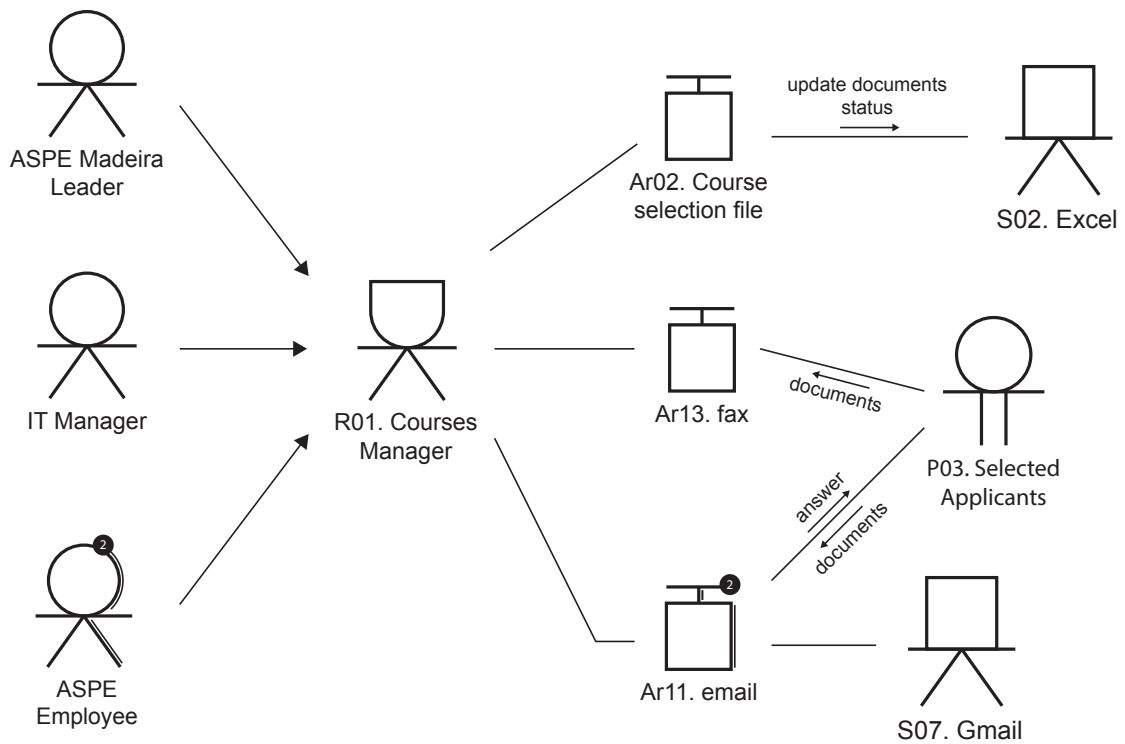
A11: Manage substitute applicants



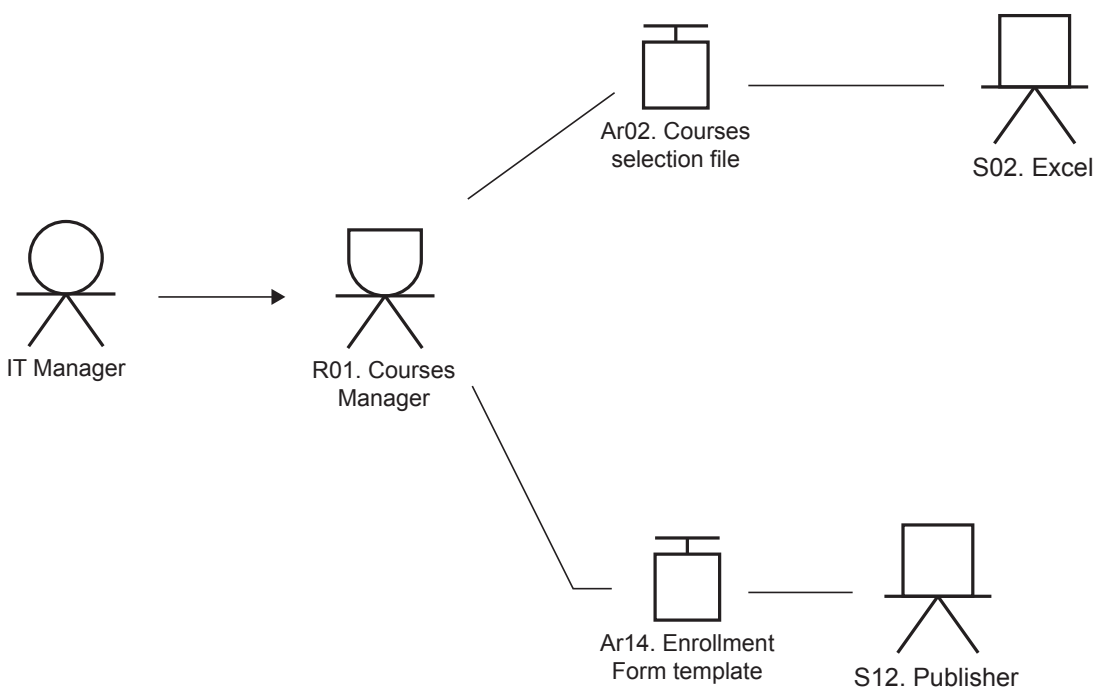
A12: Manage selected applicants confirmations



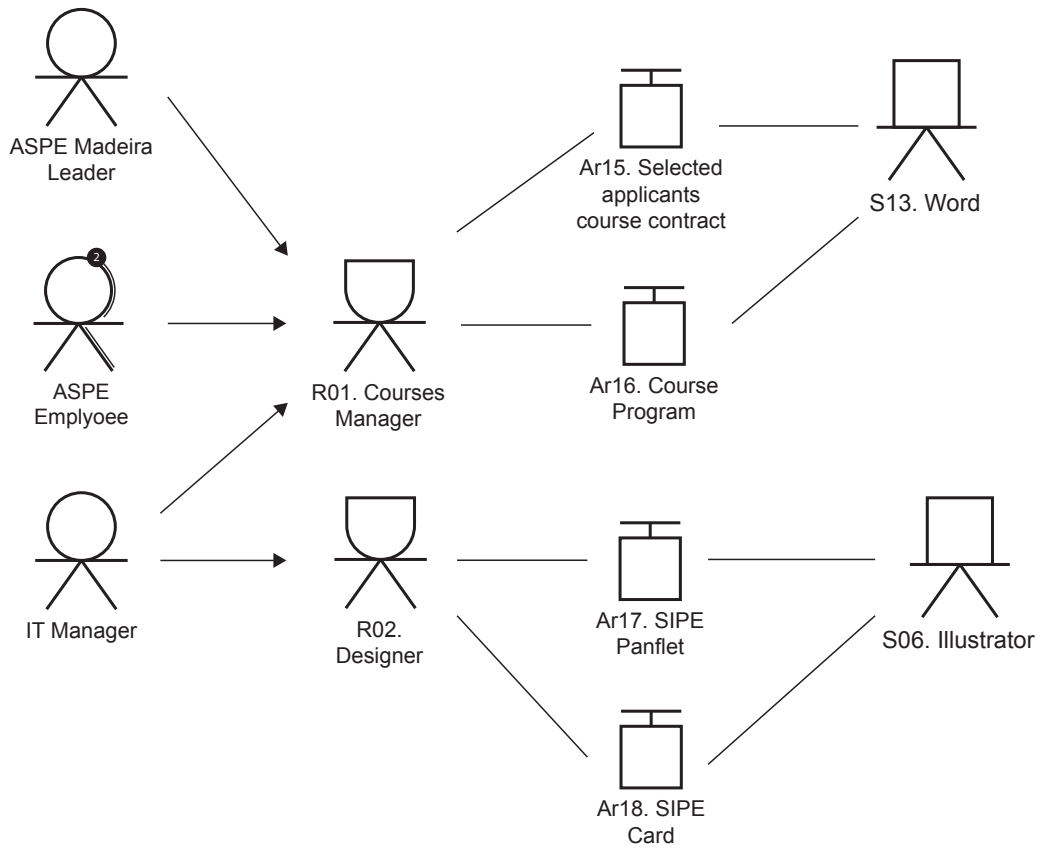
A13: Manage learners documentation



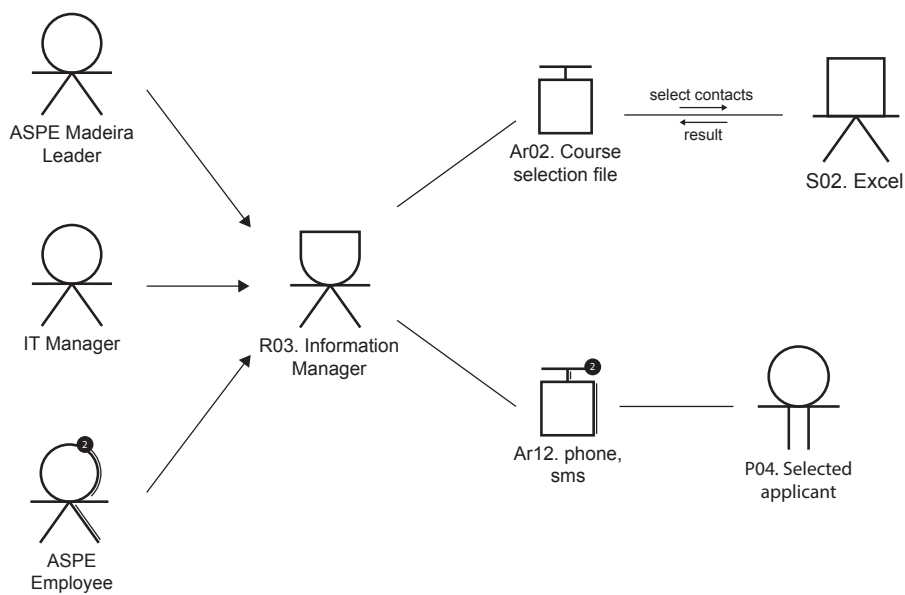
A14: Create enrollment form in paper for each learner



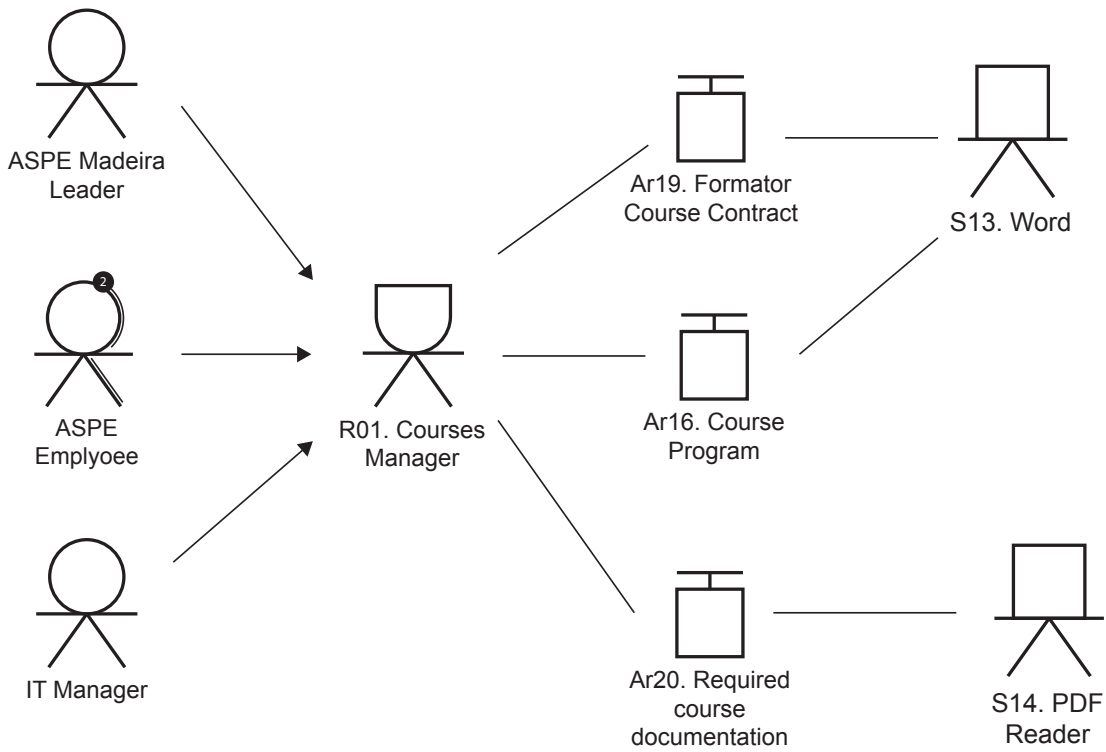
A15: Prepare bureaucratic documentation for learners



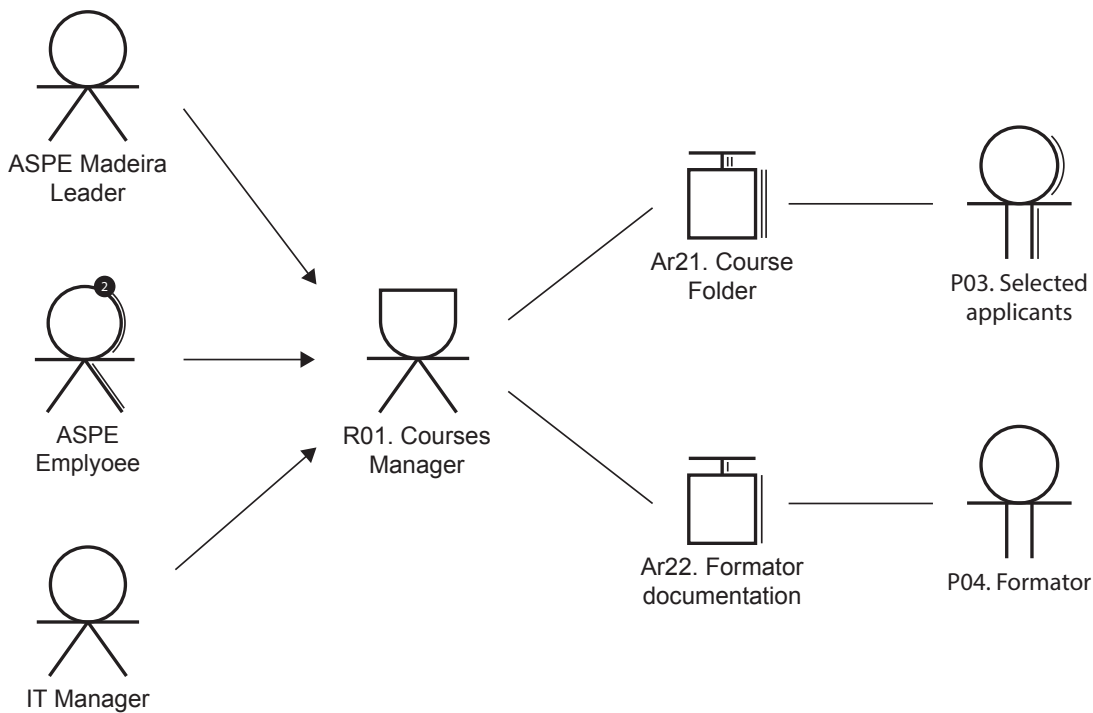
A16: Remind learners about course schedule



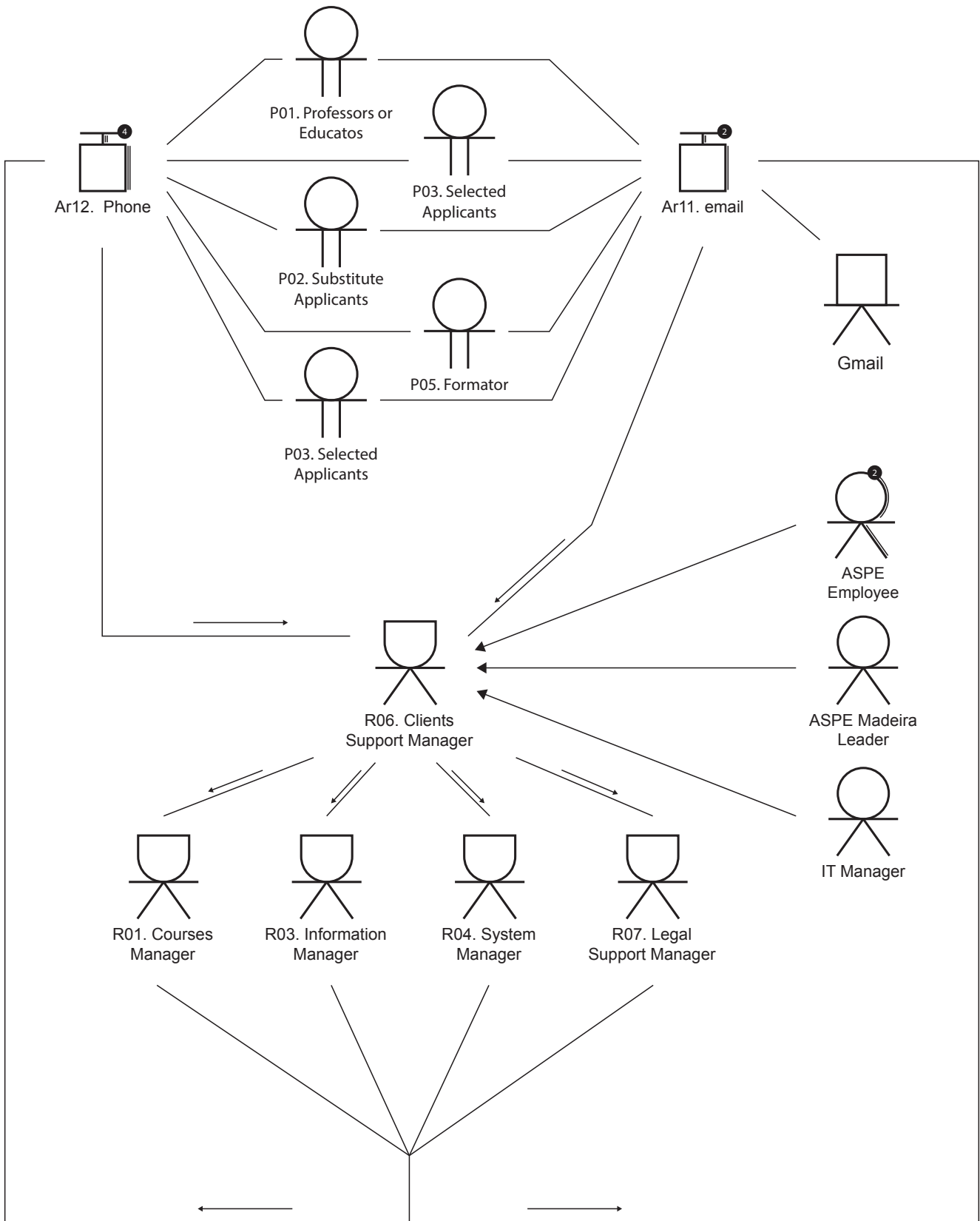
A17: Prepare bureaucratic documentation for formator



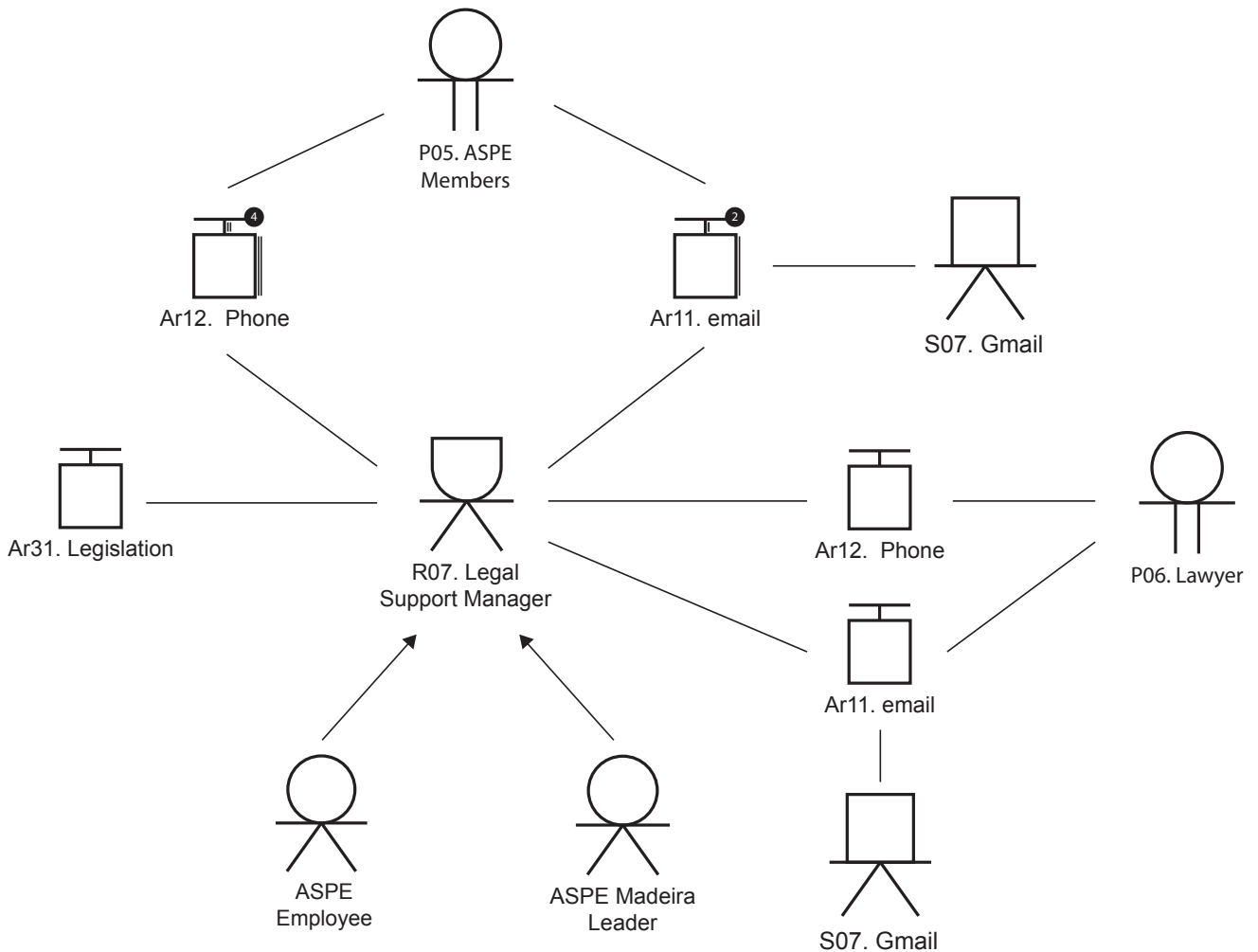
A18: Open Course



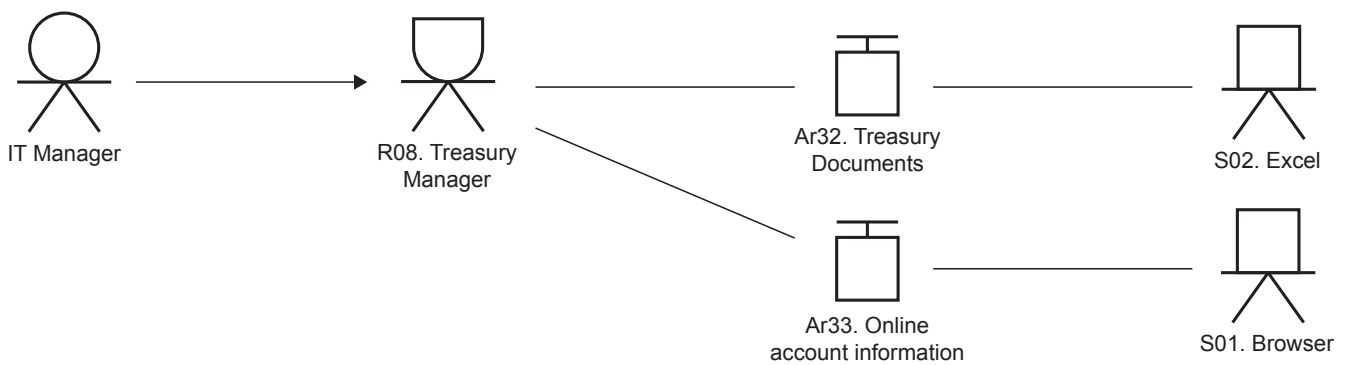
A19: Clients and Members support



A20: Legal support



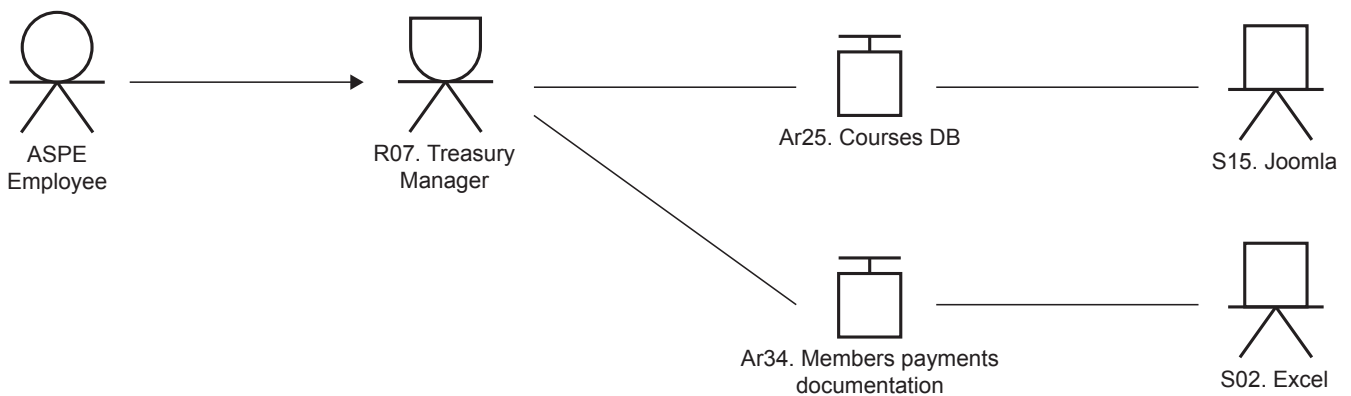
A21: Manage treasury



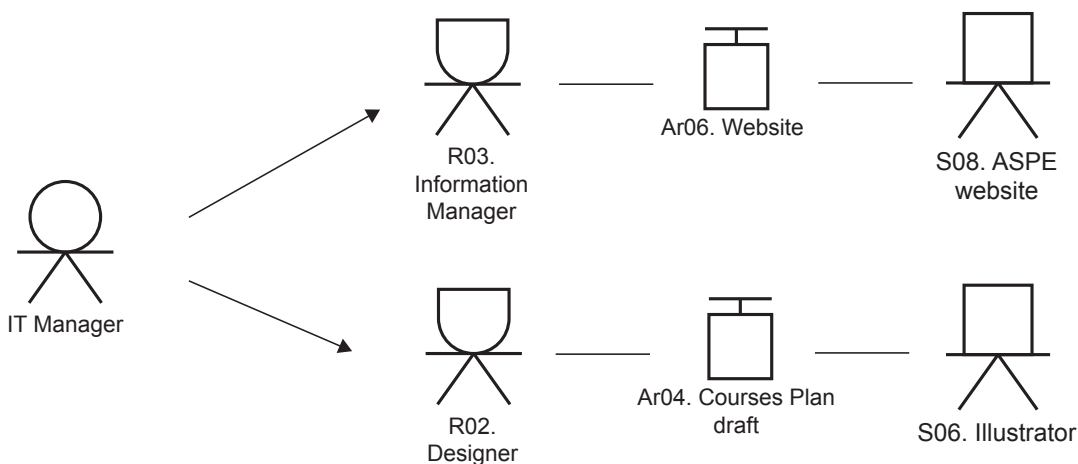
A22: Manage Hardware and Software

The principle behind this activity is very straightforward. To represent all the artifacts and systems with which the IT Manager, in the role of systems administrator, interacts is far too complex to express in a participation map in a readable manner. Participation map for this activity does not contribute to increase our knowledge about its purpose. Because of these aspects, we decided not to create the participation map for this activity.

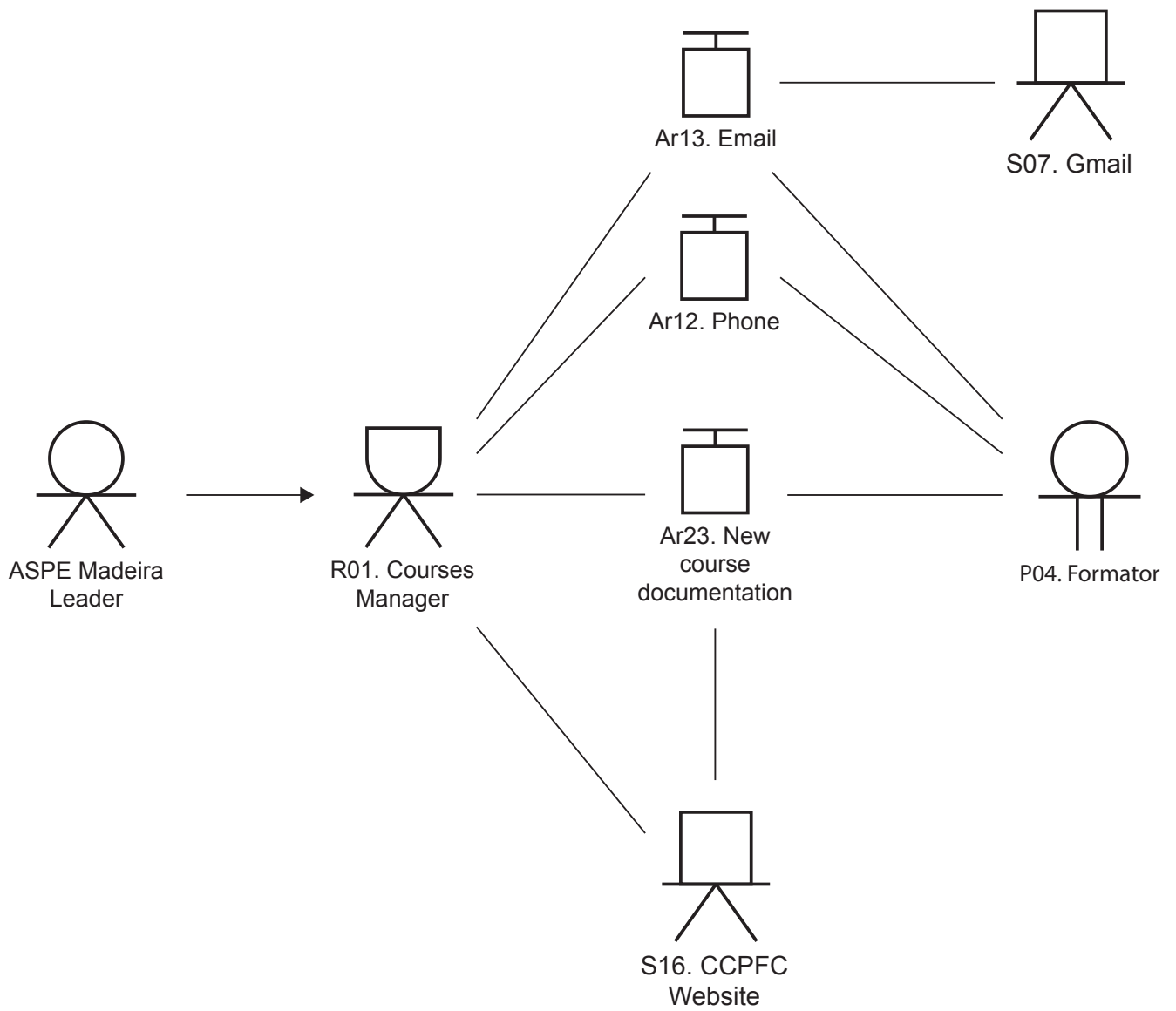
A23: Manage members payments



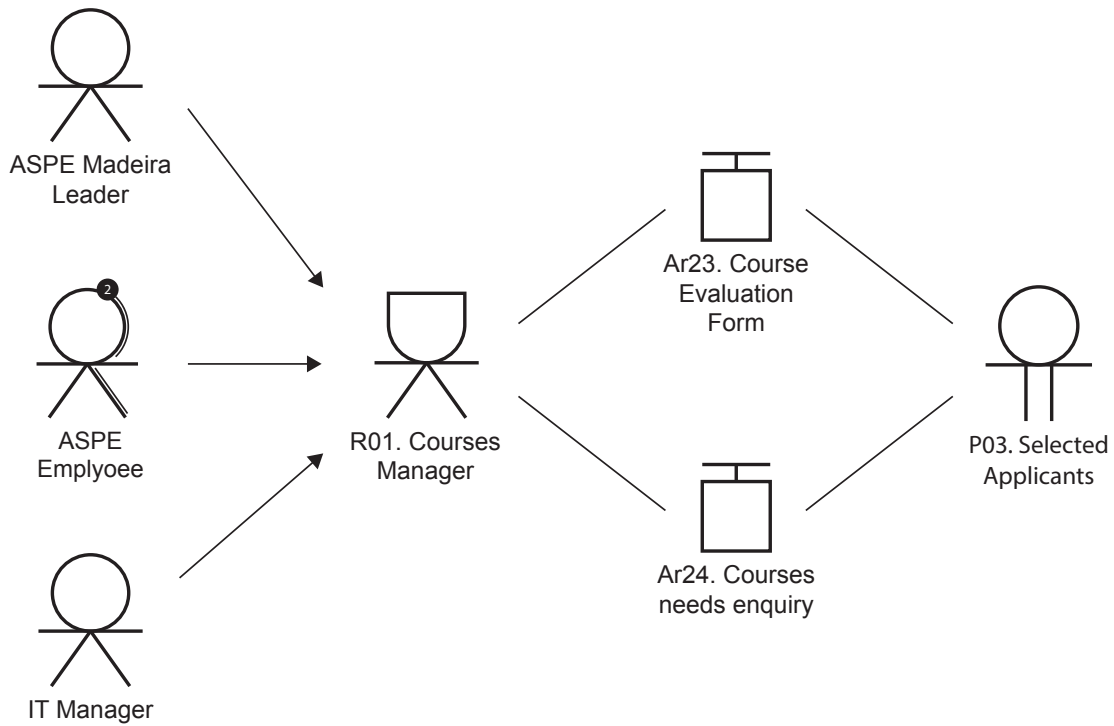
A24: Manage members payments



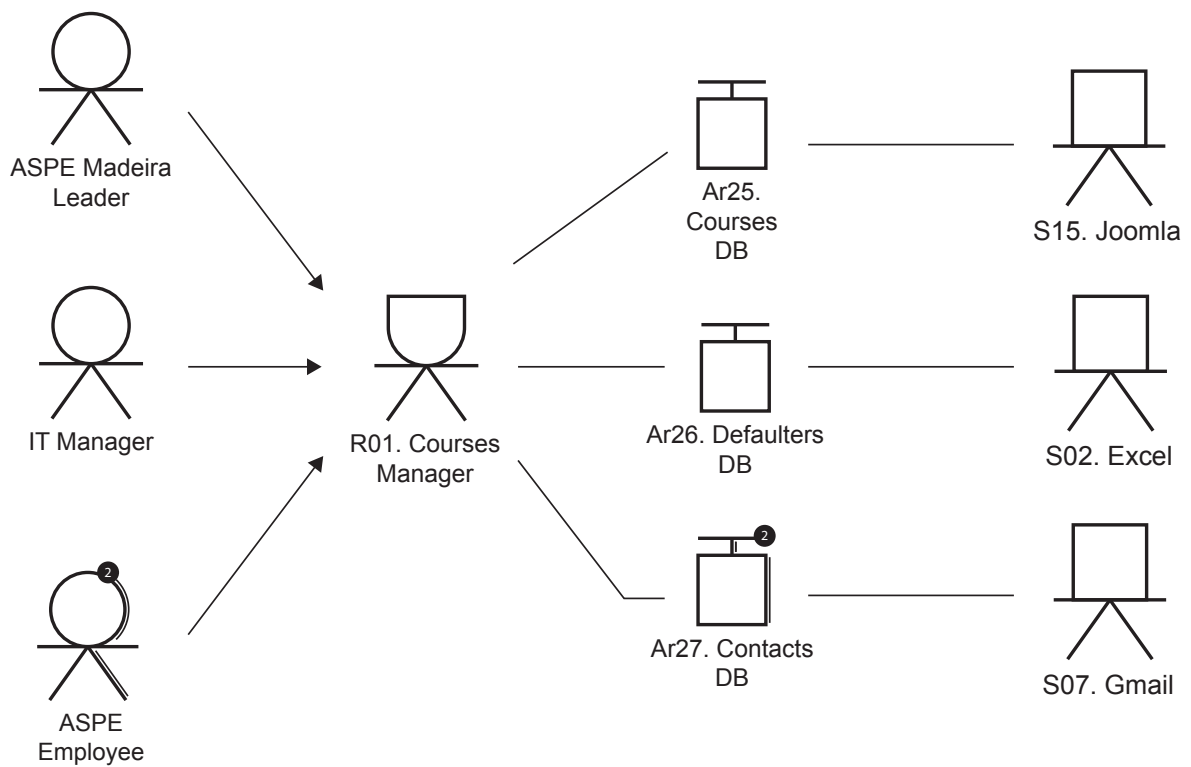
A25: Manage course accreditation



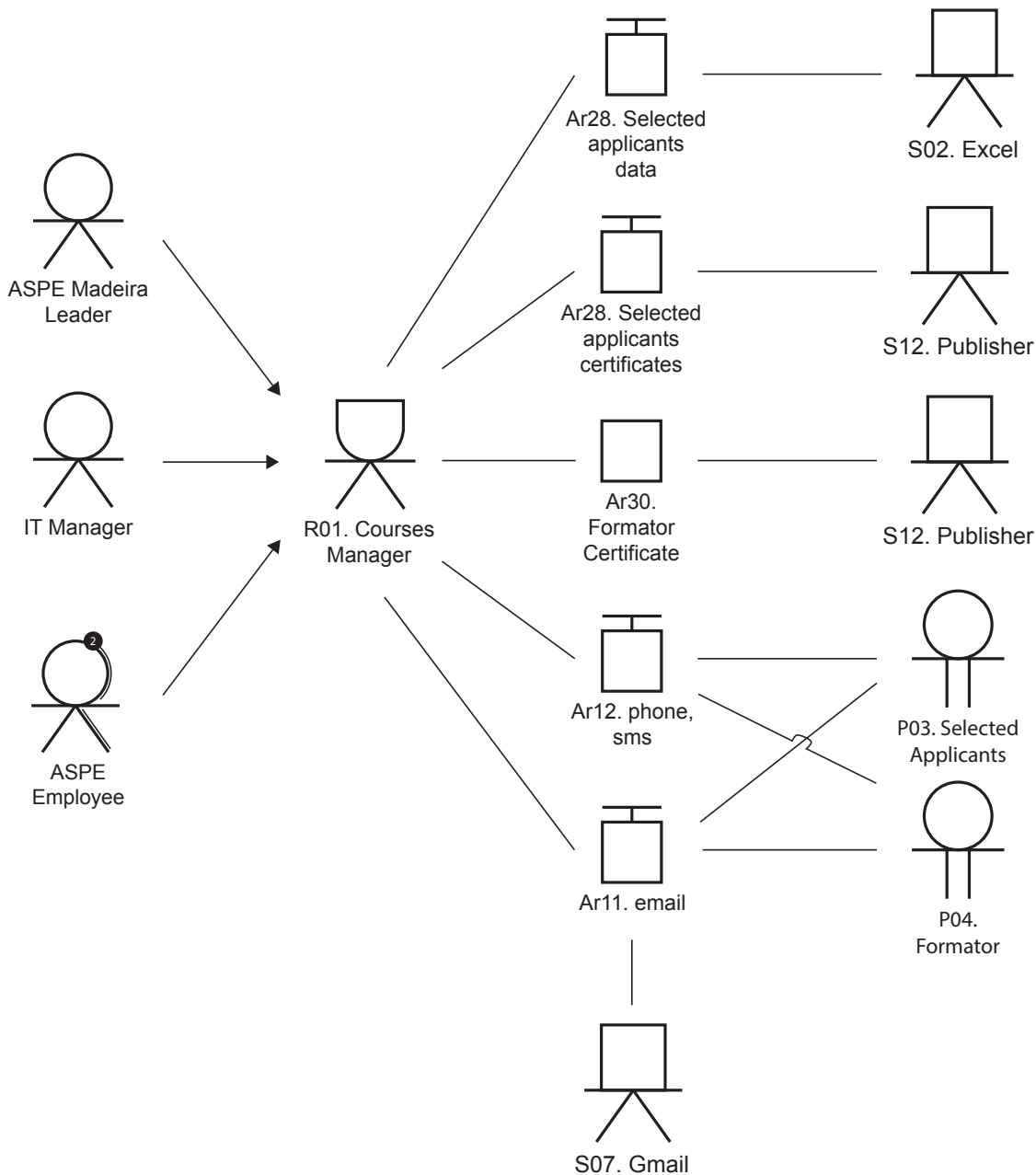
A26: Close course



A27: Update databases



A28: Certificates for learners and formator



Participation Statistics

Participation Map is without any doubt one of the modeling techniques that hugely supports problem comprehension for each activity. Within activity modeling, is also referred that proximate activities should be presented in the same participation map. Although, after trying that approach we concluded that merging activities within the same participation map converged it to a very hard to analyse structure. Another aspects that we consider to be supportive to analyse the process is participation statistics. With the methodology enhancement we were able to identify aspects such as roles per activity, actors per activity and system actors per activity, such as we show below.

a) Roles per activity

Activity	Roles								N.º of roles per activity
	R1	R2	R3	R4	R5	R6	R7	R8	
A01. Outline courses plan	X								1
A02. Create advertising of courses plan		X	X						2
A03. Customize enrollments form link				X					1
A04. Create/edit enrollments form			X	X					2
A05. Advertise courses plan			X						1
A06. Make enrollment in course(s)					X				2
A07. Manage enrollments	X			X					2
A08. Select applicants	X								1
A09. Inform selected applicants			X						1
A10. Inform substitute applicants			X						1
A11. Manage substitute applicants	X								1
A12. Manage selected applicants confirmations	X								1
A13. Manage learners documentation	X								1
A14. Create enrollment form in paper for each selected applicant	X								1
A15. Prepare bureaucratic documents for selected applicants	X	X							2
A16. Remind selected applicant about course schedule			X						1
A17. Prepare bureaucratic documents for formator	X								1
A18. Open course	X								1
A19. Answering clients and members	X		X	X		X	X		5
A20. Legal support							X		1
A21. Manage treasury								X	1
A22. Manage hardware and software				X					1
A23. Manage members payments								X	1
A24. Manage website information		X	X						2
A25. Manage courses accreditation	X								1
A26. Close course	X								1
A27. Update databases	X								1
A28. Certificates for selected applicants and formator	X								1
Number of activities per role	15	3	8	6	1	1	2	2	

Table 2. Roles per activity.

b) Actors per activity

Activity	Actors				Actors per activity
	ASPE Madeira Leader	IT Manager	ASPE Employee	Professors and Educators	
A01. Outline courses plan	X		X		2
A02. Create advertising of courses plan		X			1
A03. Customize enrollments form link		X			1
A04. Create/edit enrollments form		X			1
A05. Advertise courses plan	X	X			2
A06. Make enrollment in course(s)				X	1
A07. Manage enrollments	X	X	X		3
A08. Select applicants		X			1
A09. Inform selected applicants*	X	X			2
A10. Inform non selected applicants*	X	X			2
A11. Manage substitute applicants		X			1
A12. Manage selected applicants confirmations		X			1
A13. Manage learners documentation		X			1
A14. Create enrollment form in paper for each learner		X			1
A15. Prepare bureaucratic documentation for learners		X			1
A16. Remind learners about course schedule*	X	X	X		3
A17. Prepare bureaucratic documentation for formator*	X	X	X		3
A18. Open course**	X	X	X		3
A19. Answering clients and members*	X	X	X		3
A20. Legal support	X		X		2
A21. Manage treasury		X			1
A22. Manage hardware and software		X			1
A23. Manage members payments			X		1
A24. Manage website information		X			1
A25. Manage courses accreditation	X				1
A26. Close course**	X	X	X		3
A27. Update databases		X			1
A28. Certificates for learners and formator		X			1
Number of activities per actor	12	24	9	1	

Table 3. Roles per activity.

* Activities performed multiple times by different actors. However it is most common to be carried out by the Responsible for Informatics.

** Activities performed multiple times by one of the identified actors.

Note: For more detail about the activities referenced, please consult the activity profile for the respective activity under the “Activity Model | Collection of Activity Profiles” section (4.1.2).

c) System actors per activity

Activity n.º	System Actors																N.º of system actors per activity
	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	
A01	X	X															2
A02	X		X	X	X	X											5
A03	X		X														2
A04							X	X									2
A05			X														1
A06			X														1
A07		X	X						X	X	X						5
A08		X					X										2
A09		X					X										2
A10		X					X										2
A11		X					X										2
A12		X					X										2
A13		X					X										2
A14		X										X					2
A15												X	X				2
A16		X															1
A17													X	X			2
A18																	0
A19*							X										1
A20*							X										1
A21	X	X															2
A22																	0
A23		X													X		2
A24						X		X									2
A25							X										1
A26																	0
A27		X					X								X		3
A28		X					X					X					3
	4	14	5	1	1	2	12	2	1	1	1	3	2	1	2	0	

N.º of activities per system actor

*Within these activities, in specific cases, other system actors may be included.

Table 4. System actors per activity.

Participation Map per activity is a high granularity analysis that supports activity comprehension. As we noticed while modeling each activity, for complex processes it is very hard to track what are the artifacts, roles and system actors common among them. Therefore we consider to be relevant that Participation Map per activity is hand to hand with Participation Inventory and Participation Statistics. With the last one, developers can have an overall look of interconnections of elements between activities.

With our analysis, the first relevant aspect we gathered is that although twenty seven activities for a company is not so much, 24 of them involving the same actor (IT Manager) is quite limitative in terms of performance due to work overload. Another relevant aspect gathered in participation statistics, was the number of system actors involved per each activity. With these values, we are able to orient the solution in order to build a leaner and integrated system as well as compare the as-is with the to-be system actors and evaluate the solution.

3.2 | Role Profile | Activity-Based User Roles

From the perspective of Professor Larry Constantine, to incorporate activity modeling into usage-centered design, role profiles are modified to connect roles explicitly to the activity within which the roles are embedded and plants the idea that roles belongs to the activity. From our point of view, roles should not be strictly connected to one activity. Roles should be able to endorse one or more activities which is what happens on real work environment. Therefore, we made a small refinement to activity-based user roles which focus on cover more than one activity per role. The content of the revised Activity-Based User Role, follows the authors mechanism which is organize under three strict headings and one optional. Originally described by Activity, Background and Characteristics ,three mandatory headings, and an additional heading for Design consideration, that should be added to user roles description whenever there is the need to explicitly point out relevant design implications ([3]Constantine, 2008; [4]Constantine, 2008, [5]Constantine & Lockwood, 2005).

Our simple refinement is to change Activity heading to Activities. This would consequently affect the name of this component, having the need to update it from Activity-Based User Roles to Activities-Based User Roles. All the headings mentioned previously and how should they be described was kept as mentioned by the author, Professor Larry Constantine.

Following our refinement, where Activity heading is change do Activities, the description suffers also the required updates to be as follows:

Activities refers to the activities within which the role is played. If the activities are defined elsewhere by an Activity Profile, then it can be referred to by name or for example A02.

Note: This change was made to meet with what we believe to be an enhancement to analysing roles within a process. Hopefully, we will have the opportunity to discuss our approach with activity modeling author and validate our concept.

To avoid repetition, we will not present at this instance how Activities-Based User Roles should be described. To see further details, consult page 19.

Activities-Based User Roles

Within the participation inventory, we identified that “ASPE Madeira Leader”, “IT Manager”, “ASPE Employee” and “Professors and Educators” were the actors of the process under analysis.

Having these remembered, we will present nextly the Activities-Based User Role description for each identified role. Note that, for each activity referred below, its context of use can be seen under the “Collection of Activity Profiles” (3.1.2).

R01. Courses Manager

Activities: This role is played within the activities A01, A07, A08, A11, A12, A13, A14, A15, A17, A18, A19, A25, A26, A27 and A28.

Background: All actors except “Professors and Educators” can, within some of the identified activities, assume this role. ASPE Madeira Leader is a highly qualified Portuguese teacher and pos graduate in communications and information technologies. ASPE Employee, graduated in Portuguese/French shares the same working philosophy. However, both actors described, often develop activities focused mainly on being the quickest and better possible at that instance, the present. However, activities are often connected and both actors sometimes do not think about how the methodology that use to perform an activity will support future instances of that activity or connected ones. Although, they are always focused on performing tasks the quickest and the better, with a smile in their faces.

These two performers have a huge domain knowledge. Although, regarding the process as-is, many of the improved elements within the process tend to stress them due to their informatics constraints in certain specific aspects. From another perspective, IT Manager has an advanced awareness of the system/process and, generally, performs one activity always thinking on its possible use in the future. His background in computer science allows him to overcome the process complexity as well as improve it at each interaction. Although he has a high informatics dexterity and works fast and accurately, performing activities focusing not only in the present tends to create some tension because it defies the working perspective of other actors which focus mainly on performing tasks in the better and fastest possible way, for the present.

Characteristics: Activities under the scope of this role are highly variant in terms of complexity. The performer who carries out the activity depends according with the activity and in some cases can even shift during the activity. For example: “A14 - Create enrollment form in paper for each learner” is not a complex activity but uses one function that only the IT Manager can use. Therefore this activity can be performed entirely by him or firstly by him and at the end, which is simpler, other actors can become interveners.

Regarding frequency, its difficult to reach to a specific value because almost every activity is concurrent with another in terms of performers.

Design: The huge number of activities enrolled at the same time - concurrently - tends to be very stressful and in some cases, occurred that smaller details were forgotten. It would be perfect that the new platform had functionalities like warning mechanism for undone things. Something like an internal task list that could be defined quickly without requiring to many time. A pair of extra memory to support performers to overcome stressful days easily and without forgetting any of the task they should do.

R02. Designer

Activities: Designer role is engaged within the activities A02, A15 and A24. For the last two, this role is used as a provider of visual content validation, supporting courses manager and information manager to achieve activity main goals.

Background: All the activities mentioned above share the same performer. Graduated in computer science and enthusiastic for interface design, he developed basic skills of designer along the past 2 years. Although he is able to create good and solid works, he is far to be a designer. His creative process ensure good output but sometimes his excessive perfectionism

is very time consuming. Nowadays his skills are getting better and better, interacting faster and faster with design software platforms and taking his knowledge to another level enhances to possibility to take his jobs to another level.

Characteristics: Shorten deadline is the time assigned to perform whatever is the activity that requires design intervention. Since this role is mainly to provide or validate content to other activities, the urge is always present. Although, it can be prevented by working on these activities when the others, concurrent per performer, are stopped.

Design: The main constrain within this role is that only one actor is able to change the designed documents even when it is simple alterations as correcting a word. Allowing the performer of this role to continue his high quality design and also ensure quick changeability for any of the internal interveners of the process would change the way this specific work is done.

R03. Information Manager

Activities: To perform A02, A04, A05, A09, A10, A16, A19 and A24 following the same information methodology, consistency is crucial.

Background: Same as R01.

Characteristics: Performed on a daily basis, this role gathers activities that are simple to perform. However the overload of work underlies on the need for one actor to perform many activities at the same time, which is common. With this tense time restriction, simple activities tend to become stressful and in some cases can be interpreted as complex.

Design: Currently, information methodology guidelines are already established between ASPE work team. However, with the overload of work is often to jump over the guidelines. It would be rewarding to have a system that offers support and ensured that the methodology is followed. For ex. Elaborate schematics about the messages for applicants and formators, etc.

R04. Systems Administrator

Activities: A3, A4, A7, A19 and A22 compose the scope of work for this role.

Background: Except for A7, all the activities above mentioned share the same actor - IT Manager. Graduated in Computed Science and with two years of domain and system knowledge he is an expertise qualified performer, very organized (sometimes to much) and overall focused on performance.

Characteristics: Although activities are normally simple to perform, the context were they are developed often causes stress. For example A22. Manage hardware and software, depends on the problem occurred and the problem may overlap activities with the same performer. Although it is crucial because if there is an hardware or software issue blocking the successful implementation of another activity, it needs to be solved before anything else.

R05. Applicant

Activities: This role is engages the other side of the system through the activity where the enrollments are filled, A06.

Background: Professors and Educators performed 3661 times successfully, on the past two years. The experience is highly heterogeneous among them. From enthusiastic with new technologies to old school teachers, define the scope of different experience degrees. Their domain knowledge is highly diverse. However it is common that many teachers already know the system from a previous interaction to enroll in courses.

Characteristics: This role can be engaged to perform A06 from any computer with internet connection. Some actors who assume this role identified the platform to be confusing.

Design: Support to performers is not available directly. It would be important that the system did not let users feel like they are alone while performing the task inherent to the activity. Providing a good support to users resorting in easier and intelligent help mechanisms would be a great evolution.

R06. Clients Support Manager

Activities: This role represents a facilitator within the activity A19.

Background: All the internal interveners of the process (ASPE Leader, IT Manager, ASPE Employee) assume this role. This role is only as a forwarder to specific roles who answer to specific question. The process and domain knowledge acquired by any team member allows each one of them to perform this role without any problem.

Characteristics: Engaged on a daily basis routine, answering to a medium value of 30 call a day, it is a simple role. However the unpredictable characteristic with which the role is engaged often affects concurrent performers and activities.

R07. Legal Support Manager

Activities: Endorsed within A19 and A20 with the main goal of providing legal support to ASPE members.

Background: ASPE Leader and employee are teachers as well as the members of ASPE. Although they are not lawyers, they have good domain knowledge and many years of experience in syndicalism working allow them to gather and learn how to interpret legislation and elucidate members. However, specific questions outside of the scope of their knowledge are sent to the legal department.

Characteristics: It is impossible to predict when this role will be engaged. It has priority over all other. Legal questions are hugely variable. The level of complexity can be very simple as well as very complex, depending on the question.

Design: The main issue while providing support is to find legislation promptly. Providing performers, internal mechanisms to support this activity, would allow them to be effective and decrease the effort and resources needed to quickly answer the prompted clarifications.

R08. Treasury Manager

Activities: Engaged whenever there is the need to perform A21 and A23. Both activities are very important to maintain financial sustainability.

Background: Managing treasury (A21) is form the responsibility of the Responsible for informatics while A23 relies on ASPE Employee. Both performers have an excellent system and domain knowledge.

Characteristics: This role is engaged whenever any of the concurrent roles and activities are stopped or calmer. Activity A21 is normally performed one time per month and it is simple to do but usually the amount of documents under organization makes it take at least one full day. Regarding A23, it is done about once every two months. The current verification/management system is inadequate and compels the performer to work harder to attain the desired level of correctness.

Design: Managing members payments is a challenging activity due to the system in use. Changes in the managing system as well as a system that supports integration between delegations would increase exponentially the effectiveness of activities.

3.3

Activity-Based Task Modeling - as-is

Activity-based task modeling, within activity modeling, is an extension to task modeling based on tasks. Modeling tasks per activity is the first iteration contemplated to adjust normal task modeling to this model based methodology. With this, developers have an extended view of what an how users do tasks. Second addition to this model is the incorporation of non-interactive actions (external actions - EA) to the problem analysis ([3]Constantine, 2008).

Adding to this, in the article “Human Activity Modeling Reference Model: Collaborative Usability Inspection Tool”, Professor Larry Constantine mentions a synthesized approach to inventory tasks and external actions ([4]Constantine, 2008). From our perspective, this is the fundamental aspect which will build the bridge from problem analysis to solution.

Inventory of tasks and external actions (T/EA) per activity gives us a cleaner visualization of what T/EA occur within each activity and which of them are shared between activities. It is also possible to incorporate the combination of these tasks into a visual model such as the example show bellow:

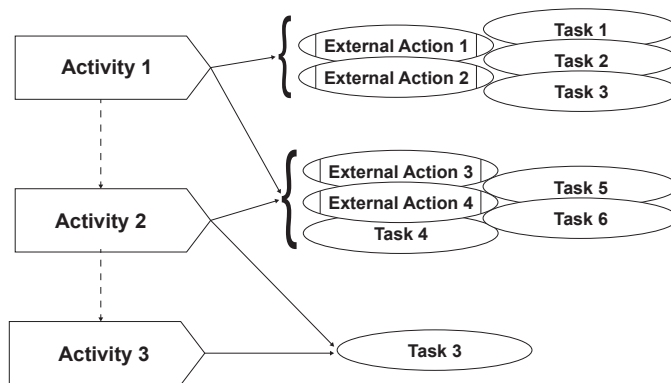
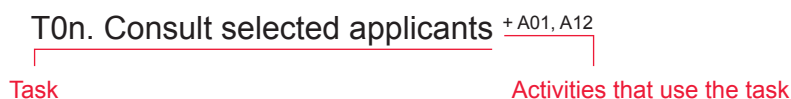


Figure 8. Model of tasks/actions per activities ([4]Constantine, 2008).

However, for complex processes it is hard to extract information because the model becomes too large and a bit confuse and sometimes it is not possible to split the problem on groups of activities.

Although this awesome idea is considered in activity modeling, we consider that it requires an additional visual trigger near task/external actions that are connected to multiple activities. Therefore, we came up with the following representation, which we will explain resorting in a fictional example of a task used in multiple activities:



As mentioned in the problem abstract analysis, within “Activity Modeling incorporated into usage-centered design” resume, activity-based task modeling is structured to explain main tasks resorting on task cases/essential use cases.

Having this real world problem as input for a study case to activity modeling methodology, we identified that performing task cases from the as-is version is to excessive, considering that a proper analysis was/is being made until this step. However, we are not discarding, task cases, in absolute. When approaching simple tasks and actions, from our point of view, if task and external actions naming is done properly, it is very deductible for developers what user and system responsibilities are. Despite that, in case of doubts among developers, tasks cases can help and should be applied.

At this instance we are bounded with the process as-is, fact that allowed us to analyse the relations among tasks, actions and activities requiring only to the inventory per activity, as we show bellow.

A01. Outline courses plan

- E01. Consult statistics from previous courses
- E02. Consult courses credited by CCPFC
- E03. Consult team members
- E04. Choose courses to develop
- E05. Define courses schedule
- E06. Create courses plan draft information

A02. Create advertising of courses plan

- E07. Get courses plan draft information
- E08. Consult and reuse elements from previous course plans
- E09. Gather creative elements/images
- E10. Export courses plan to different formats and sizes
- E11. Validate information with team members

A03. Customize enrollments form link

- T01. Shrunken link
- E12. Test shrunken link

A04. Create/edit enrollments form

- T02. New enrollments form
- T03. Copy enrollments form
- T04. Edit/consult enrollments form
- T05. Delete enrollment form
- E13. Consult courses plan ^{+ A04, A06}
- E14. Test form functionality
- E15. Check with team members ^{+ A04, A05, A15, A24, A25}

A05. Advertise courses plan

- E16. Access advertising elements
- T06. Advertise courses plan (email, national website)
- E15. Check with team members ^{+ A04, A05, A15, A24, A25}

A06. Make enrollment in course(s)

- E17. Access to the enrollments form
- E13. Consult courses plan ^{+ A04, A06}
- T07. Enroll in one or multiple courses

A07. Manage enrollments

- T08. Manage enrollments form availability
- T09. Consult enrollments statistics
- T10. Edit applicant enrollment details
- T11. Remove applicant enrollment

A08. Select applicants

- E18. Decide with team members the number of applicants per course
- E19. Inform team members to don't open certain selection files.
- E20. Access course selection file + A08, A12, A13, A14, A15, A16, A19
- T12. Filter enrollments per course
- T13. Verify applicants criteria on databases
- T14. Assign priority to each applicant
- T15. Sort priority group per date and time
- T16. Check duplicate applicants per courses coincident in schedule
- T17. Create a list for selected applicants
- T18. Create a list for unselected applicants
- T19. Create a list for applicants dropouts
- T20. Check duplicate applicants enrollments
- T21. Add duplicates to dropout applicants and tag as duplicate in the observations.
- T22. Verify applicants selected to coincident courses.
- T23. Set selected and non selected applicants
- T24. Insert last minute dropout applicants information to insert in defaulters database.
- T25. Save selection file

A09. Inform selected applicants

- T26. Gather applicants contacts + A09, A10, A16, A27, A28
- E21. Create email notifications to selected applicants
- E22. Create SMS notifications to selected applicants
- E23. Send to email + A09, A10
- E24. Send SMS + A09, A10
- T27. Update applicants notification status + A09, A10

A10. Inform non selected applicants

- T26. Gather applicants contacts + A09, A10, A16, A27, A28
- E25. Create email notifications to non selected applicants
- E26. Create SMS notifications to non selected applicants
- E23. Send to email + A09, A10
- E24. Send SMS + A09, A10
- T27. Update applicants notification status + A09, A10

A11. Manage substitute applicants

- T28. Verify if a substitute applicant is not selected to another concurrent course
- E27. Contact substitute applicant
- T29. Set substitute applicant as selected
- T30. Set substitute applicant as dropped out.

A12. Manage selected applicants confirmations

- E28. Reading selected applicants confirmation email messages and SMS
- E29. Answer selected applicants email messages and SMS

E20. Access course selection file + A08, A12, A13, A14, A15, A16, A19

T31. Update confirmation status

A13. Manage learners documentation

E30. Verify selected applicants documents

E31. Organize documentation in the physical course folder + A13, A18, A26

E20. Access course selection file + A08, A12, A13, A14, A15, A16, A19

T32. Update documentation status

A14. Create enrollment form in paper for each learner

E32. Copy enrollment form data source template

E20. Access course selection file + A08, A12, A13, A14, A15, A16, A19

T33. Insert selected applicants information in data source

E33. Copy enrollments form template

T34. Adapt enrollments form template course information

T35. Link enrollment forms to data source

T36. Create enrollment form per each selected applicant.

E34. Verify enrollment forms

T37. Print enrollments forms.

A15. Prepare documentation for learners

E35. Copy learners documentation templates

T38. Adjust the information within each learner document

E15. Check with team members + A04, A05, A15, A24, A25

E20. Access course selection file + A08, A12, A13, A14, A15, A16, A19

T39. Print learners documentation

E36. Group documentation and place it on a courses folder for each learner

A16. Remind learners about course schedule

E20. Access course selection file + A08, A12, A13, A14, A15, A16, A19

T26. Gather applicants contacts + A09, A10, A16, A27, A28

E37. Create SMS reminder to selected applicants

E38. Send SMS

T40. Update selected applicants reminder notification status

A17. Prepare documentation for the formator

E39. Copy formator documents template

T41. Edit documentation for the formator

T42. Print summary sheet

T43. Print formator contract

E40. Send documentation to the formator by email

A18. Open course

E41. Present ASPE and formator

E42. Explain course bureaucratic documentation

E43. Deliver documentation to be filled out by the selected applicants

- E44. Gather filled out documentation from the selected applicants
- E31. Organize documentation in the physical course folder + A13, A18, A26

A19. Answering clients and members

- E45. Answer incoming calls
- E46. Answer clients and members personally
- E20. Access course selection file + A08, A12, A13, A14, A15, A16, A19

A20. Legal support

- E47. Consult legislation
- E48. Consult jurist
- E49. Forward doubts to jurist

A21. Manage treasury

- E50. Organize treasury documentation per day and month
- E51. Insert documentation details in the organization file
- E52. Digitalize treasury documentation
- E53. Send treasury original documents to the accounting headquarters

A22. Manage hardware and software

- E54. Gather issue information
- E55. Consult issue solving mechanism
- E56. Contact hardware technician

A23. Manage members payments

- E57. Request new member number to the headquarters
- E58. Request members count to headquarters
- E59. Verify members list
- E60. Contact members managers
- E61. Check payments

A24. Manage website information

- T44. Insert website information related with courses
- E62. Gather and place advertising elements
- E15. Check with team members + A04, A05, A15, A24, A25

A25. Manage courses accreditation

- E63. Propose course to a formator
- E64. Analyse course proposal
- E65. Credit course
- E66. Consult existing courses
- E67. Consult course enrollments statistics
- E68. Contact formator
- E15. Check with team members + A04, A05, A15, A24, A25

A26. Close course

- E69. Explain course bureaucratic documentation

- E70. Deliver bureaucratic documentation to be filled out by the learners
- E71. Gather filled out documentation from the learners
- E31. Organize documentation in the physical course folder + A13, A18, A26
- E72. Analyse evaluations by the learners
- E73. Analyse courses needs surveys

A27. Update databases

- T26. Gather applicants contacts + A09, A10, A16, A27, A28
- T45. Update contacts database
- T46. Update courses database
- T47. Update defaulters database

A28. Certificates for learners and formator

- E74. Copy certificates data source template
- E75. Access course selection file
- T48. Insert selected applicants information in data source
- E76. Copy certificates front template
- E77. Consult courses plan
- E78. Consult CCPFC platform
- T49. Adapt certificates front template general information
- T50. Link certificates front template to data source
- T51. Create learners certificates fronts
- E79. Copy certificates verse template
- E80. Consult course program
- T52. Adapt certificate verse template
- T53. Verify certificates
- T54. Print certificates
- E81. Create SMS to selected applicants, not members, informing that certificates are ready.
- T26. Gather applicants contacts + A09, A10, A16, A27, A28
- E82. Send SMS to selected applicants - not members
- E83. Prepare members certificates to send by courier
- E84. Create SMS to selected applicants, members, informing that certificates were sent by courier
- E85. Send SMS to selected applicants - members
- E86. Prepare members certificates to send by courier
- E87. Send members certificates by courier

Since the process as-is relies in a group of different software solutions, it was a demanding task to identify what of the disperse steps within each activity should be considered tasks or external actions.

4 | Solution Strategy

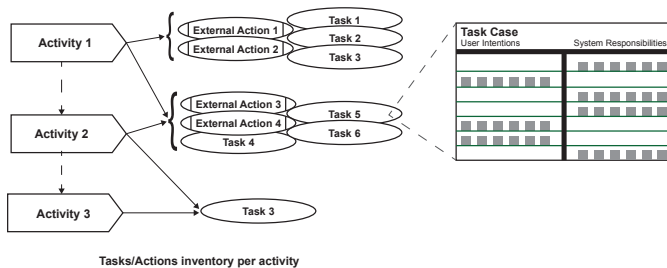
From our perspective, activity-based task modeling of the process as-is, represents the final step of problem analysis. Concerning not only with the step mentioned previously but with all the steps done to reach that point, itself included, we believe developers have all the required aspects to start building the solution.

We consider that the inventory of task and external actions (T/EA) per activity provides to developers a textual guidance to the solution interface design. Interface guidelines pop up when analysing which T/EA compose the activity and which of them are shared between activities. With a properly structured inventory, developers are able to design a solution having as guide that task X, Y or Z should be available while performing activity N. The same though can be applied to the external actions, allowing us, to identify external actions that can be transformed to tasks. Therefore we identified it as the connecting link between problem and solution.

Thus, we come up with the following model to structurize how we intend to iteratively achieve our model driven solution:

SOLUTION MODELING

step 1. ACTIVITY-BASED TASK MODELING - to be



Main Goals:

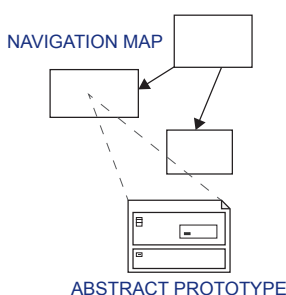
- Analyse focal tasks as-is and with all the knowledge gathered on the multiples steps of activity modeling, redesign how it should be implemented, using as connecting link activity-based task modeling.

step 2. REQUIREMENTS SPECIFICATION

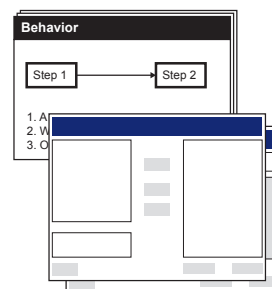
Guidelines:

- For each task derive system requirements from the user intentions within activity-based task modeling - to be. Note that non-interactive actions may influence the requirements. Analyse tasks and external actions connections among activities and dependencies between each step of problem analysis (Activity Map, Activity Profile, Participation Map, Activities Based User Roles and Activity-Based Task Modeling).

step 3. PROTOTYPES



step 4. CONCRETE SOLUTION



According with our solution model, our first step is to perform an activity-based task modeling. Having as input the analysis to the process as-is, we intend to outcome how activities share tasks and external actions among them. This will serve as starting point to our solution interface design.

Within this step we already identified two models that help developers to perform good work planning. Resorting to task/external inventory per activity developers have an overall look to the system and for dubious cases tasks modeling comes into place.

We started our system to-be analysis performing task models to each of the focal tasks and external actions. Soon we noticed that the level of complexity inherent to task modeling each task was to high and extracting valuable information from that complex web of user intentions and system responsibilities was starting to be an issue. Therefore, we changed our perspective and focused on analysing how the new system should be resorting on tasks and external actions inventory per activity. With this decision we were able to create a simpler overall look of what we intended, as we show bellow.

After applying both techniques, we concluded as the best way to build the bridge from problem to solution is to perform firstly the inventory and if some task or external action become doubtful we should use task modeling to achieve a higher level of granularity.

Within our analysis, we use only the inventory of task and external actions per activity. Note that we will only focus on activities we intend to support with our solution. Notwithstanding, we will develop the solution having in consideration future extensions that may occur to contemplate other identified activities.

Since we are trying to achieve a proper solution as well as a guide of how to apply activity modeling, we will extend the inventory by identifying which task/external actions we intend to remove and why, as well as additional T/EA and why, with a brief and concise exposition of our decision background.

Task/external action inventory per activity - to be

Note that all task or external actions referred from now on using * after the number such as “T04*...” mean that the numeration is the old one, ie, the one used on Task/External action inventory per activity for the as-is version.

A01. Outline courses plan

T01. Consult statistics from previous courses

Until this point, statistics were consulted using an excel manually updated and structured per year. Our idea is to bring this external action to the system. Our goal is to provide to our customer automatically generated statistics and an easier way to consult them. Our input ideas came directly from the activity profile, were we identified that our customer wish is to consult statistics such as number of enrollments per course, selected, non selected, dropped out applicants, enrollments per recruitment group. In addition to it, we will also include other statistical elements.

E01. Consult courses credited by CCPFC

E02. Consult team members

E03. Choose courses to develop

E04. Define courses schedule

E05. Create courses plan draft information

A02. Create advertising of courses plan

E06. Get courses plan draft information

E07. Consult and reuse elements from previous course plans

E08. Gather creative elements/images

E09. Export courses plan to different formats and sizes

E10. Validate information with team members

Activity “A03*. Customize enrollments form link” is composed by one simple task and an external action equally simple. Therefore we decided to extinguish this activity and insert within the next activity, the task to shrunk enrollments form link. Following the same principal “E12*. Test shrunken link” is merged to the next activity. The difference is that, since within “A03. Create/edit enrollments form” already exist an external action to test enrollments form functionality, “E12*. Test shrunken link” is not necessary.

Task/External actions alterations resume:

T01*. Shrunken link - changed to T06. Customize link to enrollments form.

E12*. Test shrunken link - extinguished.

A03. Create/edit enrollments form

T02. Create new enrollments form

Operations to the enrollments forms, on the process as-is, was done using Google Forms. We intend to bring all of these functionalities to the new platform. The main change we will do is that administrators will not need to add courses to the enrollments form. Our goal is to make the association to the enrollments forms according with the type of form and the type of course.

The same intentions are shared to tasks T03, T04 and T05.

T03. Copy enrollments form

T04. Edit/consult enrollments form

T05. Delete enrollments form

T06. Customize link to enrollments form

This task was performed in the process as-is, using Google URL shortener. We intend to incorporate this functionality on our solution but without using the platform mentioned previously.

E11. Consult courses plan ^{+ A03, A07}

E12. Test form functionality

E13. Check with team members ^{+ A03, A04, A05, A12, A21, A22}

A04. Manage courses

Our idea is to create one simple space focused on courses management which will provide input to courses advertisement, enrollments selection, statistics and all other functionalities related with courses. To achieve our goal we will have the following tasks and external actions.

E14. Decide with team members the number of applicants per course

On the version as-is of the process, this external action (E18*) was performed inside A08*. Select applicants. However, we will design courses management to include fields regarding the required number of applicants as well as the maximum.

- T07. New course
- T08. Edit/consult course
- T09. Delete course
- E11. Consult courses plan + A04, A07
- E13. Check with team members + A03, A04, A05, A12, A21, A22

A05. Advertise courses plan

- E15. Access advertising elements
- T10. Advertise courses plan (email, national website and regional platform)

In addition to the advertising methods used already we will have a dedicated spot for courses advertisement. Our goal is to have within course details, fields for publication dates which will act as an automatic mechanism to advertise courses. These publication dates will be accessible while adding or editing a course to the system.

All the previous mechanisms to advertise courses will be kept untouched.

- E13. Check with team members + A03, A04, A05, A12, A21, A22

Looking to the process as-is, our customer's clients could get courses information directly if they belong our customer contacts database or indirectly by consulting the national website, ie, the output of "T06*. Advertise courses plan (email, national website)".

Planning what we want achieve for the solution, we acknowledge that between "A05*. Advertise courses plan" and "A06*. Make enrollment in course(s)" was missing a connection link. From our point of view, the solution should outcome a platform where our customer's clients can always access courses information, regardless of receiving courses plan by email. Therefore we introduced a new activity "A07. Consult course(s) information" composed as follows:

A06. Consult course(s) information

- T11. Consult courses under enrollments +A06, A07

The goal for this task is to allow users access at any time a list of courses under enrollments. This will be automatically shown by the system, having in consideration the aspects we explained inside T10.

- T12. Consult courses selection

In order to enhance courses selection transparency, we will provide users a simple way to consult lists of selected and non selected applicants for each course.

- T13. Consult course details +A06, A07

Within the as-is advertising methodologies, the information given about courses. Various clients of our customer often required the full program of courses. Therefore we address that issue, bringing this functionality to the system and allowing users to consult it.

- T14. Consult all courses

Allow users a mechanism to consult every courses that ASPE has.

A07. Make enrollment in course(s)

Since we extinguished the use of Google URL shortener we will have simpler links to the enrollments forms. For courses that available to all the teaching community we intend to have a mechanism to access simply to enrollments form, without showing the actual link to the form, ie, a button with hyperlink.

Private courses will have enrollments using private forms. Therefore the access will need to be done through links, similar to the methodology used previously.

With these considerations, we renamed E17* to “Access private enrollments form” and added a new task “T15. Access public enrollments form”.

E16. Access private enrollments form

T15. Access public enrollments form

E11. Consult courses plan ^{+A03, A07}

T11. Consult courses under enrollments ^{+A06, A07}

T13. Consult course details ^{+A06, A07}

T16. Enroll in one or multiple courses

Our main changes to the process from the perspective of our customer’s clients will be done in this task. First of all, we will change how data is required to the user. We intend to use the recruitment group field as a filter to the courses in order to prevent incorrect enrollments by users. Other functionalities that compose our goals to this tasks are:

- Justification per each course;
- Priority between courses (when multiple courses are selected);
- Data pre filling after identification validation - we have the idea to validate with the system, after users fill out their identification number, if the identification number entered already exists in our system and if it occurs then the system will automatically fill out the remaining fields of the form;
- Successful enrollment email confirmation.

Outside A07, we continue our analysis to how the system should be with activities A07*. Manage enrollments and A08*. Select applicants. These represent a huge part of our solution because it is were the most relevant and time consuming tasks are included. Within the process analysis we identified these activities and soon we gathered that they were extremely interconnected. To our solution, another main change was merging “A07*. Manage enrollments” and “A08*. Select applicants” which resulted on “A08. Manage enrollments and applicants selection”. Additionally, we will do a major redesign to how enrollments are managed by administrators and which tasks and external actions they need and will be able to do on the new system.

The main difference from the problem to the solution, will be applicants selection per course. Our goal is to implement an automated mechanism to perform applicants selection. Obviously this implies a vast number of changes to the tasks and external actions identified on the process, as-is, analysis.

A08. Manage enrollments and applicants selection

T17. Verify applicants criteria on databases

We identified that courses database and enrollments data were stored in completely distinct system with no connection among them. Our solution will have a unique database and with that, applicants criteria will be checked automatically by the system, which means, users will no longer need to perform this task because the system will do it for them.

T18. Assign priority to each applicant

Following the same concept explained for the previous task, within the new system, assigning priority to each applicant will no longer be responsibility of the admin user because the system will be programmed to do it automatically.

T19. Order enrollments

This task is a redesign to T15*. Sort priority group per date and time. The purpose of T15* was to have applicants properly sorted, in order to perform the following tasks which were related to the selection of applicants to the courses.

The new purpose of this task is to order enrollments and prepare them to be automatically selected. This will be done exclusively by the system.

T20. Check duplicate applicants enrollments

Our customer decided that applicants that enrolled in duplicate to the same course, the enrollment that should be contemplated is the last one. Following the same approach, we will give the responsibility to check duplicate applicants and enrolls to the system.

Before applying the auto selection mechanism, the system will check all the enrollments and flag it as a duplicated enrollment. Making this task automatically allowed us to extinguish T21*. Add duplicates to dropout applicants and tag as duplicate in the observations.

Another aspect that we will contemplate on our solution is that duplicate applicants enrollments will not be placed along with dropped out applicants but in a specific list of duplicate enrollments.

T21. Auto select applicants

As mentioned in the beginning of the analysis of this activity, for the new system our main addition is auto selection of applicants for each course. This activity represents the redesign to "T23*. Set selected and non selected applicants" and is totally made by the system.

T22. Flag applicants as selected to other courses

This new task will occur in the new system to suppress two tasks identified on the process as-is, namely:

- T16*. Check duplicate selected applicants per courses coincident in schedule
- T22*. Verify applicants selected to coincident courses.

This will be done exclusively and automatically by the system. The intent is that, whenever an applicant is selected to a course, if he is enrolled to other courses, automatically the system flags the other enrollments as "selected to other course" and adds the information about the course were the applicant got selected.

T23. View course enrollments and selection ^{+A08, A11, A12, A13, A16}

This task is a redesign to E20*, T17*, T18* and T19*. For our solution, access to course enrollments and selection will be done within the system and there will be no external files to access which means E20* becomes a part of the system. Our goal is to allow administrator easy access and visualization of the enrollments per course and also the applicants selected to it. Within the as-is process, a specific team member was responsible to manually select applicants for each course which included creating list for selected, non selected and dropped out applicants. For the new system all of this will be preprogrammed to the system. This discards the need for administrator to perform T17*, T18* and T19*.

T24. Edit applicant enrollment details

T25. Manually set applicant(s) as selected

New functionality to allow administrators to override applicants auto selection mechanism.

T26. Manually set applicant(s) as non selected

New functionality to allow administrators to override applicants auto selection mechanism.

T27. Manually set applicant(s) as dropped out

New functionality to allow administrators to override applicants auto selection mechanism and also represents the redesign to "T11*. Remove applicant enrollment". From ours and our customer point of view, applicants that cancel enrollments should not be removed from the system, as "T11*. Remove applicant enrollment" implies. Therefore, we redesigned it

in such a way that applicants that want to cancel their enrollment are considered dropped out applicants.

T28. Manually set applicant(s) to defaulters

This new functionality acts as a redesign to “T24*. Insert last minute dropout applicants information to insert in defaulters database”. Our idea is to provide an option within the dropped out applicants list that allow admin users to assign applicants as defaulters with a single click.

We begun explaining this activity saying it resulted from the merge between A07* and A08*. However our merging process does not stop there. We identified also that, “A12*. Manage selected applicants confirmations” as well as “A13*. Manage learners documentation” should be included within this activity. Therefore we removed both activities and kept the tasks that compose them, with the following redesigns:

E17. Reading selected applicants confirmation email messages and SMS

E18. Answer selected applicants email messages and SMS

T29. Update confirmation status

E19. Verify selected applicants documents

E20. Organize documentation in the physical course folder ^{+ A08, A15, A23}

From the task identified within as-is process analysis, “T32*. Update documentation status”, we extracted three new tasks because we were not considering the nature of the documentation that each applicants needs to provide to our customer. Tied up with courses types, we have different required documents. For a financed course applicants need to confirm the presence and send to ASPE, civil identification card copy, declaration confirming professional situation. Unfunded courses are almost the same. The difference is that the declaration confirming professional situation is not required but instead is required a proof of payment. So, in the new system we will need to provided options for administrator to update the status of each document independently. Therefore we created the following tasks:

T30. Update identification document status

T31. Update professional situation confirmation document status

T32. Update proof of payment document status

The last change to this activity is including also “A11*. Manage substitute applicants”. By doing this we ensure that an activity composed by three tasks and one external actions is redesigned to just one external action. We achieved this because:

- “T28*. Verify if a substitute applicant is not selected to another concurrent course” is no longer needed due to the new functionalities described in T18.
- “T29*. Set substitute applicant as selected” is already supported by T22.
- “T30*. Set substitute applicant as dropped out” is already supported by T27.

Therefore, from A11*, the only aspect that maintains its original purpose is the external actions bellow.

E21. Contact substitute applicant

Task/External actions (not mentioned above) alterations resume:

T08*. Manage enrollments form availability - extinguished.

With the additional functionality within A05. Manage courses, for public courses we will simplify enrollments management adding to its properties, fields to the start and end

date for enrollments. Therefore, this tasks will not be needed.

T09*. Consult enrollments statistics - extinguished.

In the enrollments form as it is, enrollments to all courses were stored in the same table in Google Form back office sheet. This tasks was triggered to know the number of enrollments per each course. Our intention is to build an interface that shows immediately these informations to admin users. Therefore, this task will be extinguished.

T11*. Remove applicant enrollment - changed to T27.

E18*. Decide with team members the number of applicants per course - changed to E13, occurring within A05. Manage courses.

E29*. Inform team members to don't open certain selection files - extinguished.

Since the selection per course was made using Excel files, concurrency between team members was an issue. The new system will solve this constrain, allowing multiple users to be working on the same course at the same time.

T12*. Filter enrollments per course - extinguished

Online enrollments for all courses, in the old system were stored in the same sheet, using Google Forms. Our solution will show, to admin users, enrollments per each course automatically.

T21*. Add duplicates to dropout applicants and tag as duplicate in the observations - extinguished (consult T20. Check duplicate applicants enrollments).

T25*. Save selection file - extinguished

The new system will automatically store changes and this activity will no longer be necessary.

A09. Inform selected applicants

T33. Gather applicants contacts ^{+ A09, A10, A13, A24, A25}

T34. Send email notification to selected applicants

Within the new system, email messages will be preprogrammed which allows us to remove "E21*. Create email notifications to selected applicants". Also the external action "E23*. Send to email" will be included to the system and renamed to the current task (T34).

T35. Send SMS to selected applicants

Within the new system, SMS will be preprogrammed which allows us to remove "E21*. Create email notifications to selected applicants". Additionally, external action "E24*. Send SMS" will become a part of the system and consequently renamed to the current task (T35).

T36. Update applicants notification status ^{+ A09, A10}

A10. Inform non selected applicants

T33. Gather applicants contacts ^{+ A09, A10, A13, A24, A25}

T37. Send email notification to non selected applicants

Within the new system, email messages will be preprogrammed which allows us to remove "E25*. Create email notifications to non selected applicants". Also the external action "E23*. Send to email" will be included to the system and renamed to the current task (T37).

T38. Send SMS to non selected applicants

Within the new system, SMS will be preprogrammed which allows us to remove "E26*. Create SMS notifications to non selected applicants". Additionally, external action "E24*.

Send SMS” will become a part of the system and consequently renamed to the current task (T38).

T36. Update applicants notification status ^{+A09, A10}

A11. Create enrollment form in paper for each learner

E22. Copy enrollment form data source template

T23. View course enrollments and selection ^{+A08, A11, A12, A13, A16}

T39. Insert selected applicants information in data source

E23. Copy enrollments form template

T40. Adapt enrollments form template course information

T41. Link enrollment forms to data source

T42. Create enrollment form per each selected applicant.

E24. Verify enrollment forms

T43. Print enrollments forms.

Task/External actions (not mentioned above) alterations resume

E20*. Access course selection file - extinguished

With the new tasks T23, selected applicants information is consulted directly in the system.

A12. Prepare documentation for learners

E25. Copy learners documentation templates

T44. Adjust the information within each learner document

E13. Check with team members ^{+ A03, A04, A05, A12, A21, A22}

T23. View course enrollments and selection ^{+A08, A11, A12, A13, A16}

T45. Print learners documentation

E26. Group documentation and place it on a courses folder for each learner

A13. Remind learners about course schedule

T23. View course enrollments and selection ^{+A08, A11, A12, A13, A16}

T33. Gather applicants contacts ^{+ A09, A10, A13, A24, A25}

E27. Create SMS reminder to selected applicants

E28. Send SMS

T46. Update selected applicants reminder notification status

A14. Prepare documentation for the formator

E29. Copy formator documents template

T47. Edit documentation for the formator

T48. Print summary sheet

T49. Print formator contract

E30. Send documentation to the formator by email

A15. Open course

E31. Present ASPE and formator

E32. Explain course bureaucratic documentation

E33. Deliver documentation to be filled out by the selected applicants

- E34. Gather filled out documentation from the selected applicants
- E20. Organize documentation in the physical course folder + A08, A15, A23

A16. Answering clients and members

- E35. Answer incoming calls
- E36. Answer clients and members personally
- T23. View course enrollments and selection +A08, A11, A12, A13, A16

A17. Legal support

- E37. Consult legislation
- E38. Consult jurist
- E39. Forward doubts to jurist

A18. Manage treasury

- E40. Organize treasury documentation per day and month
- E41. Insert documentation details in the organization file
- E42. Digitalize treasury documentation
- E43. Send treasury original documents to the accounting headquarters

A19. Manage hardware and software

- E44. Gather issue information
- E45. Consult issue solving mechanism
- E46. Contact hardware technician

A20. Manage members payments

- E47. Request new member number to the headquarters
- E48. Request members count to headquarters
- E49. Verify members list
- E50. Contact members managers
- E51. Check payments

A21. Manage website information

- T50. Insert website information related with courses
- E52. Gather and place advertising elements
- E13. Check with team members + A03, A04, A05, A12, A21, A22

A22. Manage courses accreditation

- E53. Propose course to a formator
- E54. Analyse course proposal
- E55. Credit course
- E56. Consult existing courses
- E57. Consult course enrollments statistics
- E58. Contact formator
- E13. Check with team members + A03, A04, A05, A12, A21, A22

A23. Close course

- E59. Explain course bureaucratic documentation

- E60. Deliver bureaucratic documentation to be filled out by the learners
- E61. Gather filled out documentation from the learners
- E20. Organize documentation in the physical course folder + A08, A15, A23
- E62. Analyse evaluations by the learners
- E63. Analyse courses needs surveys

For the new integrated platform we will build, database integrity is key. We will have in considerations the multiple aspects gathered within the process analysis, specifically the disintegration of databases and for the solution our main goal in terms of data is to completely eliminate the need to update different databases regarding courses information. We mean with this, that T46* as well as T47* will no longer required to be updated by the user because the system will take care of it. Therefore, "A27*. Update databases" stays as follows:

A24. Update databases

- T33. Gather applicants contacts + A09, A10, A13, A24, A25
- T51. Update contacts database

A25. Certificates for learners and formator

- E64. Copy certificates data source template
- E65. Access course selection file
- T52. Insert selected applicants information in data source
- E66. Copy certificates front template
- E67. Consult courses plan
- E68. Consult CCPFC platform
- T53. Adapt certificates front template general information
- T54. Link certificates front template to data source
- T55. Create learners certificates fronts
- E69. Copy certificates verse template
- E70. Consult course program
- T56. Adapt certificate verse template
- T57. Verify certificates
- T58. Print certificates
- E71. Create SMS to selected applicants, not members, informing that certificates are ready.
- T33. Gather applicants contacts + A09, A10, A13, A24, A25
- E72. Send SMS to selected applicants - not members
- E73. Prepare members certificates to send by courier
- E74. Create SMS to selected applicants, members, informing that certificates were sent by courier
- E75. Send SMS to selected applicants - members
- E76. Prepare members certificates to send by courier
- E77. Send members certificates by courier

4.2

Requirements Specification

Accordingly with the defined solution methodology, we identified, as second step, proper requirements specification documentation ([6] IEEE STD 930-1998, 1998). Since, in activity modeling, requirements derive from the vast problem analysis as well as activity-based task modeling, we consider that for a working environment in a team is crucial that adequate requirements documentation is done. From our perspective, different developers can interpret certain aspects as different requirements.

Without contradicting, transposing the solution strategy, within this master thesis development we represent a team of one, in terms of development. Therefore we decided that in this specific case, requirements specification and proper documentation would not add a lot to our work. But we still want to make clear that, despite we did not made standard requirements documentation, we informally extracted the requirements. Moreover, a fact that contribute to our decision was that even before the start of the problem analysis using activity modeling we were already experts on the problem since, we have been working with our customer for the past three years. All the analysis made since the start of this project, resorting in activity modeling theory, embraced us even more with the problem.

Reaffirming our perspective, for development in larger teams we consider requirements specification and documentation a decisive step to ensure developers know what are the goals they intend to achieve as well as keeping all of them synced.

4.3

Prototypes

On the third step of our solution strategy, prototype development merges all the aspects gathered during problem analysis as inputs to the sketching board were the constrains, problems and considerations are crafted to produce the first solution outlines.

Our customer main requirement was their desire to have a platform that could go abroad and across the vast teaching community, with a simple and easy access.

From the meetings with our customer and the numerous hours of work with them, it became clear for us that, in order to launch the platform across the community, we needed to go to the web. Furthermore, this idea merges with the wish to build a platform that could act as a bridge and the beginning point to the unification of the various disperse syndicate filiations and its headquarters, which is a goal to achieve outside the scope of this work.

Therefore, we identified that our prototypes should be consider for two different actors. All the teaching community is addressed as normal users and will be the users who will interact with the front-end component of the website. Regarding website maintenance and management, we will develop a back-end component which will have private access for the syndicate team members as admin users with privileges to all functionalities included on the system. However, this is not a static configuration. Joomla! CMS has in its core functionalities, users management. With this, our customer, has the ability to define which administrative functionalities each user might have.

The first outline prototypes were no more that rough sketches, so to support our customer solution proposal analysis we built the refined prototypes that we will show next, starting by the front-end and then the back-end component.

Front-end prototypes

Within the context of this work, we are giving the most emphasis on the activities that involve the courses advertising, enrollments, selection and all the other aspects surrounding them. However, our customer doesn't offer exclusively that service. We mentioned this fact because it influenced our prototyping in such a manner that we will explain in further detail when we tackle each prototyping decision.

Home page

Since we are aiming towards a service that goes broad, going online is, from our point of view, inevitable. Therefore the solution is focused on developing a website to the syndicate. Using this platform as the ground foundations, our goal is to solve the identified issues as well as introducing new functionalities/services. Website home page will be as follows:

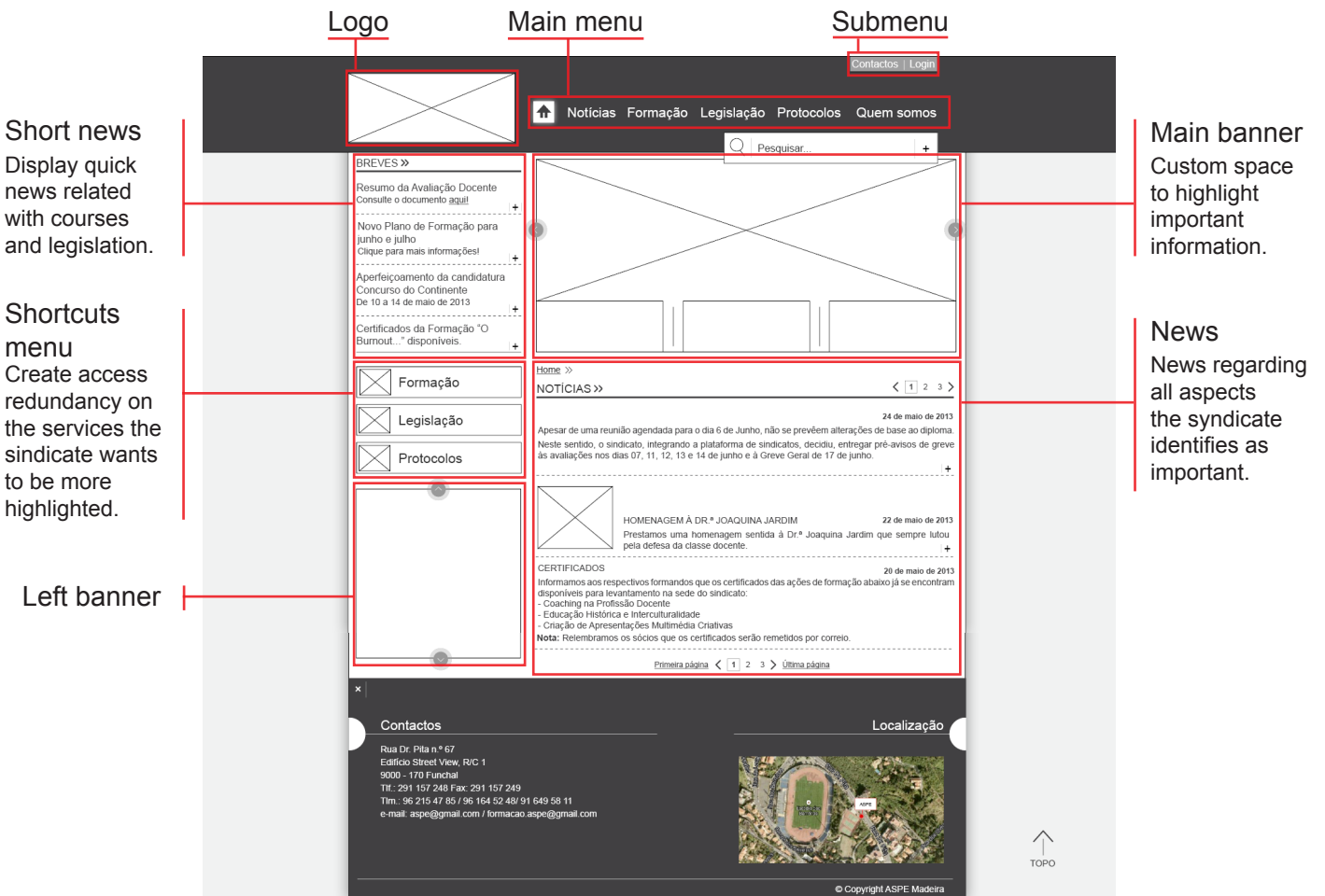


Figure 9. Prototype - front-end home page.

This new website will bring a new look to our customer services bringing them and allowing their clients to be in contact with the most cutting edge information technology. This will also serve as one wide advertisement spot, in accordance with what we identified within A05. Advertise courses plan, ie, create to ASPE larger platforms to advertise their courses.

Courses page

One of the strongest services that our customer offers to the community is the opportunity for all the teachers and educators to keep updating their knowledge. Clearly this implies that this service needs to be highlighted on the new website to be developed. Thus, within the main menu there is an option to access a dedicated page for courses and their related informations which will be developed as bellow:

Search courses
Search courses via multiple criteria such as course formator, destinataries, etc.

Courses enroll form
Access to the enrollments form where the client is able to enroll in one or more courses.
*1 Buttons that have the same behavior as described before.

Available courses
List of available courses shown automatically according with configurations done by admin users.

Compare courses

Course further details

Right banner
Banner that can be used to advertise the syndicate services or any other aspect.

Courses news
Short news about courses

Subscribe to receive courses plan
Allow the users to inform the syndicate that they want to receive the courses plans. Additionally to the standard required email, we introduced name and recruitment group. Name ensures that we will have human readable data and recruitment group is a step to a new functionality which would allow system administrators to send specific newsletter to specific teachers and educators.

Selected clients per course
Show a list of courses with their selected clients and substitutes.

Course archive
Show all the courses that the syndicate developed.

Figure 10. Prototype - front-end courses page.

Providing the information online to all the community embraces the philosophy of our customer, ASPE, to be transparent in their processes and help teachers and educators on their daily needs. Outside the scope of this master thesis we will continue to work as a team in order to integrate other services into this new platform and build increasingly an even more complete system.

Enrollments form

Both the prototypes shown previously are completely new functionalities since there was nothing like it on the previous version of the system (version as-is). However our next prototype regarding online enrollments form is a service that ASPE already offer to their client, although in a different platform. Having this in consideration we will present the prototypes for the new form and point out some prototype decisions using the old system as a comparison. Bellow we show our solution prototype beginning on the first step of the form.



Figure 11. Prototype - enrollments form - first step.

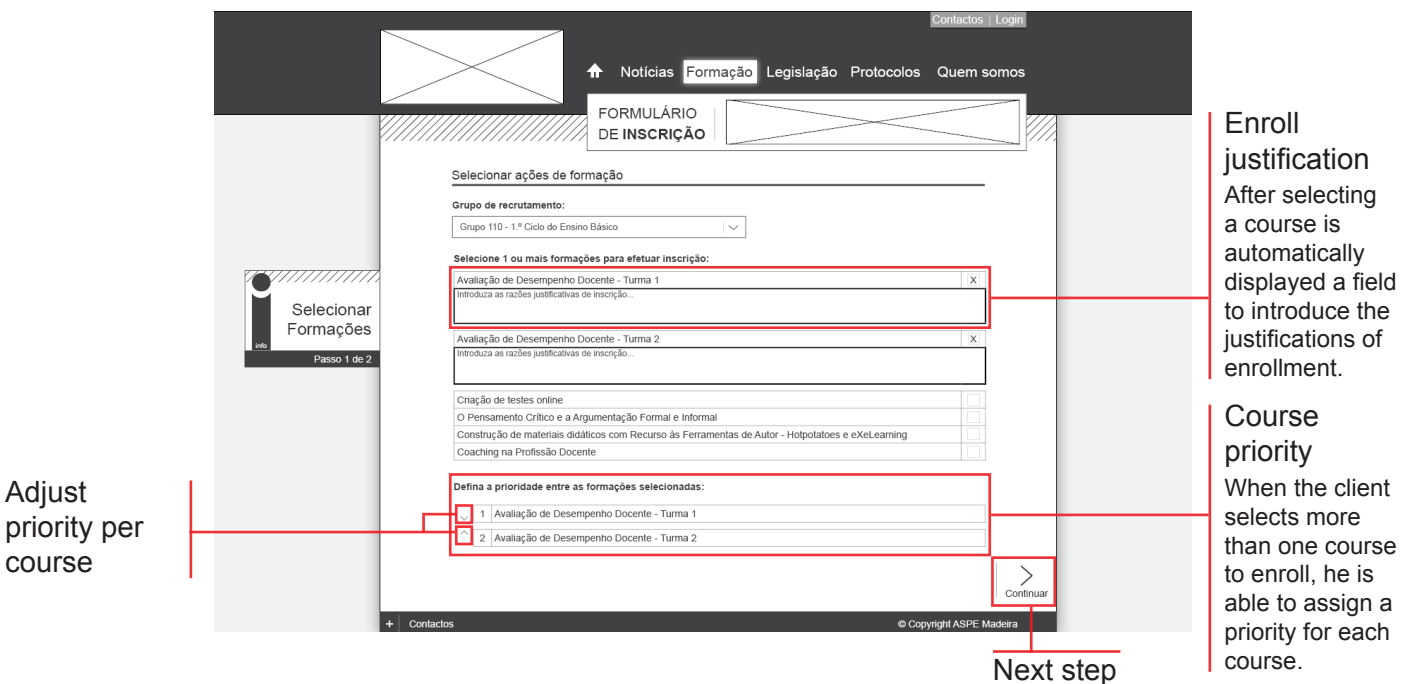


Figure 12. Prototype - enrollments form - first step - multiple courses selected.

The first main change made to the enrollments form was its filling order, which reflects on the first step of the form. By placing as first field the recruitment group, the first thing the client sees after selecting his group, is the courses he can enroll. On the old form his personal and professional data was required first and then the list of courses was presented.

Improvements examples:

1. If we consider a case where the client is not interested in none of the available courses, on the old form he could needlessly fill out all his personal and professional data before even seeing that there were no courses of his interest. This prototype solves that inconvenient.
2. On the old form, courses were presented equally to all teachers, ie, even if the course was not directed to his teaching group he could see it and in the worst case scenario he could enroll on it. With this prototype this problems gets solved.
3. Using the old form if the client enrolled in multiple courses, he had only one generic field for the justification. This meant that the syndicate team needed to split the justification for each course selection. Another related issue is that the old system didn't have any mechanism to specify priorities between courses. Since it happen, clients often included on the general justification their desire to be selected if possible to one course prior to another. With the functionalities included on the prototypes above, all those cases get solved.

The second step of the new form regards to clients personal and professional data, as follows:

Client identifier

Restraining the client to fill firstly the civil identification number allows the system to verify if he is an old client or not. If he is then his data will show on the form and the fields are unlocked. If he is not client then the form only unlocks de fields.

Return button

Submit button
Enrollments form submit with embedded validation mechanisms.

Figure 13. Prototype - enrollments form - second step - locked fields.

Improvements after changes:

1. On the old form, clients database and enrollments form were two completely different systems. This system will be integrated and, whenever clients enrolls on a course, if he changes for example his address, it will be update to all the other system functionalities.
2. For clients that are already on the system database the enrollment process get simpler.

With all the data filled out properly, ie after clicking the submit button and if any of the validation mechanisms trigger an error, user is informed as follow:

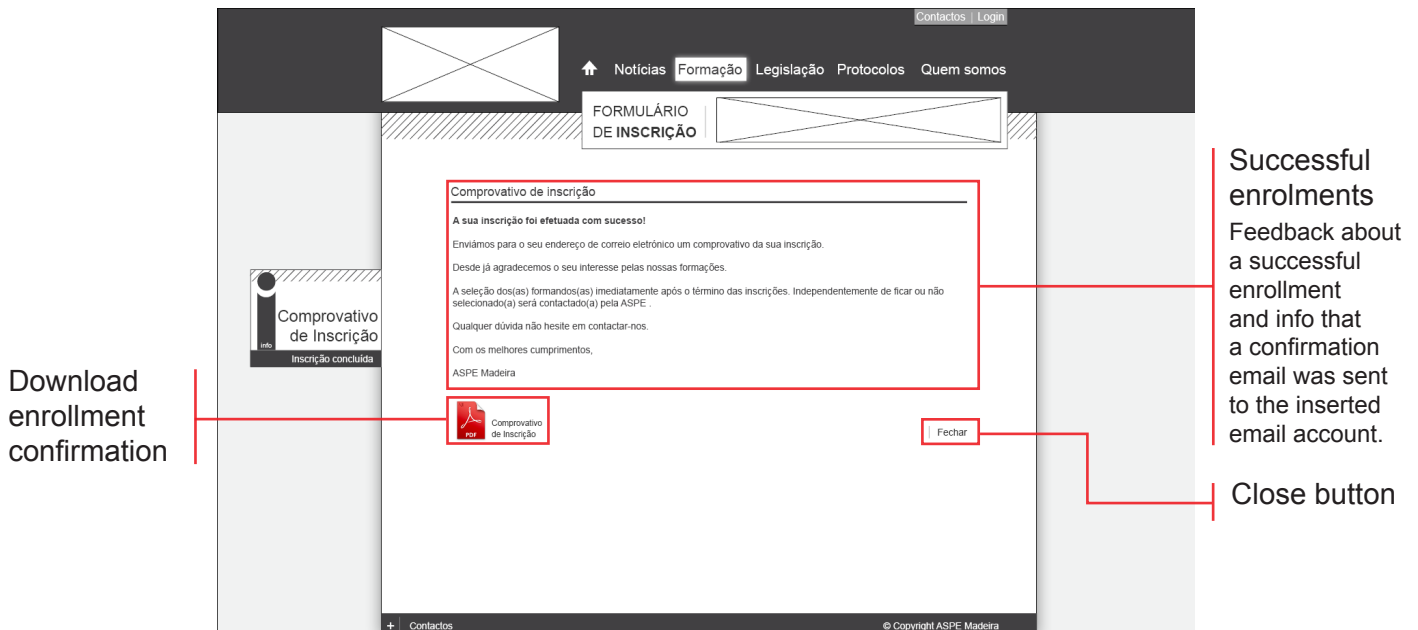


Figure 14. Prototype - enrollment confirmation message.

For the purpose of this master thesis, the prototypes shown reflect solutions to the problems we are addressing. Other components of the website will be part of additional services to be implemented outside the scope of this work. Therefore, at this instance, we will not present prototypes regarding does services.

Now we will focus on the prototypes for the administrators which make all the functionalities previously shown, work.

Back office Prototypes

First of all is important to refer some key aspects that guided our admin prototypes development. The main aspect to consider is that we are developing an online platform to be used daily after the end of this project, so easy and dynamic content management is key to customer satisfaction. Nowadays we are surrounded by good open source content management systems (CMS) that allow a normal user, without lots of knowledge on information technologies (IT), to create a simple website. What we aim is to use the well designed functionalities of one CMS and custom build an extension to suppress our specific needs. Therefore, we will only present prototypes regarding courses management and all other functionalities related to website maintenance will not be contemplated on our prototypes.

Home page

The main objective within administrator functionalities prototypes, was to ensure that the system is not overwhelming on information and functionalities. Therefore we came up with the first change on our approach about how the system should operate. In chapter 5.1, we identified “A03. Customize enrollments form link” should operate within the activity “A04. Create/edit enrollments form” and it

made a lot of sense. However, at this point we gathered with our customer and analysed if private enrollments form was really needed. We came up to a conclusion that we would only need private forms 2 or 3 times per year. So, in order to simplify, we all decided to take out that functionality and use a unique form for all the courses. With these changes admin prototypes came as follow:

Main menu
Menu with main items such as courses, enrolled clients, syndicate associates and statistics. Other functionalities will be included within each top rubric.

Search mechanism
Search courses by default and specific searches by clicking on the plus sign.

Courses filter
Filter courses per state, year, formator, etc.

↑ | Formações | Sócios | Formandos | Estatísticas
🔍 Pesquisar... +
Nuno Rodrigues

Formações por estado ▾

Formações com inscrições abertas

Formação	Inscrições até	Inscritos	Selecionados	Não Selecionados	Desistências
Avaliação de Desempenho Docente - Turma 1	31-10-2013	15	14	0	1
Avaliação de Desempenho Docente - Turma 2	30-10-2013	55	25	29	1
Criação de teste online	27-10-2013	30	20	8	2

Formações a iniciar

Formação	Data de início	Selecionados	Não Selecionados	🔍
O Pensamento Crítico e a Argumentação Formal e Informal	15-11-2013	14	0	🔍
Construção e materiais Didáticos com Recurso às Ferramentas de Autor- Hotpotatoes e eXeLearning	15-11-2013	20	6	🔍
Coaching na Profissão Docente	12-11-2013	25	15	🔍

Formações a decorrer

Formação	Local	Data de término
Filmes Educativos na aula de Português e História	EB23 Dr. Horácio Bento de Gouveia	22 de junho

Admin identification

Courses under enrollments
Table composed by course name, enrollments finish date, number of enrolled, selected, substitutes, and dropout clients.

Course further details

Courses to begin
Table composed by course name, beginning date, selected and substitute clients.

Ongoing courses
Table composed by course name, place being developed and finish date.

Figure 15. Prototype - back-end home page.

Alerts mechanism
System to alert administrators to incoming events such as beginning and ending courses, courses with short enrolled clients, etc.

Search mechanism
Search courses by default and specific searches by clicking on the plus sign.

Courses filter
Filter courses per state, year, formator, etc.

↑ | Formações | Sócios | Formandos | Estatísticas
🔍 Pesquisar... +
Nuno Rodrigues

Alertas

- Formação "O Burnout ..." encerra a 22 de junho.
- Formação "Filmes Educativos ..." inicia a 22 de junho.
- Formação "Filmes Educativos ..." não cumpre o número mínimo de formados.

Admin identification

Courses to begin
Table composed by course name, beginning date, selected and substitute clients.

Ongoing courses
Table composed by course name, place being developed and finish date.

Figure 16. Protótye - back-end home page - alerts mechanism.

Apart from the functionalities mentioned above, it is also important to refer that administrator will be able to add, edit and delete courses via proper options under the top menu for courses (“Formações”).

Due to simplicity of those system interactions, for the purpose of this prototype explanation, we will not present the form to create and edit a course. Another functionality is that all the course names will be the trigger to get in to the clients selection panel for each course.

Applicants selection per course

The most demanding task to perform on the system applicants selection per course. Despite it is not visible on these prototypes, we aim towards a semi-automatic selection process. Our goal is that, whenever each applicant enrolls in a course, the system automatically checks all criteria and performs auto selection. With that system support, admin user will only need to perform small changes derived from clients who dropout or any other specific case. To achieve that, administrator will always have the possibility to override the auto selection mechanism and perform manual selection of applicants. With these concepts well set, we came up with the following prototypes:

Course selector

List of courses under selection with the selected course highlighted.

Course management information

Counter

Hide and show fields

Button to trigger options to hide and show data columns.

Inscrição		Dados Formandos			Seleção	Gestão			
n.º	Dia	Hora	Nome	Telemóvel	email	Prioridade	Confirmação (0)	BI e NIF (0)	Pagamento (5)
1	01/12/2013	16:45:03	Andreia Duarte Dinis	964875859	asdd@hotmail.com	1	Confirmado	ok	Pago presencialmente
2	01/12/2013	17:55:30	Bianca Sousa	962545484	bas@gmail.com	1	Confirmado		
3	01/12/2013	19:25:23	Fernando Nuno	962515136	fbn@hotmail.com	1	Confirmado		
4	05/12/2013	21:05:23	Mónica Karmen	961531854	mnjk@hotmail.com	1			
5	07/12/2013	16:45:03	Yesika Yven	963118574	yty@gmail.com	1	Confirmado		
6	09/12/2013	17:55:30	Luís Augusto	965487134	loa@gmail.com	1	Confirmado	ok	Pago presencialmente
7	10/12/2013	19:25:23	Bernardo António Timóteo	923123548	bat@hotmail.com	1	Confirmado	ok	
8	11/12/2013	21:05:23	António Silvério	915488712	ais@gmail.com	1		ok	Pago presencialmente
9	12/12/2013	23:00:11	Beatriz Silvério	938548195	bis@hotmail.com	1			
10	20/12/2013	11:42:21	Nuno Afonseca	926484519	nka@gmail.com	1			
11	20/12/2013	11:23:23	Afonso Olavo Nóbrega	963213548	noa@hotmail.com	2	Confirmado	ok	Pago por transferência
12	20/12/2013	18:20:00	Luis Antonino	921542364	lak@gmail.com	2	Confirmado		
13	20/12/2013	19:05:33	Júlia Sousa	939395958	jss@hotmail.com	2	Confirmado	ok	Pago por transferência
14	20/12/2013	21:11:22	Cristina Alonso	960645548	opla@hotmail.com	3			

Receita	Total de pagamentos	140
Despesas	Aluguer sala	0
	Formador(a)	560
	outras despesas	0
	Balanco Total	- 420

Send selection info via SMS

Send selection info via email

Financial balance

Figure 17. Prototype - back-end applicants selection per course - selected applicants.

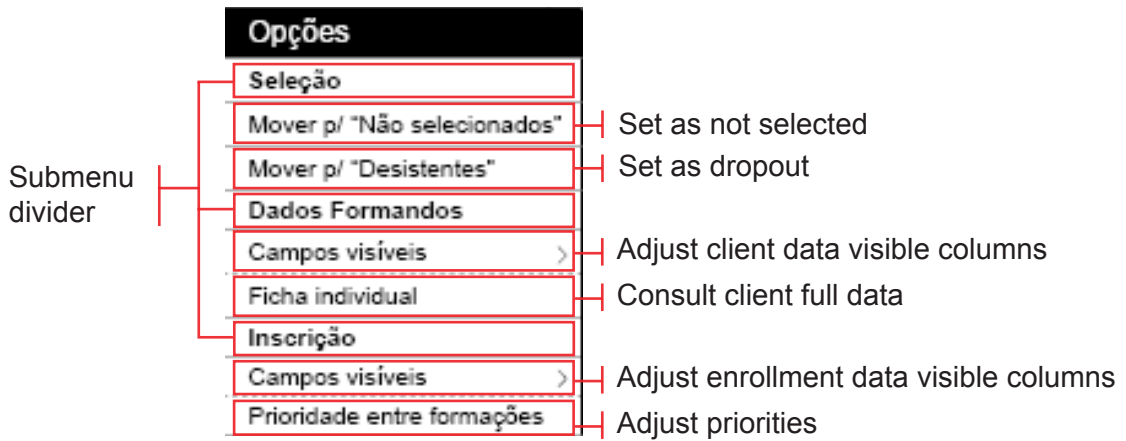


Figure 18. Prototype - back-end selected applicants options menu.

In addition to the functionalities shown, all the table rows when clicked will have the following behaviour:

Tabs bar

Using this tab bar users will be able to change between a list of general enrolls, selected clients, unselected clients and clients who dropped out. *3

Selected row

Formações | Sócios | Formandos | Estatísticas

Pesquisar... | Nuno Rodrigues

Formações com inscrições abertas

Avaliação de Desempenho Docente - Turma 1
Avaliação de Desempenho Docente - Turma 2
Criação de teste online

info Tipo: Formação Não Financiada Notas:
Preço: 20 sócios 40 não sócios Confirmar a sala para a formação
Vagas: 11 de 25

Inscrições (15) | **Selecionados (14)** | Não selecionados (0) | Desistentes (1)

Inscrição		Dados Formandos	
n.º	Dia	Hora	Nome
1	01/12/2013	16:45:03	Andreia Duarte Dinis
2	01/12/2013	17:55:30	Bianca Sousa
3	01/12/2013	19:25:23	Fernando Nuno
4	05/12/2013	21:05:23	Mónica Karmen
5	07/12/2013	16:45:03	Yesika Yven
6	09/12/2013	17:55:30	Luís Augusto
7	10/12/2013	19:25:23	Bernardo António Timóteo
8	11/12/2013	21:05:23	António Silvério
9	12/12/2013	23:00:11	Beatriz Silvério
10	20/12/2013	11:42:21	Nuno Afonseca
11	20/12/2013	11:23:23	Afonso Olavo Nóbrega
12	20/12/2013	18:20:00	Luis Antonino
13	20/12/2013	19:05:33	Júlia Sousa
14	20/12/2013	21:11:22	Cristina Alonso

Mover para "Não Selecionados" | Mover para "Desistentes"

Dados Pessoais

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N.º Id. Civil: 14585478 Tipo de documento: Cartão de Cidadão
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Telefone: Telemóvel: 923 123548 email: bat@hotmail.com

Dados Profissionais

Escola onde leciona: EB1/PE Ribeiro Domingos Dias
Escola à qual pertence: EB1/PE Ribeiro Domingos Dias
Grupo de recrutamento: 110

Nível de ensino:
 Educação Pré-escolar
 1.º Ciclo do Ensino Básico
 2.º Ciclo do Ensino Básico
 3.º Ciclo do Ensino Básico
 Ensino Secundário
 Educação Especial

Habilitações:
 Bacharelato
 Licenciatura
 Pós-graduação
 Mestrado
 Doutoramento

Seleção e Gestão

Prioridade seleção	Confirmação	BI e NIF	Pagamento
1	Confirmado	ok	

Observações:

Home • **Formações com inscrições abertas**

Set as not selected | Set as dropout | Editable client data

Figure 19. Prototype - back-end applicants selection - consult/edit applicants data.

*3 For each tab the content is identical, so we will not present the other tabs lists in these prototypes. Changes that are going to be considered is for example: if a user is on the tab for the non selected clients then the options “Set as not selected” shown on Figure 9 will change to “Set as selected”.

Statistics

Statistics reports which we included on the main menu is a new functionality that we are looking forward to develop. However, due to time constrains, we will not implement it within the context of this master thesis. Since this is work is just a starting point for a partnership between our team and our client, at the instance of the presentation of this thesis we will have additional functionalities to the system and if this is one of them we will present it.

Prototype conclusion

Although it is an unusual mechanism to use on prototype evaluation, we recurred to a well know system to perform simple strategy analysis: SWOT analysis. Thus, we present bellow our the analysis according with the above mentioned methodology (^[25] Wikipedia, 2013).

		Helps to achieve the goal	Hinders goal achievement
Aspect origin	Internal (Organization)	<p>STRENGTHS</p> <ul style="list-style-type: none"> • Unified platform for different services; • Accessible every where; • Efficiency gains; • Easier mechanisms to accomplish tasks; • Applicants auto selection mechanisms; • New functionalities; • Supports concurrent access by all team members; • Unique database; • Database autonomous update 	<p>WEAKNESSES</p> <ul style="list-style-type: none"> • Requires internet connection; • Requires IT knowledge; • Users reluctance to change; • Administrator users adaptation to changes;
	External (Ambient)	<p>OPPORTUNITIES</p> <ul style="list-style-type: none"> • Extendable platform; • Additional functionalities; • Further differentiation of services within the platform; • Uniformization between delegations. 	<p>THREATS</p> <ul style="list-style-type: none"> • Other formation centers can access to our courses detailed information; • Bug related issues; • Virus and hacker attacks; • Incorrect data inserted by users.

Implementation Methodology

As we have been mentioning on the previous chapter, content management system (CMS) are a huge part of web development. In the early 1990's Microsoft and Lotus released the first CMS packages. More than a decade after, the current most popular open source CMS were giving their first steps. Among others, Drupal initial release was on 2001, WordPress 0.71 was available for download in May of 2003 and Joomla 1.0 was released on September 2005. Although there are many other CMS these three are the most renowned on last few years ([13] Labyrinth Solutions, 2012; [16] Racket, 2011; [26] Wikipedia (2013)).

Since the solution is not restricted by which CMS we use we opted to build our solution based on Joomla CMS. Despite this, all the work we are going to present bellow could be done using any other CMS as base.

Why Joomla?

Joomla is an award-winning content management system, which is built with a strong platform that will allows us to create a custom extensions to manage ASPE courses. Outside the scope of this thesis, we intend to develop other extensions regarding other services offered by our customer.

Joomla uses a very wheel known software architecture model, Model-view-controller (MVC), see figure 6 on the right, which consists on organizing data flow in a way that the system is properly extendable and secure.

With over 200.000 community users and contributors we will have lots of users with who we can trade experiences and overcome any constrains.

Apart from that our customer work team already made a course directly related with this platform which is surplus value because the amount of time needed to explain how this CMS works, decreases.

With the version 3.0 of Joomla! some quite important concerns were overtaken. Nowadays users access web content using multiple devices with lots of different sizes. Therefore, responsive web design was an evolution to this version and we will used it to built our custom extension and template ([7] Joomla!, 2013; [11] Kramer, 2013; [26] Wikipedia, 2013).

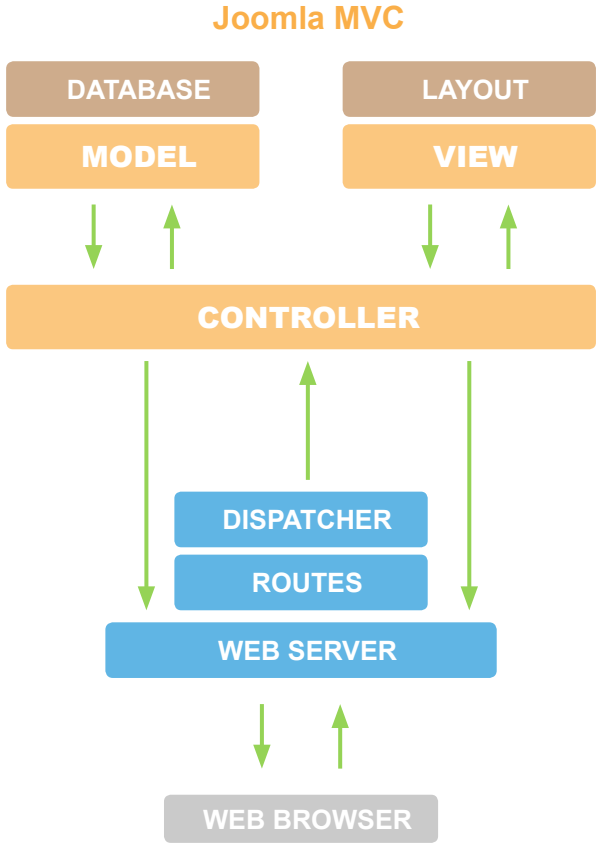


Figure 20. Joomla MVC.

Keeping the same analysis methodology, we will follow the same structure used to explain the prototyping process, presenting first how the website looks (Front-end) from the perspective of a normal client of our customer and after how it is managed (Back-end). To preserve customer confidentiality some details of the real website print screens will be blurred.

Real website front-end overview

Since we adopted the Joomla! CMS as our development base structure for the front-end we developed a custom template according with the specifications gathered with our customer which led to the prototypes shown previously. To ensure optimal usage experience we crafted our template in a responsive web design perspective, allowing easy reading and navigation across smartphone, tablet and desktop computer.

Home page

Search
To simplify and create a template that is responsive we modified its position.

Submenu
Although it is not being used, our custom Joomla template ensured that admins are able to insert a submenu at this position if they desire.

Shortcuts menu
This functionality was kept as prototyped.

Left banner
Although it is not being used, this space is present on the custom template. Content can be inserted using Joomla core functionalities.

Contacts
Kept as prototyped.

Location
Kept as prototyped.

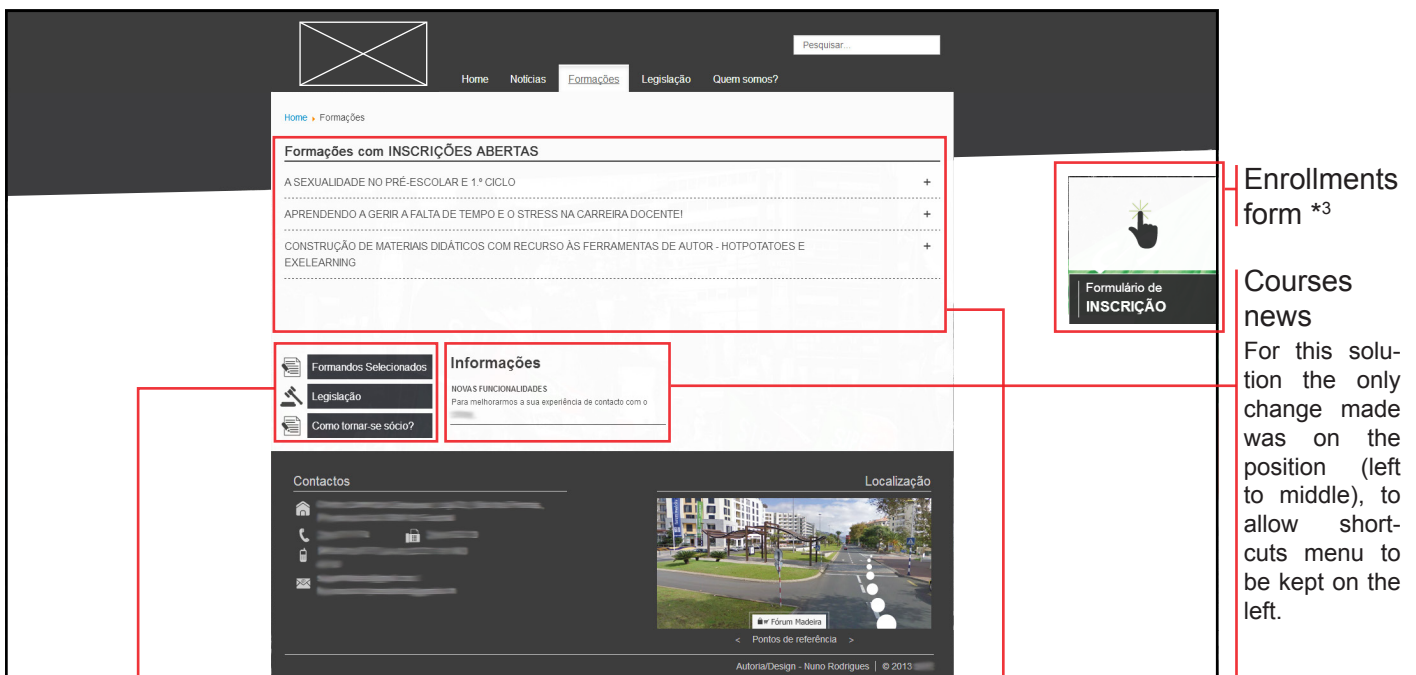
Figure 21. Real website - font end home page.

- *1 Main banner

From the prototyped version to the implemented, after meetings with our customer and master thesis supervisor we decided to exclude the concept of shortnews from the top left position, due to its placement relevance. Therefore we cleaned up the interface extending the main banner to occupy all the space as shown.
- *2 Featured News

The first noticeable change is what we called it. Featured news instead of news makes much more sense. Following customer specifications, we added on the main menu an option for news. This simple change created a butterfly effect which allowed us to perform the changes explained previously on the main banner which led to the removal of short news from its original position (top left), redesign and transform it to become featured news.

Courses page



Enrollments form *3

Courses news

For this solution the only change made was on the position (left to middle), to allow short-cuts menu to be kept on the left.

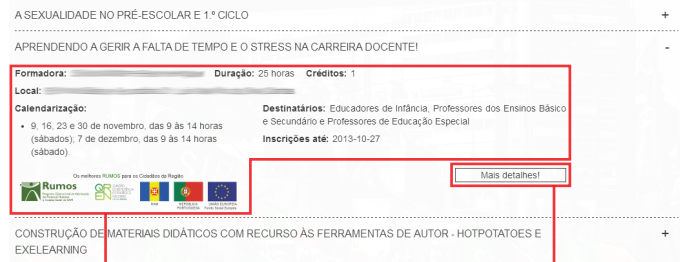
Shortcuts menu

We prototyped two contextual buttons on the middle which we called “Selected clients per course” and “Course Archive” (consult page 93 to consult the prototype). However after evaluation we gathered info that it was preferable to maintain coherence and use the shortcuts menu on the left and use them also as contextual shortcuts. What we mean with this is that on this menu our customer is able to insert any type of shortcut, course related or general.

For example the first one “Formandos Seleccionados” redirects to a list of courses with a list of selected and substitute applicants which can be consulted bellow in further details under the rubric “Courses selection lists page”. This functionality served also as a redesign for the button “Selected clients per course” and “Course Archive” (currently not being used) shown on the prototypes.

Available courses

List of courses available to enroll. Since there is too many information to show, from the prototype towards this solution we redesigned this component using collapsible elements. With this implementation we are able to present all the available courses in the same page and their information can be access by clicking on their title or in the plus sign on the right. When the user interacts in that way, for each course there will be shown info as bellow:



Course info

Formator; Duration; Creditation; Schedule; Destinataries; Enrollments finish date and the image reflects the type of course (Financed or not).

Course extra details

To see further details consult bellow “Course details page”.

Figure 22. Real website - front-end courses page.

*3 On our prototype we included inside each course a button to redirect to enrolls. For the solution we remove it because of the following aspects:

- maintaining a button within each course would require asking for the recruitment group, check if it belongs to the course destinataries and only after redirect to the enrollments form.
- many applicants enroll in multiple courses at once.

In addition to the changes explained previously for this first version of the solution, due to time constrains, we needed to cut some functionalities respectively the search mechanism, compare courses and the functionality to subscribe to receive courses plan. However we aim to implement them outside the scope of this master thesis.

Course details page

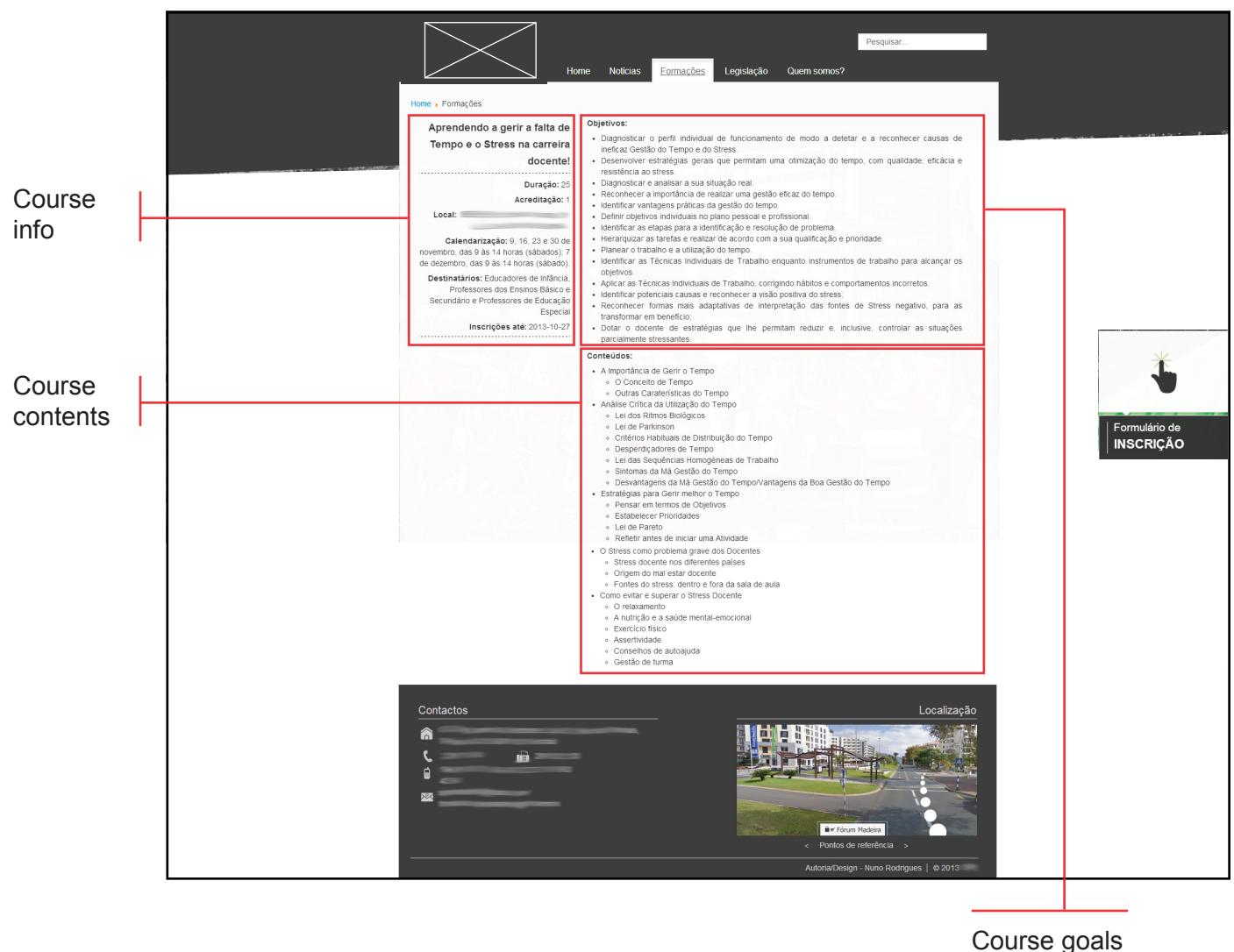


Figure 23. Real website - front-end course details page.

For future iterations of this solution, we might implement course details as a modal whenever the course extra details button is clicked. This idea should bring a greater look and feel and contribute to an even more rewarding user experience.

Courses selection lists page

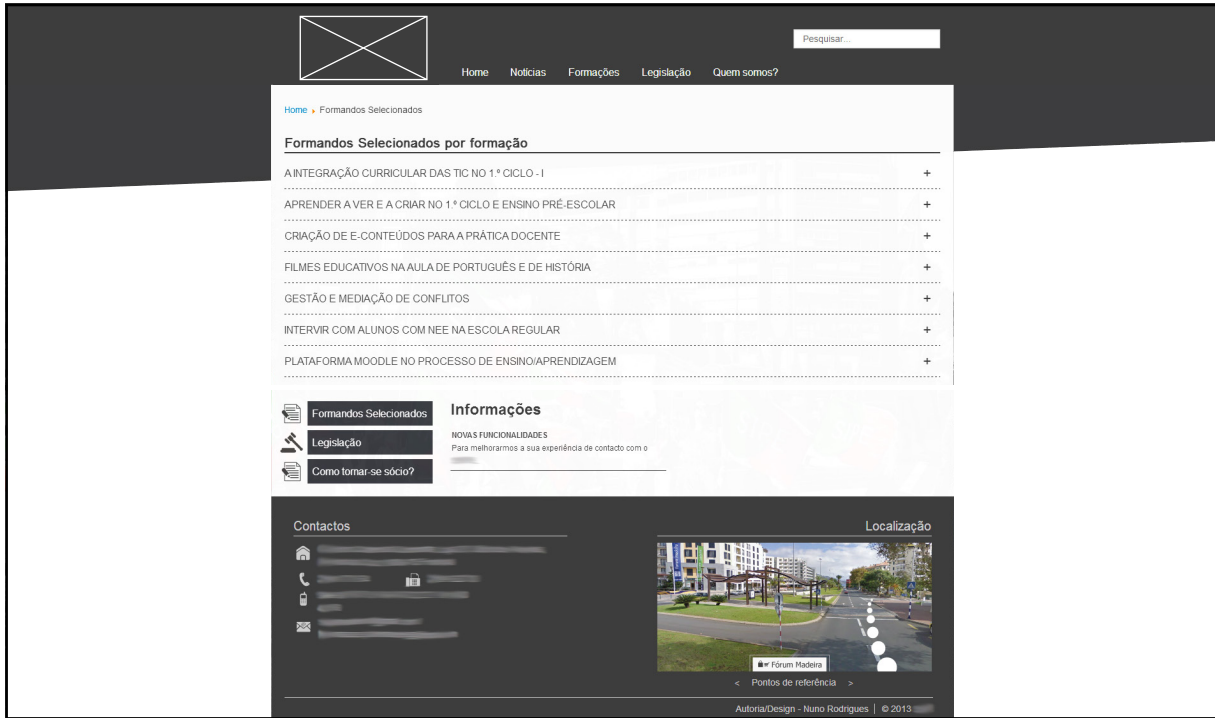


Figure 24. Real website - front-end courses selection lists page.

Our main goal was to keep the look and feel throughout the all website. Therefore, at first instance, this page and courses page only differ on the title and the visibility of the enrollments form access button. Changes become evident once users click on each course. In addition to course informations users will get a list of selected applicants and if there is any, a list of substitutes. Since it is too large we will only show an example for a list of selected applicants, in smaller proportions.

Tabbed information

Using tabs mechanism we were able to include multiple information within the collapsible course panels in an effective way. For each course there are tabs for “Selected applicants list”, “Substitute applicants” and “Course info” (equal to courses page). However this tab menu can be different because the list of substitute applicants only appears if there is any. Displaying “Course info” within this page is a decision that came directly from user tests. During the test, users normally accessed “Courses page” to remember schedule and other details.

Formandos Seleccionados por formação

A INTEGRAÇÃO CURRICULAR DAS TIC NO 1.º CICLO - I +

APRENDER A VER E A CRIAR NO 1.º CICLO E ENSINO PRÉ-ESCOLAR +

criação de e-conteúdos para a prática docente -

Lista de selecionados Lista de suplentes Dados da formação

#	Nome do(a) formando(a)
1	A...
2	A...
3	A...
4	A...
5	C...
6	D...
7	D...
8	E...
9	I...
10	J...
11	J...
12	L...
13	M...
14	M...
15	M...
16	M...
17	P...
18	R...
19	S...
20	T...

FILMES EDUCATIVOS NA AULA DE PORTUGUÊS E DE HISTÓRIA +

Figure 25. Real website - front-end course selection lists - list of selected applicants.

Enrollments form

Since this front-end page is the most complex, we will explain it step by step, starting to identify each step we will follow:

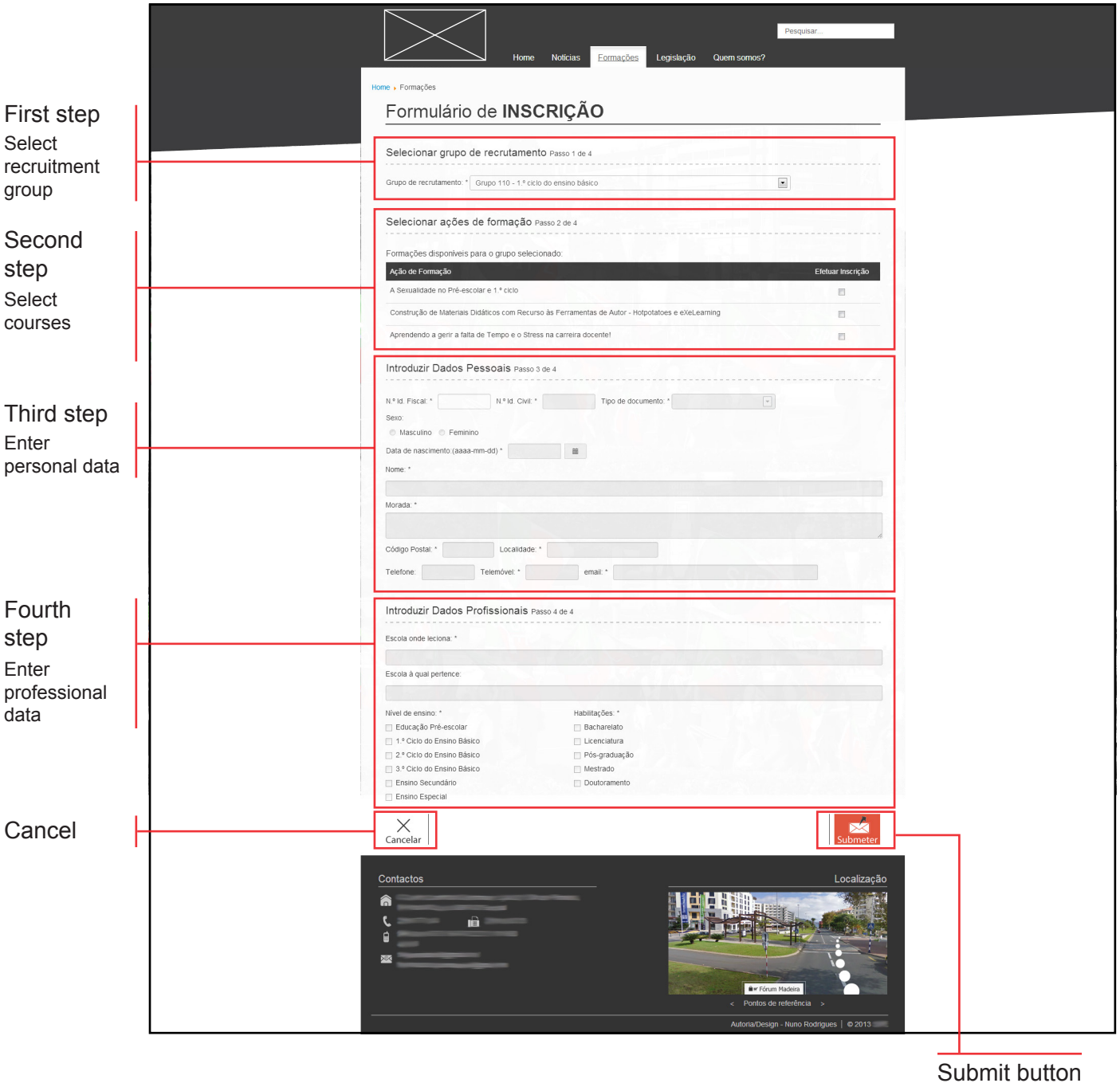


Figure 26. Real website - enrollments form.

Enrollments form was without any doubt our main front-end challenge. Its nature requires lots of attention on validation mechanisms and extensive test. After many hours work and analysis with our customer, master thesis supervisor and testers we came up with a few changes from our prototype up to this instance. Generally our main change was to create the form continuously, going against the initial concept of one page per step. Within each step we made a few modifications but we will explain them hereinafter inside the respective step detailed explanation.

First step - Select recruitment group

Exactly as prototyped, changing the field to enter the recruitment group (old online enrollments form) to a select box avoided mistyping errors, supported auto selection and allowed us to use it as a filter to display the available courses for that specific selected group.

Figure 27. Real website - enrollments form - first step - select recruitment group.

Second step - Select courses

Following the prototyped concept, with a clean and simple interface we made possible to our customer's clients to introduce enrollment justification for each course they enroll, very easily.

As a completely new functionality, applicants are now able to select priority among courses they select. Looking back to our prototypes we change a little bit our interaction idea but we are happy with the simplicity of our solution.

Also as an extra functionality is a link on the courses titles to their full details. At this instance the behaviour applied on click is to open on a new tab the page "Extra course details". For a near future we intend to implement it using a modal, avoiding the need to get out of the form to consult courses information.

Ação de Formação Selecionada	Prioridade
A Sexualidade no Pré-escolar e 1.º ciclo	2
Construção de Materiais Didáticos com Recurso às Ferramentas de Autor - Hotpotatoes e eXeLearning	1

Figure 28. Real website - enrollments form - second step - select courses.

Third step - Enter personal data

Despite this looks quite equal to what was prototyped, one very important change was made.

Our initial concept was to use the national identification number as client identifier. However, after consulting old courses enrollments data, we gathered that many clients entered their Portuguese identification number followed by the verification letters. We could build validation mechanisms to

accomplish field correctness but we found a simpler solution. Portuguese fiscal identification number is unique for each person and it is always composed by 9 digits. So, we updated our concept and established it as the client identifier within the system. This methodology allowed us to simplify our implementation with no impact for the end-user, our customer's clients.

The update explained previously is quite important to user's interaction in this third step, regarding personal data filling. As shown bellow on the figure 9, before user enters their fiscal identification all the remaining fields are locked. What happens is that, whenever users enter their fiscal identification number, the system reloads the page, verifies if the user is already a client and if he is all his data is shown on the form. As we mentioned on the prototypes analysis, if the user is not a client all the other filed on the form are unlocked.

Figure 29. Real website - enrollments form - third step - enter personal data.

Fourth step - Enter professional data

Completely tied with the third step, whenever users are already clients on the system, this data gets field automatically. All the required information is very simple and easy to enter.

Figure 30. Real website - enrollments form - fourth step - enter professional data.

Embracing all the steps mentioned previously are the validation mechanisms. Triggered via submit button, these are the key towards data correctness. We introduced lots and lots of verification mechanisms using regular expressions and after a extensive testing we came up with a strong system that ensures that data from the users that fills the system database are secure. Since we delivered to our customer, on September 10, the first version of the platform, we refined some mechanisms and we will present afterwards one general example:

Using the example show on the right, whenever users click on submit the validation process starts.

If one or more errors are identified, the validation mechanism automatically creates a panel on the beginning of the form to display error information.

To ensure that users see the information regarding the errors we added a behaviour to focus on that element.

Within this information note is shown only the fields that were not validated.

As it is clear, correct fields or field groups are present with a green background while unvalidated fields are presented with a transparent red background and a red two pixel border.

Since we are aiming towards a very broad public, using error notification information with all the uncorrect fields placed accordingly with the order they are presented on the form, we ensured that users with color blindness might aswell take benefit from the validation help mechanism.

After extensive testing we conclude that textually indicating where the error is, users were able to correct it and successfully submit the enroll.

Formulário de INSCRIÇÃO

Existem campos por preencher ou preenchidos incorretamente!

Em "Selecionar ações de formação", selecione no mínimo uma ação de formação para efetuar inscrição.

Em "N.º Id. Civil", o um número inserido não está correto. O número deverá conter entre 7 a 9 dígitos, sem espaços e sem letras.

Em "Data de nascimento", a data não está inserida no formato correto. Deverá introduzir da seguinte forma, por ex.: 1978-05-29

Em "Código Postal", o código introduzido não está no formato correto. Deverá introduzir da seguinte forma, por ex.: 9000-103

Em "email", o email introduzido não está no formato correto.

Em "Nível de ensino", insira o seu nível de ensino.

Em "Habilitações", insira as suas habilitações.

Após a correção dos campos identificados com contorno a vermelho, volte a submeter o formulário. Se todos os dados estiverem bem preenchidos aparecerá uma mensagem indicando que a inscrição foi efetuada com sucesso.

Selecionar grupo de recrutamento Passo 1 de 4

Grupo de recrutamento: * Grupo 110 - 1.º ciclo do ensino básico

Selecionar ações de formação Passo 2 de 4

Formações disponíveis para o grupo selecionado:

Ação de Formação	Efetuar Inscrição
A Sexualidade no Pré-escolar e 1.º ciclo	<input type="checkbox"/>
Construção de Materiais Didáticos com Recurso às Ferramentas de Autor - Hotpotatoes e eXeLearning	<input type="checkbox"/>
Aprendendo a gerir a falta de Tempo e o Stress na carreira docente!	<input type="checkbox"/>

Introduzir Dados Pessoais Passo 3 de 4

N.º Id. Fiscal: * 243068638 N.º Id. Civil: * 132818 Tipo de documento: * Bilhete de Identidade

Sexo:

Masculino Feminino

Data de nascimento: (aaaa-mm-dd) * 13-08-30

Nome: *

Nuno Filipe Nóbrega Rodrigues

Morada: *

Rua Almirante Reis, n.º 5

Código Postal: * 9125

Localidade: * Funchal

Telefone:

Telemóvel: * 966704748

email: * testpurposes2gmail.com

Introduzir Dados Profissionais Passo 4 de 4

Escola onde leciona: *

Escola BS da Ponta do Sol

Escola à qual pertence:

Escola B1,2,3 / PE Ciclos Prof. Manuel Santana Barreto - Fajã da Ovelha

Nível de ensino: *

Educação Pré-escolar

1.º Ciclo do Ensino Básico

2.º Ciclo do Ensino Básico

3.º Ciclo do Ensino Básico

Ensino Secundário

Ensino Especial

Habilitações: *

Bacharelato

Licenciatura

Pós-graduação

Mestrado

Doutoramento

✕
Cancelar

✉
Submeter

Figure 31. Real website - enrollments form - validation example.

Although the real website is not confined only to the pages shown above, the ones we showed are directly tied with the initial problem that we are targeting. Activities such as course advertisement, course enrollments were solved and also extra functionalities were added to enrich some of the activities previously identified. Notwithstanding, for future solution iterations we will focus also on the functionalities that compose the website in order to create an attractive platform which will indirectly contribute to a stronger advertising platform for our customer's courses and other services.

From now on we will explain how the front-end website is managed using the back-end component.

Real website back-end overview

Since we decided to use as our base structure Joomla! CMS, in terms of design, we used the standard back-end template. For the custom component that we will show ahead, we focused on maintaining interface coherence. As well as the front-end, back-end website is responsive, which allows our customer team to be able to work not only on a desktop but also on tablets and smartphones.

At this instance we performed a commonality analysis between all the elements gathered with activity modeling, prototypes and our customer's prototype validation. The output of this analysis introduced a new concept, converging to a more fitted structure.

In the prototypes, in order to add new courses we introduced a simple option in the interface ("New course"). However, results from our commonality analysis refines this approach. We identified that it is quite often for our customer to develop a course multiple times. With our initial prototypes, our customer would need to duplicate information in the system to get multiple courses because each course has many data, such as name, duration, accreditation, addressed to, objectives, contents, etc, that never change, independently of when or where it is developed.

From our customer's validation, we gathered that they use two distinct nomenclatures to what we defined to be courses. To refer to a course developed one single time, they use the nomenclature course and repeated courses are called "classes".

Our approach for the solution, derived from the comparative analysis, uses the nomenclature previously explained but with strict methodology, i.e.:

- A course is composed by static information, such as name, duration, accreditation, addressed to, objectives, contents, etc.
- A class has information about where, when, formator, applicants selection criteria, etc.
- To develop a course, at least one class needs to be associated to it, i.e., a course cannot be developed without having a class.
- A class does not exist without a course.

With our new concept enlightened, we iterated our back-end to embody the new concept and redesigned its look and feel to maintain our custom component interface coherence with Joomla back-end interface. Therefore the first version of the solution was implemented as follow:

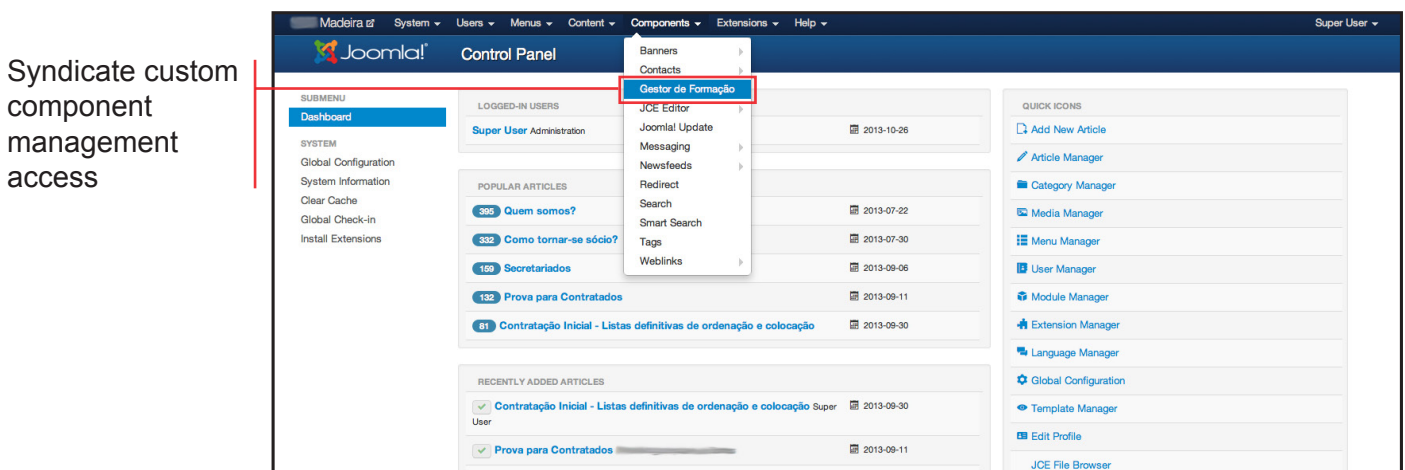


Figure 32. Real website - back-end main page - custom component access.

Custom component - Home page

Menu

Within this solution first release, the only functionality that we did not implement due to time constrains, was the statistics. However, all the effort spent on the database development will allow us to develop that component almost effortless. Additionally, to support changes on the methodology we included in the menu options to manage courses and classes wich we will explain bellow.

Page title

Courses under enrollments

From the prototype to this point we added a column for the class identifier and all other aspects remain the same.

Ongoing courses

From the prototype to this point we added a column for the class identifier and all other aspects remain the same.

Courses to begin

Although its not presented a table of courses to begin, whenever there are courses to begin in 5 days or less a table is shown. Following the methodology change, we added the column for a class identifier and all the other columns were kept exactly as prototyped.

Figure 33. Real website - back-end main page - custom component home page.

In order to get this solution, additional changes to prototypes influenced the concepts for the search mechanism, course filter, and course details. For each one of them we made the following changes:

- Search mechanism - Our initial concept goal was to offer a general search functionality that would perform searches accross all the system. However, it is quite simple to have contextual searches which allow users to perform searches within each page. In the case of home page , shown above, we decided that a search functionality was not needed because the amount of courses that appear on it will never be to extense to require the need for a search mechanism.
- Course filter - this functionality was prototyped with the intention to allow users to filter courses per date, type, etc. Although it is not shown on the image above, this functionality is used on other pages, as we will show bellow.
- Course details - splitting the old term courses into courses and classes we needed to change this functionality. Therefore we created on the menu the option to manage courses and classes and allowed there the ability to consult the information, as we are going to show after. After meeting with the customer the most desired shortcut was the easy access to the selection of enrollments page. With that knowledge we created a link on each course name that redirects to the selection

of enrollments to that respective class. Explaining this with the actual interface its easier and is exactly what we will show previously:

Turma	Nome formação	Inscrições até	Inscritos	Selecionados	Suplentes	Desistências
Curso 3, Ação 1	A Sexualidade no Pré-escolar e 1.º ciclo	2013-10-27	22	20	0	0
Curso 25, Ação	Aprendendo a gerir a falta de Tempo e o Stress na carreira docente!	2013-10-27	102	25	62	0
Curso 23, Ação	Construção de Materiais Didáticos com Recurso às Ferramentas de Autor - Hotpotatoes e eXeLearning	2013-10-27	47	20	17	0

Turma	Nome formação	Local	Data fim
Curso 2, Ação 1	A Integração Curricular das TIC no 1.º Ciclo - I	Escola Básica e Secundária Gonçalves Zarco	2013-11-09 14:00:00
Curso 4, Ação 1	Aprender a ver e a Citar no 1.º Ciclo e Ensino Pré-escolar	Escola Básica e Secundária Dr. Luís Maurílio da Silva Dantas	2013-11-02 14:00:00
Curso 19, Ação	Criação de e-conteúdos para a prática docente	Escola Básica e Secundária Gonçalves Zarco	2013-11-30 14:00:00
Curso 1, Ação 3	Filmes Educativos na Aula de Português e de História	Escola Básica e Secundária de Santa Cruz	2013-11-02 14:00:00
Curso 1, Ação 1	Gestão e Mediação de Conflitos	Escola Básica e Secundária Dr. Luís Maurílio da Silva Dantas	2013-11-02 14:00:00

Shortcut to class enrollments

Class name is “Curso 1, Ação 1” and course is “Gestão e Mediação de Conflitos”. Normally a shortcut to class enrollments should be a link on top of the class name. However we identified that the our customer team members communicate between each other using always phrases such as “the second class of the course Gestão de Conflitos” which means that they focus mainly on the aggregation of the class and course name but focus on the course name when talking among them. After customer validation we bended the standard implementation methods and placed the link to class enrollmnets on each course name. This resulted to be very straightforward to them.

Figure 34. Real website - back-end main page - custom component home page focused on classes.

Now we will present how users prepare classes to be presented on the front-end of the website. The first step is to create the ground for the class, ie, create the course in which the class is based.

Custom component - courses management page

Search courses

Nome Formação	Destinatários
<input type="checkbox"/> A Integração Curricular das TIC no 1.º Ciclo - I	Professores dos grupos 110 e 120.
<input type="checkbox"/> A Sexualidade no Pré-escolar e 1.º ciclo	Professores dos Grupos 100, 100 EE, 110, 110 EE, 910, 920 e 930
<input type="checkbox"/> Aprendendo a gerir a falta de Tempo e o Stress na carreira docente!	Educadores de Infância, Professores dos Ensinos Básico e Secundário e Professores de Educação Especial
<input type="checkbox"/> Aprender a ver e a Citar no 1.º Ciclo e Ensino Pré-escolar	Professores dos grupos 100, 100EE (Educação Especial do Pré-escolar da Região Autónoma da Madeira), 110 e 110EE (Educação Especial do 1.º Ciclo da Região Autónoma da Madeira)
<input type="checkbox"/> Construção de Materiais Didáticos com Recurso às Ferramentas de Autor - Hotpotatoes e eXeLearning	Professores de todos os grupos de recrutamento (Ensino Regular e Ensino/Educação Especial)
<input type="checkbox"/> Criação de e-conteúdos para a prática docente	Educadores de Infância e Professores de todos os grupos de recrutamento (Ensino Regular e Educação Especial)
<input type="checkbox"/> Filmes Educativos na Aula de Português e de História	Professores dos Grupos 200, 210, 220, 300 e 400
<input type="checkbox"/> Gestão e Mediação de Conflitos	Professores de todos os grupos de recrutamento (Ensino regular e Ensino/Educação Especial)
<input type="checkbox"/> Intervini com alunos com NEE na escola regular	Educadores de Infância e Professores dos Ensinos Básico e Secundário (Ensino Regular)
<input type="checkbox"/> Plataforma Moodle no Processo de Ensino/Aprendizagem	Educadores de Infância, Professores dos Ensinos Básico e Secundário e Professores de Educação Especial

Course options

Options to manipulate the courses. With new, edit and delete options, admin users are able to easily manage courses that will serve as base for the classes to advertise to the teaching community.

Existing courses

List of courses already introduced in the system.

Figure 35. Real website - back-end custom component - courses management.

One important aspects to mention is that admin users do not need to create a courses whenever they want to create a class. For example if the class is based on a course that is already inserted on the system then reuse comes into place.

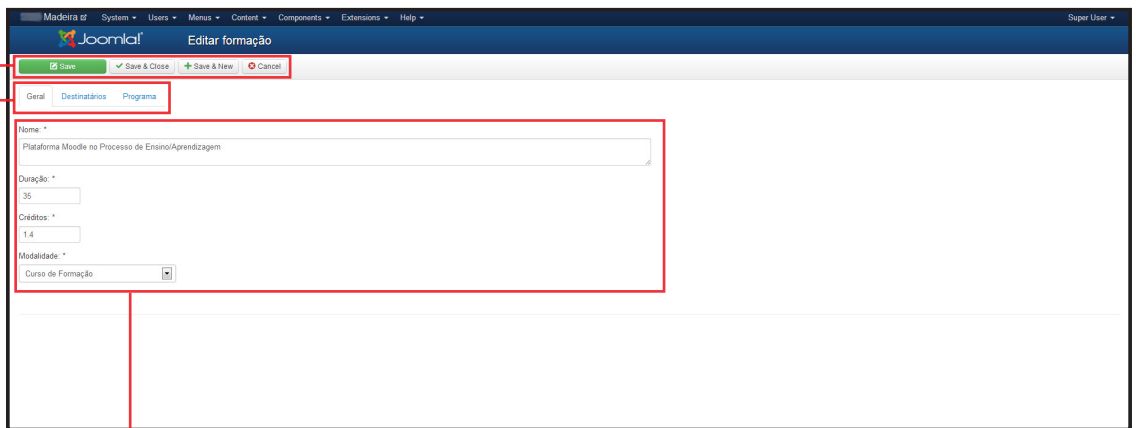
As mentioned previously, admin users have in their hands the ability to create new courses, edit and delete existing ones. Delete is made directly from the list of courses, selecting the desired and pressing delete on the toolbar menu. For other side new and edit are done in a form as show bellow. Since new and edit are the same we will present the edit version which is filled with data.

Custom component - Edit course

Options

Data group tabs

To create a cleaner interface and also maintain a connection with the Joomla! look and feel we used tabs to group the content per categories. For the case of courses the first tab represents general data. Next will show the second tab that regards course destinataries and finally the third tab that is for course program.



General data

In the respective order, course name, duration and accreditation are three of the fields that are show on the front-end whenever a class is advertised (see Figure 22). The fourth field is apart of an idea for a future implementation regarding statistics.

Figure 36. Real website - back-end custom component - edit course general tab.

Destinataries per recruitment group

One of the functionalities we had in the new enrollments form was automatic classes filtering per recruitment group. This mechanism uses the groups introduced in this part to compare with the selected one in the enrollments form (see Figure 27 and 28). As shown, users have options to select all or none of the groups and since a vast number of courses is directed to all or almost all the groups, its quite a useful functionality.

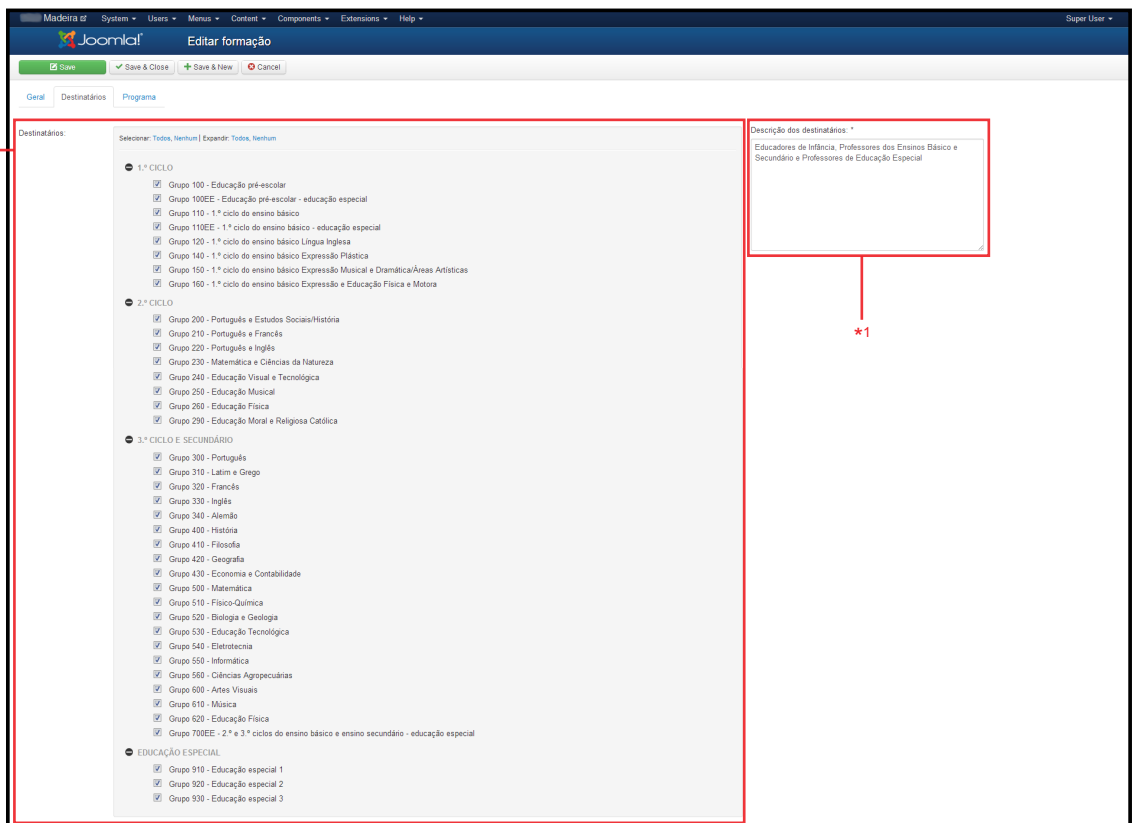


Figure 37. Real website - back-end custom component - edit course recipients tab.

*1

Destinataries according with CCPFC

CCPFC (Conselho Científico e Pedagógico de Formação Contínua) is the entity that provides accreditation to our customer courses. Therefore, it is quite important to bound the information that is provided in the front-end to the credited info. This field is used to present the destinataries as shown in Figure 22.

Finally, third tab regards course program and it is directly connected with the information that is shown in the front-end on course further details (see figure 23). Focusing in keeping it simple we implemented it as follows.

Course guidelines

Currently this component is not being used. However we intend to create extra functionalities that will need this data.

Course objectives

Course contents

The screenshot shows the Joomla! back-end interface for editing a course program. The interface is divided into three main sections, each with a rich text editor and a word count:

- Enquadramento:** Contains introductory text about the Moodle platform and the course's purpose. Word count: 120.
- Objetivos:** Contains a bulleted list of course objectives, such as understanding the platform structure, improving pedagogical practices, and developing basic competencies. Word count: 136.
- Conteúdos:** Contains a bulleted list of course contents, including Moodle introduction, group creation, access to the platform, video usage, Moodle activities, evaluation, and security. Word count: 233.

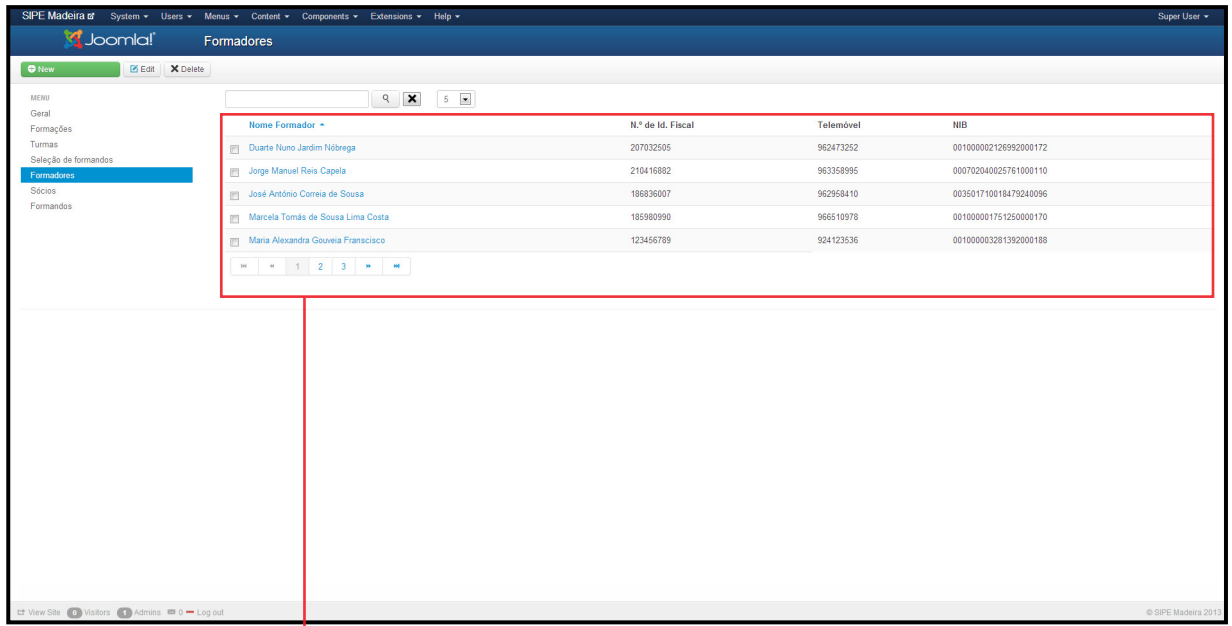
Figure 38. Real website - back-end custom component - edit course program tab.

With the elements pointed previously admin users are able to create the ground base for a class. Another step that is required before creating the class is adding to the system the formator that will be associated to it. As well as for the course, if the formator for the class is already in the system then this step is not needed.

We intended to create a simple interface and coherent interface, so we implemented formators management page with the same structure as courses management page. We also kept the options new, edit, and delete in the tool bar and their behaviour is the same as for courses management page.

The obvious difference is with the table were is shown the data which for the case of formators has more data presented as follows:

Custom component - formators management



Formators short data

After meeting with our customer we identified that the most common data they search within the formators are their fiscal number, mobile phone, and their bank account number. Therefore these fields compose the resume information always available on the formators management page.

Figure 39. Real website - back-end custom component - formators management page.

Actions triggered from each one of the options, follow the same methodology as in Figure 35 with the proper fields related to formators. Due to its simplicity look and feel we will not display them at this instance.

After this point administrators are able to create properly new classes in the system.

Custom component - classes management

Keeping up with design coherence we implemented classes management with same aspect as courses and formators management pages. Decisions related to most relevant data were taken after meetings with our customer. Note below that we don't show schedule data because those informations are constant in another pages that we will explain after.

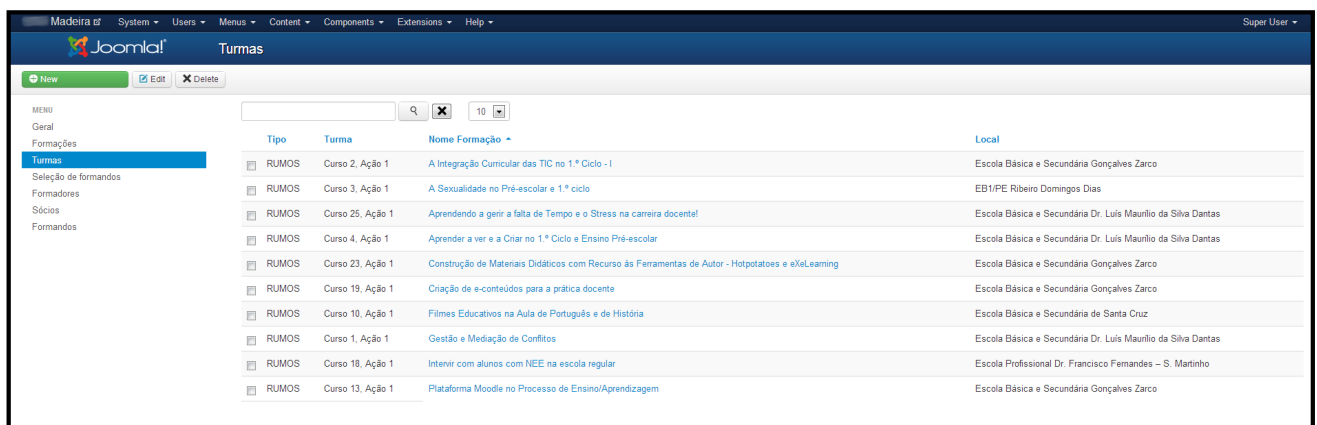


Figure 40. Real website - back-end custom component - classes management page.

Although editing a class is similar to courses and formators edit mechanisms we will show how it looks in order to build a parallel between front-end and back-end.

Custom component - Edit class

To support our front-end to back-end analysis we will explain the most relevant fields that affect what normal users see, following the same order as presented on the images.

Classes general data tab

Course name - At front-end, users see the course name since it is easier and more attractive than the class denomination.

Class type - As gathered on the analysis, our customer has different types of courses. On advertisement different type of information is shown, so this field is used to adapt what is presented on the front-end. For example, this class is a financed class so, logos from program founder are shown (see Figure 22). Other types of classes have different information such as price that we did not present above.

Class state - establishes if the class is under enrollments, development or finished. Classes under enrollments will be shown on the front-end website like Figure 22.

Formator - With this field admin users are able to associate one formator to the class which will be presented on the front-end website when the class is advertised.

Beginning and end date for enrollments - penultimate and antepenultimate fields define the time window when a class is available to enrollments.

Observation - Last but not least this is a field where information like "Mandatory to bring laptop".

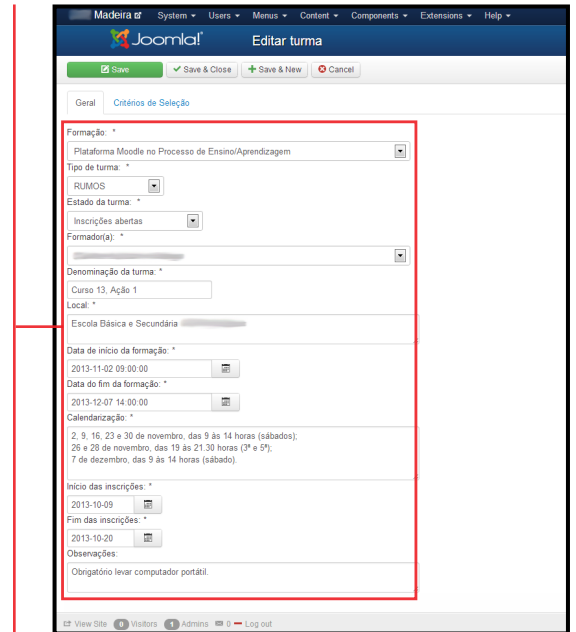


Figure 41. Real website - back-end custom component - edit class general data.

Classes selection criteria data tab

Minimum number of applicants - although currently this information is not being used, we intend to implement a warning mechanism to alert admin users when the number os selected clients is inferior than the number introduced in this field.

Maximum number of applicants - this field is being used by the automatic selection mechanisms and allows it to select clients until a predefined maximum.

School spots - This field is being used to affect what columns should appear in the table with class enroll that we will explain further down. Although the initial idea was also to use the value of this field in auto selection due to data constraints*1 we will only do it in future iterations of the solution.

*1 Grouping together the data from the school introduced by users is a challenge because they use school abbreviations and the comparison gets really tricky to do. We got together with our customer decided that for an initial version we would not contemplate the auto selection by this criteria, with a compromise to address it in a later solution release.

Selection criteria - Admin users have the ability to include 4 different selection criteria to use in auto selection. Appended to each criteria is a client priority and a price per priority. The first aspect is used by auto selection mechanism to order applicants by their priority. Price is used to display in the front-end class advertisement. However we have extra functionalities that we aim to implement in the future.

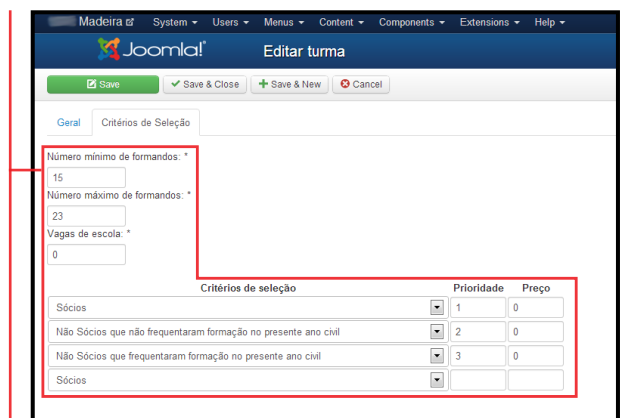


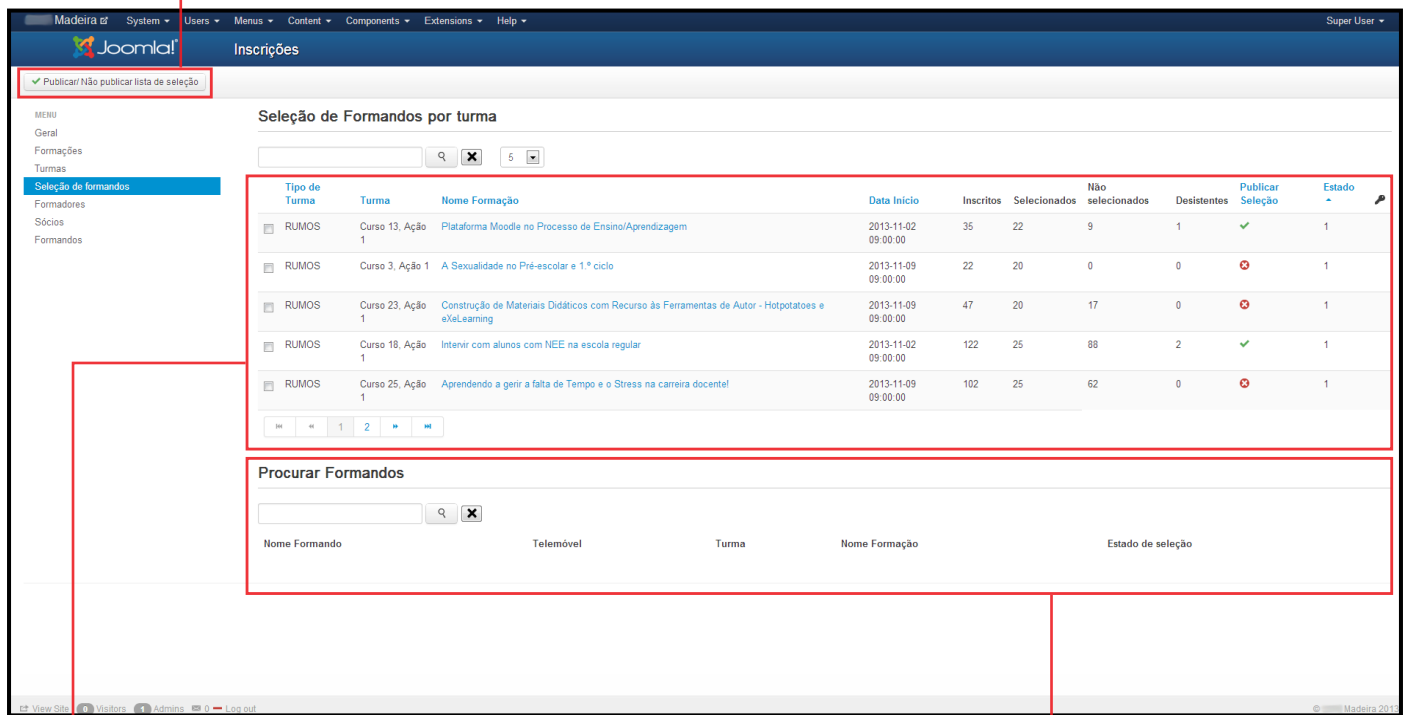
Figure 42. Real website - back-end custom component - edit class selection criteria data.

Having this in place and after clients start performing enrolls, auto selection mechanism is activated and admin users can see it within enrollments selection menu options, as follows:

Custom component - Enrollments manager

Publish class enrollments selection

Option to publish or unpublish selected and substitute applicants on the front-end as shown in Figure 24 and 25.



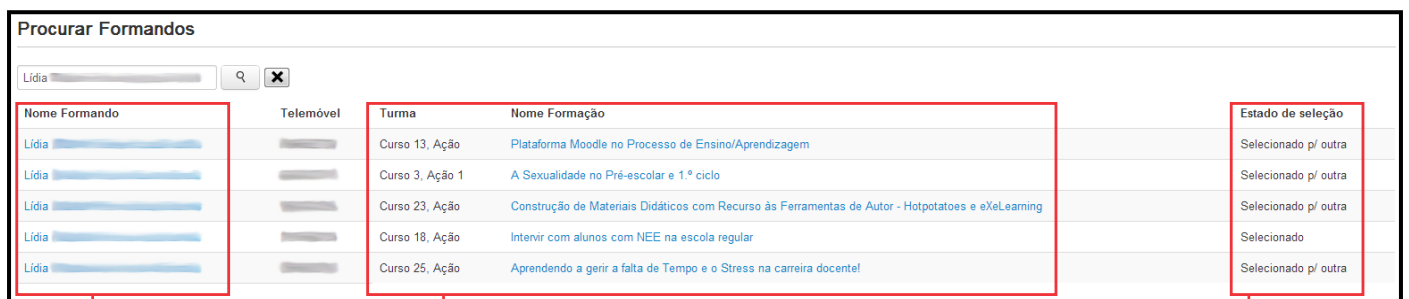
Enrollments selection resume per class

Without accessing to each class, admin users have an overall visualization of enrollments evolution and at the same time the number of selected, substitute and dropout applicants. For each class, its title acts as a link to the page of enrollments per class.

Search applicants

New functionality that allows administrators to search applicants by name, mobile phone, and email. See the example below.

Figure 43. Real website - back-end custom component - enrollments manager.



Applicant name

Applicants that match search criteria.

Class enrolled

Class were the resultant applicant enrolled with link to the specific class enrollments.

Enrollment state

Figure 44. Real website - back-end custom component - enrolled applicants search results.

Custom component - Enrollments manager

The main functionality addressed in the solution was the auto selection mechanism. However, our customer required that their team members had the ability to override the system. To achieve it, we built options that allow them to mark applicants as selected, substitute, dropped out and excluded. Whenever a manual override is made to the selection, the enrollments altered get locked which means that system auto selection won't alter those enrollments state. Additionally we added a lock/unlock button to allow admin users to change it according with their intentions. To maintain coherence with all the pages shown until now, options buttons were placed on the toolbar bellow the page title.

As we did previously to explain the enrollments form page, we will provide an overall view of the this page and then explain in further details the relevant aspects it contemplates.

Class denomination and course name

Tabbed enrollments per state

Within each tab is in the respective order, global enrollments, selected, substitute, dropped out, excluded applicants and new states derived from autoselection, selected to other class and doubled applicants for the same class.

Main Toolbar

Auto selection lock
Visual feedback of applicants enrollments who get their state manually changed or locked.

Enrollment and applicants data

For this first release of the solution we present fixed columns and provide users to order ascendently or descendently by any of the data columns that their header is blue. This follows the convention of the adopted CMS. For a future solution release we intend to allow users to select other columns with clients information to be shown or hidden. Also for this release, applicants name act as links to applicants editing form.

Lists of contacts

Since the time was short to develop all the desired functionalities, we were forced to leave for a future release the solution to the methodologies used to inform applicants.

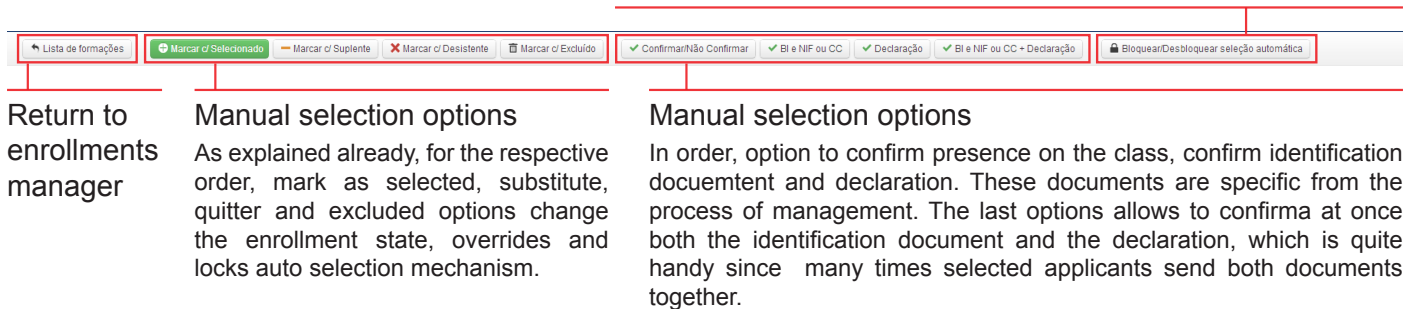
Selected applicants management

Presented only on the tab of selected applicants, this table component provides a visual feedback of the management aspects confirmed and to confirm by the selected applicants. The information shown here is manipulated using the toolbar options, which we will explain in further details after.

Figure 45. Real website - back-end custom component - enrollments per class.

Enrollment state lock/unlock option

With the intent to provide flexibility to administrators we came up with this mechanism that allows to override auto and manual selection.



Return to enrollments manager

Manual selection options

As explained already, for the respective order, mark as selected, substitute, quitter and excluded options change the enrollment state, overrides and locks auto selection mechanism.

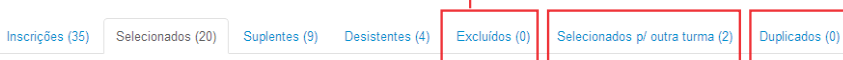
Manual selection options

In order, option to confirm presence on the class, confirm identification document and declaration. These documents are specific from the process of management. The last options allows to confirma at once both the identification document and the declaration, which is quite handy since many times selected applicants send both documents together.

Figure 46. Real website - back-end custom component - enrollments per class, toolbar.

“Excluded” state

Within the old selection methodology, this enrollment state did not exist. Create with the intention to mark selected applicants that do not confirm their presence on the proper giving time.



“Selected to other” state

With the new auto selection mechanism, whenever a client enrolls to multiple courses and get selected to one of them, all the other are marked as “selected to other” with reference to the selected class.

“Doubled” state

Selection mechanism verifies automatically if exists clients enrolled in duplicate to the same class and if it occurs, then the first enrollment between get flagged as “doubled”.

Figure 47. Real website - back-end custom component - enrollments per class, tabs bar.

All the images shown from the platform reflect all the functionalities we addressed within this master thesis. The amount of work required to develop a custom component for our customer, restrained by the short deadline, forced us to take out some of the initial functionalities we wanted to offer in this new platform. However, our partnership with our customer does not come to an end, quite the opposite. From now on we have a strong platform which we will continue to add functionalities. It is a non stopping work that will enhance day by day, what our customer is able to achieve with it.

To implement all the functionalities shown within this chapter, we revived our prior knowledges and acquired new ones, resorting on web search and tutorials, such as:

- Joomla! 3 Essential Training ⁽¹⁰⁾ Kramer, 2013);
- Joomla! 1.7: Programming and Packaging Extensions ⁽¹²⁾ LeBlanc, 2011);
- Templating with Joomla! 3 and Bootstrap ⁽¹¹⁾ Kramer, 2013);
- PHP Tutorial ⁽²²⁾ Refsnes Data, 2013);
- Object-Oriented programming with PHP ⁽¹⁵⁾ Peck, 2013)
- SQL Tutorial ⁽²¹⁾ Refsnes Data, 2013);
- PHP with MySQL Essential Training ⁽²³⁾ Skoglund, 2013);
- HTML Tutorial ⁽¹⁷⁾ Refsnes Data, 2013);
- CSS Tutorial ⁽¹⁸⁾ Refsnes Data, 2013);
- JavaScript Tutorial ⁽¹⁹⁾ Refsnes Data, 2013);
- jQuery Tutorial ⁽²⁰⁾ Refsnes Data, 2013);
- Potential backward compatibility issues in Joomla 3 and Platform 12.2 ⁽⁸⁾ Joomla!, 2013);
- Overriding Pagination Limit in Joomla ⁽¹⁾ Bourque, 2012).

5 | Results

One of our main goals was to deliver to our customer a proper solution to his problem, within the tight deadline. In the early days of September, 2013, we delivered to our customer our solution first release. Within this, all the functionalities required to develop courses effectively are available. To overcome the short schedule, some secondary functionalities were not provided on this first version. However, since then, we have been working together, fixing some bugs as well as adding already new functionalities.

We are very pleased to say that, from September 10, 2013, which is the date when our solution was introduced to our customer's clients, until November 4, 2013 we have had the following results, in terms of access:

Month	Unique visitors	Number of visits	Pages	Hits
Jan 2013	0	0	0	0
Feb 2013	0	0	0	0
Mar 2013	0	0	0	0
Apr 2013	0	0	0	0
May 2013	0	0	0	0
Jun 2013	0	0	0	0
Jul 2013	0	0	0	0
Aug 2013	0	0	0	0
Sep 2013	837	1,066	7,896	59,593
Oct 2013	812	1,206	11,681	61,818
Nov 2013	38	54	1,044	3,311
Dec 2013	0	0	0	0
Total	1,687	2,326	20,621	124,722

Table 5. Monthly history according with webstats.amen.pt

The statistical values, shown above, represent accesses to all the pages inside the platform. Within our first release, we were focused mainly on supporting our customer to perform courses management and courses advertisement to their clients. Using statistics gathered by the website host, the page of courses in the new website was accessed in September 3741 times, in October 4903 times and in the first four days of November, 78 times. Beads made, our additional advertisement strategy made the courses page to be consulted in the first two and a half months, 8722 times.

Within these results we are not able to specify which of the accesses were made by the first time but we can identify a growing tendance, comparing unique visitors and numbers of visits for each month, shown in Table 5.

Is also important to refer that our customer released in these past two months ten courses which had 554 enrollments, increasing already the medium number of enrollments from 52 to 55 applicants per course.

All the results we presented until know relates to our customer's clients which was reflected within our solution analysis in activities "A06. Consult course(s) information" and "A07. Make enrollment in course(s)". Our solution offers users completely new functionalities to easily and effectively consult available courses, large details for each course and applicants selection lists per course which

suppressed the needs gathered along problem analysis. Not new but completely different from what it was, users are now able to enroll in courses in a dedicated platform from ASPE. This is a huge difference in terms of service quality and professionalism.

When we first analysed this functionality, we identified that our customer's clients took in average 5 minutes to enroll in a course, and many calls were made asking for help with filling the form.

Within these two months we had two distinct opportunities to test our solution. The first one was immediately when the website was released. Applicants started to enroll in courses and approximately 15 applicants contacted ASPE in order to be supported in the enrollment process. We worked hand in hand with our customer in this stage, gathered all the feedback received by users and immediately solved the bugs that originated the reported issues, mainly related with the validation mechanisms. Our main addition was the panel where is shown a resume of filling errors, as shown in Figure 31. After this, in October, our customer released/advertised five new courses and enrollments started to be done. To these last five courses our customer had 332 enrollments and only 3 calls were received asking for support in the enrollment process.

About the average time to perform each enrollment we included a functionality within the form that allows the platform to automatically fill out the data of existing clients in the system. With this addition, the time required to enroll in courses was shortened. For new applicants, the average time required to fill the form is practically similar. It is impossible to quantify exactly the average time but, since the form is simpler and with less fields, users should be able to perform it a bit faster.

In order to receive feedback from users that interacted with the front-end of the website, when the first five courses started, we delivered to applicants a questionnaire about the new ASPE website, focused on the courses advertising strategies, website functionalities and enrollments form. To see the structure of the questionnaire, consult attachment i. Enquiry about the new ASPE website.

From the results of the enquiry, according with question 4 results, most of the applicants considered easy and very easy to consult the information about courses. As expected, 11 applicants expressed they had difficulties accessing courses information. We assume these applicants to be some of the 15 applicants that contacted ASPE for help when the website was released.

The brand new functionality allowing applicants to consult course objectives and contents was consulted by 87.2% of the enquired applicants. Regarding the access to the functionality previously mentioned, only 7 applicants set as satisfactory and all the others categorized it as simple or very simple. Generally, the information as well as accessing it was rubricated as complete and simple, respectively.

The redesigned enrollments form was categorized by 62.5% of the enquired applicants as very simple, 35.4 % as simple and 2% as complex. We believe that all the iterations made after the first release of the solution, fix the difficulties users had in the first use of the system. To ensure it, we will be working with our customer as well as performing new enquiries to validate the iterations.

Another new functionality, list of selected and substitute applicants in the front-end of the website, was not consulted as much as we intended. However, we consider to be normal because all the applicants are directly informed to their personal contacts which disregards the need to consult it on the website. Despite that, this functionality works as required by our customer and allows him to be even more transparent about how applicants selection per course is made.

Overall, 95.3% of the enquired applicants considered the website to be good and very good, 93.7% fast and very fast and with good design.

Regarding the back-end functionalities, to support our customer to overcome many of the identified limitations, we obtained very enthusiastic feedbacks from its team members. Time constraints forced us not to implement some of the secondary functionalities but all the relevant functionalities to manage courses were implemented.

We planned to provide statistics to our client but we were not able to detail it as we want. However we still enhanced this task. With our solution, team leader is now able to consult in the platform the number of enrolled, selected, substitutes and dropped out applicants per course. As we show in Figure 44, we added a search mechanism which allows him to consult specific enrollments details for a specific course and/or class, per applicant info such as name, email, mobile phone, national identifier number and fiscal identifier number.

From prototypes step until the solution we iterated our initial concepts. Supported by a commonality analysis between the elements gathered within each step of activity modeling and our customer, we were able to absolutely remove the need to create enrollment forms. Within the analysis, we identified that enrollments forms had always the same data and directly validated with our customer that automatization was the key. To achieve automated advertisement and enrollments forms, we added courses and classes management, allowing administrator users to manage and automatically update what their clients are able to consult in ASPE front-end website.

The most challenging activity in the process was applicants selection. Our solution was overall focused on simplifying how the activity is performed and the effort it requires. We firstly started to merge enrollments management with applicants selection. To support this activity we added also within classes characteristics, details regarding selection criteria, maximum and minimum applicants per class. With these alterations to the process we were able to implement applicants selection mechanisms that perform autonomously verification of duplicate enrollments and criteria assignment to each applicant per class enrolled and applicants selection, as well as setting them as selected, substitute, duplicate and also if an applicant is selected to other course. All these tasks were made manually by the IT Manager, after the end of enrollments per each class, and took 7 hours to perform with the desired level of correctness.

Currently, applicants enrollments selection is made autonomously by the system while the enrollments are being made and it only takes 15 seconds to select all applicants to five courses. In addition to the notorious time reduction, this new functionality also grants our customer, higher level of correctness to applicants selection. Further more, team members can easily know, while enrollments are being realized, the number of enrollments they have as well as the number of elements that are automatically selected and substitute for each class. This supports their work because if they notice that a class is short in enrollments they can be proactive and immediately add some extra time for teachers and educators to enroll in that specific class.

However there is still another side to the coin. Automatic selection is handy but administrators need to be able to change manually a specific applicant state of selection. To support that, we offer a group of options that allow them to manually override the system and set any member as selected, substitute, dropped out and excluded, which we shown in Figure 46. In contrast with the old strategy, change an applicant to substitute or any other state is as simple as clicking a button.

New functionalities does not stop here. We also brought to the system, within this specific component, selected applicants management. To consult further details about this functionality, consult Figure 45.

Another rewarding aspect, resulted from the applied changes, is that we were able to overcome another huge constrain. Within the old applicants selection strategy, only one element of the team was able to perform this activity and whenever one team member wanted to access courses selection file they needed to required other to close it. With our solution all team members can interact simultaneously with applicants selection per class each class.

Within the solution strategy we established that we will have in the new system, options to send mails and SMS to selected and substitute applicants. However, within the first release of the solution, those functionalities were not provided. Automatic creation of enrollment forms in paper as well as certificates for each one of the selected applicant was also functionalities that we were not able

to include in fullest within the first release. Enrollment forms in paper were supported in a small percent, reducing the effort required to perform this tasks. One of the actions required in the old approach was data source adaptation before adding connection with the templates in Publisher. Currently, we provided an options were administrator can immediately download the data source, ready to be connected with the template. To consult how this process was made, consult "A14. Create enrollment form in paper for each selected applicant" within 4.1.2. Activity Model - Collection of Activity Profiles.

Last but not least, our solution supported another very time consuming activity. In the old strategy, there was three types of databases. These were not connected and manually updated. Our solution has a new custom made database with automated update mechanisms. Therefore old databases are extinguished with exception to the contacts database that is used inside ASPE gmail account. However, the new data structure was made in a way that, contacts database can be in the future extinguished.

Overall, for the activities that we redesign, we allowed to ASPE, not only, simple interaction and time effort decrease. We gathered in participation statistics within problem analysis that the actor "Responsible for Informatics" was an intervener in 24 of the 28 identified activities. Our solution supports work distribution among team members, allowing the actor mentioned previously not to be necessary in almost all activities.

6 | Future iterations

One solution is never the final solution. Our partnership begun with the goal the suppress the needs from our customer to manage courses effectively and with a simpler methodology as well as providing their clients better ways to access courses information and enroll on it.

However, the partnership between us and our client does not come to an halt with the end of this project. This is just the starting point to many evolutions to come. As we mentioned previously our customer main goal for their structure, with have a unique integrated platform among all their delegations, spread across Portugal. Our solution provided them with a strong platform with which we will be able to continue building new functionalities and even adding new services do it.

Outside the scope of this master thesis, we will start to work on those functionalities that, due to time constrains were not implement, such as:

- Statistics.
- Send email messages and SMS to selected applicants with a simple click of a button.
- Send email messages and SMS to substitute applicants with a simple click of a button.
- Send custom email or SMS to applicants, using only the platform.
- Fully automated enrollment forms per applicant.
- Fully automated certificates per applicant.
- Courses filter mechanisms in the front-end.
- Courses plan as newsletter.

A part from these we already merged ideas with our client in order to develop in the following months, mechanisms that will allow formators to be connected with the system, allowing them to fullfill their obligations directly in the platform as well as extending our solution to embrace new services such as treasury management, ASPE members management interconnect with all the delegations.



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7 | Conclusion

Throughout this work we were impelled by the wish to achieve both of the proposed goals and learn as much as possible during this process. Our main goals were to study activity modeling with the support of a real problem from our customer, ASPE, and solve our customer's problem. At this instance, we are able to express that we achieved both of them.

Regarding our customer's problem, we came up with a solution that is currently being used in its real work context. As reported within the results, in the first two months after the delivery date of the solution, the front-end was consulted by 1687 unique visitors, had 2326 visits and the pages that compose it were viewed 20621 times (Consult Table 5). Back-end component of the solution, addressing website maintenance and courses management, was implemented with all the main functionalities it requires and our customer's feedback was overwhelming. The solution potentiated their work to another level, reducing the time cost required within each activity and enhancing the quality of its outputs.

All of these results were achieved without any doubt due to activity modeling problem to solution analysis. This model driven analysis allowed us to deliver to our customer a proper solution, as well as identify within their structure other activities that could be enhanced in the future.

From the software engineering point of view, this methodology defies some of the core concepts we have entrenched. With this approach, having this work in consideration, we spent almost the same time analysing our customer's structure as the time to implement the solution to their issue. However, we have to express that it was time well spent. Activity modeling propelled our solution to a high level of correctness keeping each solution concept tangibly connected with problem analysis.

Notwithstanding, not all the steps of the analysis were easy to apply. Our first struggle surged immediately with the initial step of activity modeling analysis approach, namely, activity map within the activity model. Since our customer's process as-is was composed by 28 interconnected activities, sharing among them actors and artifacts, it was hard to begin the abstraction of the problem. To overcome these difficulties, we merge with activity map the concept of activity catalog, allowing us to firstly specify the activities that compose the process without the connected elements among them. This decision allowed us to start activity map development with an overview of all the activities that compose de process as-is.

Following our analysis, the collection of activity profiles, from our point of view, is one of the most demanding steps of the methodology but it is where a detailed inside view of each activity is performed. To properly develop an activity profile it is crucial to be involved with the interveners that perform each activity, understand how they perform it and in which conditions.

Third step of problem analysis was the participation map. Within this, we opted, as well as for the activity map, to start its development resorting to a participation inventory which sums out all the actors, roles, players, artifacts and system actors that compose the process as-is. All these elements were gathered from the analysis of each activity profile and allowed us to have a general view of all the elements that compose the process as-is. Additionally, we also opted to perform the participation map for each one of the activities in separate and, apart from the methodology notation intrinsic to participation map model, we consider this process to be a very straightforward approach to see how the elements, composing each activity, are related. Summing up this step, we added participation statistics since we believe it enhances the visualization of the shared resources among activities.

Activity-based user roles is the fourth step of activity modeling problem analysis. Immediately at the start, from our point of view, restricting roles to be connected only to one activity was not related with what occurs in the real work environment. Therefore, we iterated on this technique in order to allow

roles cover more than one activity. With this change, we analysed user roles in a perspective of **activities**-based user roles instead of **activity**-based user roles. Besides the aspects that compose user role analysis, we were able to identify which activities were related to each role.

Lastly, one of the most demanding steps, was activity-based task modeling. Our customer's process as-is did not rely on an integrated system and we endeavour to identify which activity elements should be rubricated as tasks, i.e., supported by the system or external actions, i.e., actions that influence the process but are not a part of the system. Despite of these difficulties, we established a criteria and rubricated each tasks and external actions. From our perspective, this step is fundamental to build the bridge between problem and solution.

Still inside activity-based task modeling conclusions, from our point of view, resorting on task cases/essential use cases is a very demanding and confusing way to approach a complex process as-is. Therefore, we strongly suggest to perform it using an inventory of task and external actions, which is a leaner way to analyse the process. In addition to the core aspects of the above mentioned inventory, by the authorship of engineer Larry Constantine, we added a simple notation, in order to have a stronger visualization of the tasks and external actions shared between activities.

$$\text{T0n. Consult selected applicants} \quad + \text{A01, A12}$$

However, we do not discard task cases in absolute. Accordingly with the analysis, task cases should be used whenever the task and external actions comprehension required a higher level of granularity.

Although we referred to activity modeling steps linearly in a sequential process but, in practice the process is iterative and the steps are sometimes developed concurrently.

At this instance our problem analysis was completed and we started building an abstract solution. From the original solution modeling to ours, we added activity-based task modeling of the system to-be and requirements specification as two additional elements to support the bridge between problem and solution. With these additions, we started solution modeling building a complete activity-based task modeling to-be through a commonality analysis among all the elements gathered within the problem analysis. We consider this to be the beginning overview of what activities and tasks should be addressed in the solution.

For this work, we did not describe formally the requirements specification. However, we consider it to be important to exist when the development is made in larger teams.

With all the abstract analysis made until this point we were able to prototype an interface for the solution and, despite it, we did not explicitly specify how each prototyped component was connected with the identified activities, tasks and external actions in the activity-based task modeling to-be. It is important to refer that it could be done. However, since we developed all of these steps, we validated if every tasks was being addressed in the prototypes intrinsically. Notwithstanding, we believe that is a good prototypes validation approach, tie up prototype elements with activities, tasks and external actions identified throughout the design process.

From this step until the first release of the solution, commonality analysis and customer validation were crucial to identify iterations and develop the adequate solution.

With all the aspects referred until this point, we conclude that activity modeling is a well defined methodology that supports software engineers to properly analyse problems and achieve a well defined solution, suited with their customer's reality.

With the iterations made to activity modeling as well as solution modeling, we concluded that it should be expressed with the following structure:

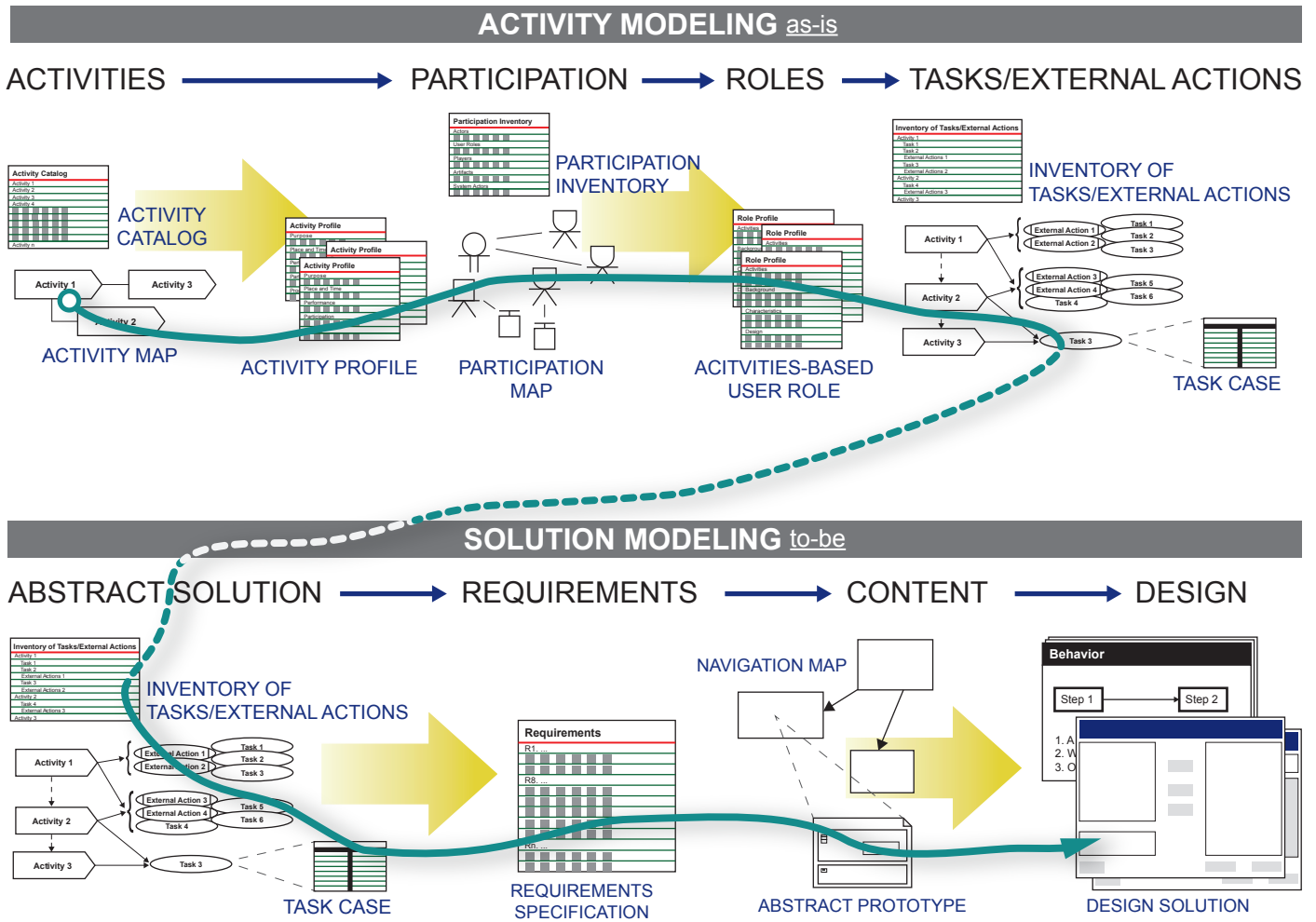


Figure 48. Redesigned logical overview of usage-centered design with activity modeling.

Overall, this was an arduous work. During this, we were able to revive prior knowledges in software development and programming such as MySQL, PHP, HTML, CSS, Javascript, jQuery, CSS, Object Oriented Programming and MVC Development. Additionally, we enriched our knowledges since we are now able to properly apply Activity Modeling to problems and implement a custom template and a custom component for Joomla! CMS.

Apart from the mentioned above, we also used some unconventional editors, inDesign and Illustrator, to develop the present document with the highest level. It was also a challenge to develop a work of this magnitude in a non native language, but we are pleased to have had the possibility to endorse a work of this nature.

From our point of view, this work summarizes a great effort, not only to provide a solution to our customer but also to do it while learning, validating, iterating and providing guide lines about how to use activity modeling to analyse a problem, build a connection between problem analysis and solution, and develop the solution itself.

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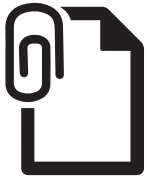
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Attachments

Attachment i. Enquiry about the new ASPE website.

Attachment ii. Enquiry about the new ASPE website - Results

Inquérito

O presente questionário pretende avaliar a facilidade de utilização do sítio eletrónico do sindicato. A sua participação é essencial para o desenvolvimento desta análise. As questões que se seguem são de resposta confidencial e ocuparão, sensivelmente, 10 minutos do seu tempo, pelo qual ficamos extremamente gratos.

1. Sexo?

- Feminino
- Masculino

2. Idade?

- até 25 anos
- 26 a 35 anos
- 36 a 45 anos
- 46 a 55 anos
- + de 55 anos

3. Nível de ensino?

- Educação Pré-escolar
- 1.º Ciclo do Ensino Básico
- 2.º Ciclo do Ensino Básico
- 3.º Ciclo do Ensino Básico
- Ensino Secundário

4. Encontrou a informação sobre as formações disponíveis?

- Muito facilmente
- Facilmente
- Satisfatoriamente
- Dificilmente
- Muito dificilmente

5. A informação sobre as formações está completa?

- Muito completa
- Completa
- Satisfatória
- Incompleta
- Muito incompleta

6. Pesquisou os objetivos e conteúdos das formações?

- Sim
- Não

7. Se respondeu “Sim” anteriormente, encontrou os objetivos e conteúdos das formações:

- Muito facilmente
- Facilmente
- Satisfatoriamente
- Dificilmente
- Muito dificilmente

8. No geral, encontrou a informação pretendida?

- Muito facilmente
- Facilmente
- Satisfatoriamente
- Dificilmente
- Muito dificilmente

9. No geral, classifique a informação disponibilizada?

- Muito completa
- Completa
- Satisfatória
- Incompleta
- Muito incompleta

10. Classifique o processo de inscrição nas ações de formação.

- Muito simples
- Simples
- Complexo
- Muito complexo

Sugestões:

11. Classifique o conteúdo do email de confirmação de inscrição.

- Muito completo
- Completo
- Suficiente
- Incompleto
- Muito incompleto

12. Consultou a lista de formandos seleccionados e suplentes no site do sindicato?

- Sim
- Não

13. Caso tenha respondido “Sim” na questão anteriormente, encontrou a lista de seleccionados e suplentes:

- Muito facilmente
- Facilmente
- Satisfatoriamente
- Dificilmente
- Muito dificilmente

14. Como classifica o site do sindicato em termos de velocidade de acesso?

- Muito rápido
- Rápido
- Satisfatório
- Lento
- Muito lento

15. Como classifica o aspeto gráfico do site do sindicato?

- Muito bom
- Bom
- Satisfatório
- Mau
- Muito mau

16. Classifique globalmente o novo sítio eletrónico do sindicato?

- Muito bom
- Bom
- Satisfatório
- Mau
- Muito mau

Se achar pertinente, faculte-nos algumas sugestões para melhorar a oferta de serviços no nosso sítio eletrónico:

Agradecemos a sua colaboração!

Inquérito

O presente questionário pretende avaliar a facilidade de utilização do sítio eletrónico do sindicato. A sua participação é essencial para o desenvolvimento desta análise. As questões que se seguem são de resposta confidencial e ocuparão, sensivelmente, 10 minutos do seu tempo, pelo qual ficamos extremamente gratos.

1. Sexo?

- Feminino 73
- Masculino 23

2. Idade?

- até 25 anos 0
- 26 a 35 anos 39
- 36 a 45 anos 40
- 46 a 55 anos 16
- + de 55 anos 1

3. Nível de ensino?

- Educação Pré-escolar 20
- 1.º Ciclo do Ensino Básico 28
- 2.º Ciclo do Ensino Básico 13
- 3.º Ciclo do Ensino Básico 31
- Ensino Secundário 20

4. Encontrou a informação sobre as formações disponíveis?

- Muito facilmente 48
- Facilmente 39
- Satisfatoriamente 10
- Dificilmente 1
- Muito dificilmente 0

5. A informação sobre as formações está completa?

- Muito completa 41
- Completa 48
- Satisfatória 5
- Incompleta 0
- Muito incompleta 1

6. Pesquisou os objetivos e conteúdos das formações?

- Sim 89
- Não 13

7. Se respondeu “Sim” anteriormente, encontrou os objetivos e conteúdos das formações:

- Muito facilmente 31
- Facilmente 49
- Satisfatoriamente 7
- Dificilmente 0
- Muito dificilmente 0

8. No geral, encontrou a informação pretendida?

- Muito facilmente 39
- Facilmente 53
- Satisfatoriamente 7
- Dificilmente 0
- Muito dificilmente 0

9. No geral, classifique a informação disponibilizada?

- Muito completa 36
- Completa 55
- Satisfatória 6
- Incompleta 0
- Muito incompleta 0

10. Classifique o processo de inscrição nas ações de formação.

- Muito simples 60
- Simples 34
- Complexo 2
- Muito complexo 0

Sugestões:

There were no suggestions made.

11. Classifique o conteúdo do email de confirmação de inscrição.

- Muito completo 67
- Completo 29
- Suficiente 1
- Incompleto 0
- Muito incompleto 0

12. Consultou a lista de formandos seleccionados e suplentes no site do sindicato?

Sim 20

Não 69

13. Caso tenha respondido “Sim” na questão anteriormente, encontrou a lista de seleccionados e suplentes:

Muito facilmente 5

Facilmente 12

Satisfatoriamente 2

Dificilmente 1

Muito dificilmente 0

14. Como classifica o site do sindicato em termos de velocidade de acesso?

Muito rápido 15

Rápido 60

Satisfatório 10

Lento 0

Muito lento 0

15. Como classifica o aspeto gráfico do site do sindicato?

Muito bom 22

Bom 57

Satisfatório 5

Mau 0

Muito mau 0

16. Classifique globalmente o novo sítio eletrónico do sindicato?

Muito bom 32

Bom 49

Satisfatório 4

Mau 0

Muito mau 0

Se achar pertinente, faculte-nos algumas sugestões para melhorar a oferta de serviços no nosso sítio eletrónico:

There were no suggestions made.

Agradecemos a sua colaboração!