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IT'S ALL ABOUT COMMUNICATION: Designing Learning Objects For An Entire University

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Abstract: This paper is about one of the most challenging issue a team faces when designing learning objects in large scale: professor-designer communication. Despite having a technically qualified and satisfied team, proper infrastructure and experience, for us both communication and the vision professors have about interacting and using technology in classroom are bottlenecks. Several time design tasks are delayed because we do not understand each other languages - and because we (designer) and them (professors) master very different domains, sometimes we cannot help them to improve their design visions. We will frame this paper on our experience, but we believe that it can be extended to every medium/large team designing and developing several learning objects at the same time.

Palavras-chave: Authoring Tools and Content Development, e-Learning Hardware and Software, Design Methodology.

2 INTRODUCTION

Designing learning objects is a complex task, given its high domain dependency and multidisciplinary nature. It requires that the knowledge and pedagogical beliefs of both designers and professors be incorporated into the interface, posing a challenge to both, as they have to act as partners from the earliest phases of the process by sharing their knowledge and experiences.

The prevalence of Information and Communication Technologies (ICT) for educational environments justifies the urge to understand how to better design educational artifacts. Despite accumulated experience and knowledge, it is still a great

challenge. Winters & Mor (2008) state that the methodological weakness in the development [design] of such artifacts might be the reason they did not have the desired engaging effect [in educational settings]. However, the fact that it is difficult to design, and that design itself is difficult to teach (Schön, 1983), might be an explanation for this scenario.

There are two relevant characteristics about designing learning objects: (1) they focus on teaching and learning, which are complex, multifaceted endeavours, and (2) they cannot be designed, even in the conceptual phase, neither by a single person, nor by a team with a single area of expertise.

To say that learning objects are focused on teaching and learning is more than to merely state its purpose. It also conveys the commitment to translate the theoretical interpretation of these processes into an instructional design and into a user interface. This is not a simple goal to meet, as there are no direct and objective means to translate any theoretical interpretation into software features.

The second characteristic, that we think makes educational software so special, is its inherent interdisciplinarity. Within interdisciplinary design teams, people have to integrate information, techniques, tools, concepts and theories from more than one body of knowledge; and to solve problems which solutions are beyond the scope of one single subject (Committee on Science, Engineering & Public Policy, 2004). Squires (1999, p.463) pointed out that "workers in these areas (design, programming and teaching) rarely speak to each other or take note of each other's work". In research on usability evaluation for educational software, Zaharias & Poylymenakou (2009, p. 76) mention an "ellipsis of research validated usability evaluation methods that address the user as a learner in a holistic way, which includes the consideration of cognitive and affective learning factors". Hinostroza & Mellar (2001, p.27) assert that in addition to having knowledge of learning theories, educational software designers should take teaching practices into consideration. The above authors point to a scenario where all members of the design team should share a large, multidisciplinary base of knowledge.

This paper is about one of the most challenging issue a team faces when designing learning objects in large scale: professor-designer communication. Amongst us, this hypothesis has been raised based on our daily experience dealing with professors and with the design and development team. We have been collecting data via structured and informal interviews with professors, intending to track and measure our process.

3 HOW ARE LEARNING OBJECTS DESIGNED?

The ideal learning objects design team should have several members. These include, for example, professors and instructional designers, analysts and programmers with different backgrounds, graphic, motion and interaction designers, writers and text-reviewers. Ideally, these team members would also share knowledge on relevant issues such as technology limitations and possibilities, design practices, classroom routines, and teaching practice and learning theories.

Siozos et al. (2009) achieved this through the adoption of participatory design practices, which besides encouraging participation of all team members in every phase of the development, brings users to the design team. Triantafyllakos et al. (2011), by

their turn, used a “design game” framework, called “We! Design & Play”, for designing educational software. The goal of design games is to focus on a set of skills, which are important in approaching design tasks. Perhaps the most famous example of a design game is the one you play with marshmallows and spaghetti, trying to build a stable structure, as tall as possible.

Winters & Mor (2008), for example, approached the integration of this multifaceted knowledge through the adoption of design patterns. During a one-year project, they elaborated and connected 120 patterns that were used in the design of educational environments, with the aid of a web toolkit. Crossier et al. (2002) proposed a less structured, yet more flexible method, based on user centred design and focusing on the integration of teachers with the development team.

In addition to methodological proposals, there are also research studies on guidelines for designing learning interfaces. The aim of these studies is to propose and validate a set of guidelines that, if followed, would help to design better interfaces. Regarding the design of Collaborative Learning Environments, Rubens et al. (2005) proposed seven design principles, based on an analysis of practices in European countries. Jones (2008) advises the use of storyboards as a means to bootstrap the design of learning tasks. Ariga & Watanabe (2008) designed a web design course to enhance the “visual expression” of students who are not in art or design courses.

There is yet another variable that should be accounted for: the familiarity educators have with technology. Only as long as they really embrace it as a language, as a medium, they will be capable of envisioning pedagogical solutions using it. This is the basic premise of the TPACK model (Mishra & Koehler, 2009) - TPACK stands for Technological Pedagogical Content Knowledge. The expertise embodied in the TPACK of a teacher is different from the knowledge of a discipline expert. Teaching mathematics to young children requires different pedagogical uses of digital technologies than teaching history in secondary school or literacy in the early years. In each case, the expert teacher needs to make creative links between what is being learned (content), how it is taught (pedagogy), and the appropriate tools (technology). This model is very popular amongst education researcher and practitioners, and there is a lot of information on it via scientific papers, presented in prestigious journals, as well on their web site - http://www.tpack.org/

The point of this brief presentation is to show that, as in all areas of design practice, there is an effort to create better ways to manage the process of learning interfaces development. These methodological efforts represent the crystallized knowledge of a community and, as such, are of great value. But before exposing the facts that lead us to this conclusion – and what we are doing to bridge this gap – let us frame this article by presenting ourselves.

4 FRAMING THE PROBLEM: WHO WE ARE AND WHAT WE DO

NAPEAD – http://www.ufrgs.br/napead – was planned to be a centre to design and develop learning objects for the university we work at, which is one of the best universities in Brazil – in fact, it has recently been rated as the best university, by the Ministry of Education (UFRGS, 2012-a). UFRGS has 89 undergraduate courses, 141 post

graduate courses, more than 47.000 students and more than 2.600 professors - about 87% of these hold a PhD degree (UFRGS, 2012-b).

NAPEAD was created in 2009, subordinated to SEAD, which is responsible for fostering and implementing distance learning in our university, - with the purpose to design and develop digital learning materials to support distance education courses at our university. It has, since 2010, the support of CAPES - Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - a federal funding agency, and from the University itself. The original team consisted of one coordinator, one vice coordinator, three chiefs of staff (technical staff with experience in the production of videos, animations and hypertexts) and students/trainees. This structure has changed over the years and in 2013, under a new coordination, the team has been reorganized and has now two permanent staff members (a technician and a learning specialist; 2nd author) plus nine undergraduate students/trainees.

The coordinator is a professor, nominated by SEAD, but she does not work 20 hours per week at NAPEAD (currently, the 1st author is the team leader; and the 3rd author was leader from 2010 to 2012).Out of those nine students, six are Design majors, one is Statistics major and two are Art majors - all of them are highly skilled in their fields. They work 20 hours per week and since 2012, they receive a scholarship which value is 2.3 times higher than regular university scholarships – actually, it is almost what is paid for a recently graduated student in our state in Brazil. Before that, the scholarship value was very low (as usually they are), so it had an impact on students' commitment with the job. As one of the benefits they have, every end of semester they are allowed to focus on their finals, plus the requirement of total work hours is not as rigid as it would be on an actual job. This assures we have the most qualified students/trainees with us, and they stay for quite a long time (on average, more than two years; empirical data). We have the possibility to call more students if necessary.

NAPEAD has developed hundreds of learning objects of several types, and they are all freely available from our web site: http://www.ufrgs.br/napead.

Since 2001, SEAD calls professors to submit their projects, and as long as they adhere to pre-specified criteria (i.e. is the proposal: well documented?; for distance education? ; encapsulated?) these projects are evaluated and selected to be either developed by NAPEAD or by professors themselves. The objective of these calls is to support the production of digital learning materials and at the same time to promote the introduction of technologies in education in the undergraduate courses.

4.1 Our design process

Briefly, our methodological process follows (Carneiro & Silveira, 2010):

1 The first step is called Comprehension. It is when the professor plans the learning object by gathering information such as content, goals (what is the student expected to learn?) and suggestions for use, as a guidance for other potential users.

2 The second step is called Preparation: the professor has to deliver design related documentation, such as sitemaps (for hypertexts) and storyboards (for animations).
3 The third step is Designing, and can be roughly divided in the following steps:
   a. The team at NAPEAD analyses the material the professor has planned and call him for an interview – this moment would be the equivalent of briefing the client.
   b. The team at NAPEAD go through several design iterations before the final interface is designed. Sometimes there is a need to call in the professor again, for problems and doubts that have not been foreseen in the first interview, nor were documented. He will be asked to review the progress periodically.

4. The next step is Development: it happens mostly inside NAPEAD and very seldom the professor will be called in again. This is the moment when one member of the team is appointed as responsible for the project and for the necessary interaction with the professor, by creating a cooperative design and implementation of the project.

5. The last step is called Presentation, when the learning object is ready, it is evaluated for its usability (Silveira & Carneiro, 2012) and submitted to the professor. If approved, it is uploaded to our repository, and is available to anyone. If the professor does not approve it, we make the required corrections and submit it again.

Although going through the above mentioned design process, it has been taking more than six months to deliver very simple learning objects – hypertexts, animations and videos. For instance, a web design studio would not take more than a month to create an animation like the one depicted in figure 1-a, or a hypertext like the one depicted in figure 1-b.

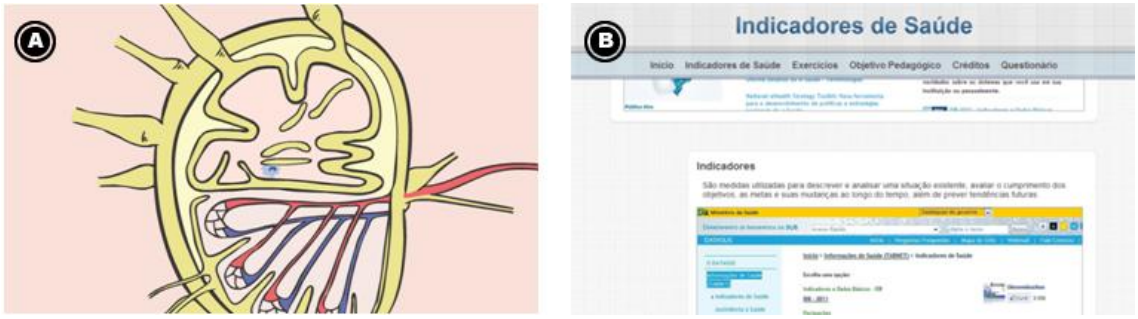

Figure 1 -Two examples of learning objects: an animation of the inflammatory process (a) and a hypertext explaining how to find and use data on the Brazilian public health system.

Why is this happening? We work with a fine infrastructure, a friendly management environment, the most talented students/trainees and highly engaged professors – we should be far more productive! Our view then is that we may be facing communication difficulties throughout the process.

5 HOW IS DESIGNING LEARNING OBJECTS DIFFERENT FROM DESIGNING NON-LEARNING OBJECTS?

The comparison between a regular hypertext and a hypertext as a learning object is not fair at all. When a client – for example a local business or industry – hires a web designer to create their web page, they already know what its content is going to be. Even if they do not have all the content at hand (as they usually do not have), the designer does not have much trouble figuring out how the content should be structured. Even on more complex cases – i.e. an e-business – the content is known; it is familiar. On the other hand, consider the same designer helping a professor to build a hypertext on the 'Brazilian Public Health System', or an animation on the 'inflammatory processes triggered by a mosquito sting'. The designer has very little information, if any, about the subject. The professor has no knowledge about design. It will most likely not take one month to deliver the hypertext. We have thus, identified two factors that contribute to our delivery-time being so long.

The first factor is the professor (as the local business who hires a web designer) not having a significant part of the content at hand when he submits a proposal, nor when he is called in for the first interview with the design team. There were times when the hierarchical structure of a hypertext (i.e. the sitemap) had to be created at the interview moment, because it was rather unclear. There were many times when development just stopped, for lack of content.

The second factor is that, frequently, development stops because we do not fully understand what the professor is trying to say. That is: after the first interview, when the professor explains what he wants (we write it down, we make sketches, diagrams and so on), we feel like we completely understood what he said. However, when we reach a given point at the development, we do not know what to do, and we have to call the professor in again. The problems are not like: "what is supposed to be on this page?", but "what is supposed to happen if I click here?" or "will these circles change their colour as they blend in?" From our experience, this kind of problem can be hardly solved with a phone call or an email message – they can only be solved face to face. However, for this to happen, both, the student who is in charge of the project and the professor, need to have common gaps in their schedules. As the student has twenty hours when he can meet the professor, and the professor has at least twelve hours when he cannot meet the student (when he is in class), sometimes the interview can only happen one week after the problem has been identified. It is not unusual this interview takes much more than a week to be scheduled, as sometimes the professor is in a conference, has meetings and other commitments related to his duties.

This is empirical data; this is what we live day to day. However, since 2010, we have been collecting data from structured evaluation interviews with the professors. Analysing the interviews' transcripts, we searched for instances of references to communication issues (i.e. complaints, suggestions, and direct references).

5.1 Interviews with professors

The evaluation interviews with professors have showed that our hypothesis concerning professor-designer communication problems have in fact an impact on the length we take to deliver the learning object ready for usage. Professors have raised difficulties found during the first and second steps of our design process as their main challenge. These difficulties and their impact on the comprehension of the learning

object by the design team made us think about alternatives to enhance communication between professors and the design team.

5.2 Tracking the design and development process

For the purpose of recording and monitoring the implementation of digital learning materials, a project management web application named Redmine (http://www.redmine.org/) was adopted.

For each new project, the tasks were recorded and assigned to a member of the team, so that the entire project could be documented.

By analyzing these records, we can identify some communication problems between professors and designers:

- Professors, in general, have a limited comprehension about what a hypertext is, which explains their difficulty to create a navigation tree and plan possible hypertextual trails. Most professors are used to organize their materials and contents in a linear way, which explain their difficulty in rearranging content in a hypertextual manner.

- Animations require specific details, which most professors do not consider necessary. Usually they teach from still images and oral narratives supported by their body language. So they think that is enough to pass static images and written descriptions for the designer to implement the animation.

- Videos are usually thought as recordings of someone talking about a certain subject. There are no subtitles - so there is no consideration with possible hearing by impaired users. It is then crucial to know how to make a script which anticipates the inclusion of different media.

- The relationship between the student/trainee (one who knows and understands about the technical possibilities of the implementation) and the professor (one who knows the content; the “client” who is asking for a service) was aggravated by language differences (technical X content) and by the hierarchy set. Curiously, the student/trainee is empowered in this situation, as he gets to say “I know how to do it and I say what you can and cannot do".

- A lack of commitment of the students/trainees due to their other interests beyond the job. Also, as said previously, in NAPEAD's early days they would get a very low pay for the job.

- There was not a team leader to follow up and to monitor the activities of the students/trainees.

- Professors had difficulty using the forms given by NAPEAD to detail their projects.

These issues reflect some of the obstacles described in the TPACK model (Mishra & Koehler, 2009).

6 HOW ARE WE TRYING TO MAKE COMMUNICATION MORE EFFICIENT?

At NAPEAD, several workshops have been organized with the intent of explaining our design and development process to professors. The goal is to raise awareness of our difficulties, so that together they can be overcome.

For example, when we issued the 13th call for projects, three workshops have been offered, aiming at explaining the call for projects, the requirements for submission and the documents used for submitting a project. After this, the former coordinators interviewed the professors, so that both sides would better understand the project - sometimes the professors themselves did not had a sharp clear vision of what they wanted. Only after this understanding was achieved the technical development would take place.

For the 18th call (in2013), intending to lessen these situations, it has been requested that every project had a document describing its structure – for example a sitemap or a storyboard, and that the whole content had to be delivered to the design team at NAPEAD at the moment of acceptance. The plan was to clarify the understanding of the project by the team, to emphasize to professors the need to have the project detailed sooner in the design process, and to avoid having to wait for the professor to create the content. However, only seven professors answered to that call – a very low amount of submissions, considering the size of NAPEAD's team. Recently, while interviewing a group of six professors who are usually engaged with SEAD's initiatives, we found out that they chose not to submit their proposals because they did not know how to create that documentation – what is the purpose, format and the information it should communicate. This kind of documentation is basic to any designer – but professors are not designers.

For this reason, in August 2013, another workshop took place, aiming to explain: what, in NAPEAD's vision, a learning object is; the learning objects we have designed as well as the goal of such documentation. It was an eight hour and two session professional training. The first session consisted of a presentation of NAPEAD, its design and development process and the definition of learning objects according to SEAD's point of view. The second session was a hands-on practice with sitemaps and wireframes. The goal of this practice was to document Xenubi (Perry et al, 2011), a Trump game about periodic properties. This game was chosen because its mechanics is very simple (it was reasonable to expect most of the class would know the rules of a Trump game) and because its subject should be familiar, to some extent, to everyone.

Professors were encouraged to draw, but some were not comfortable with drawing, and indeed most of them had difficulty filtering or expressing what the game was and how it worked, resulting in insufficient or unclear documentation (figure 2). Besides, it was clear that more practicing time was needed.

For this reason, the workshop lessons were fine-tuned throughout a Science Education post-graduation course, where the students (most of them are high school science teachers) also had to make sitemaps, wireframes, scripts and storyboards. The first author was the instructor of this class, which theme was "Designing Learning Objects" – so we could assume these students were motivated.

In December the workshop happened again, in an expanded version (12 hours), covering also scripts and storyboards. The program also changed, due to the feedback

of the previous workshop and that of the Science Education class. The main changes were the following:

- We have started by showing the results of the proposed exercise, made by participants who were not good illustrators. In fact, the examples we chose are from a Chemistry teacher who does not have sophisticated drawing skills, but who communicates her goals very clearly.
- Secondly, at the end of each session we explicitly encouraged everyone to show their drawings to one another – if other people can understand what you mean without you saying any words, you probably reached your goal. In the last day, each participant should bring a draft of the proposal they intended to submit (to 2014's call, which shall happen in January). Everyone gathered together at a large table, were every project could be seen by all participants. And that was when we started to reach a more ambitious goal.

7 CONCLUSIONS

The issue is not only about understanding what professors want to do when they are planning learning objects: it is also about helping them communicate their proposals more effectively, in a way that the production team can implement them satisfactorily.

At the December workshop last day, as all participants gathered at a table presenting their ideas, the whole group made several relevant suggestions – which made each proposal a lot more interesting. For example, figure 2shows the proposal of a Pharmacy professor who would like to make a new version of a previous game she had designed with NAPEAD - a very simple game about the Brazilian Public Health System and which mechanics had several pitfalls. After the collective interventions it turned into a Facebook game, a much more dynamic game in fact.

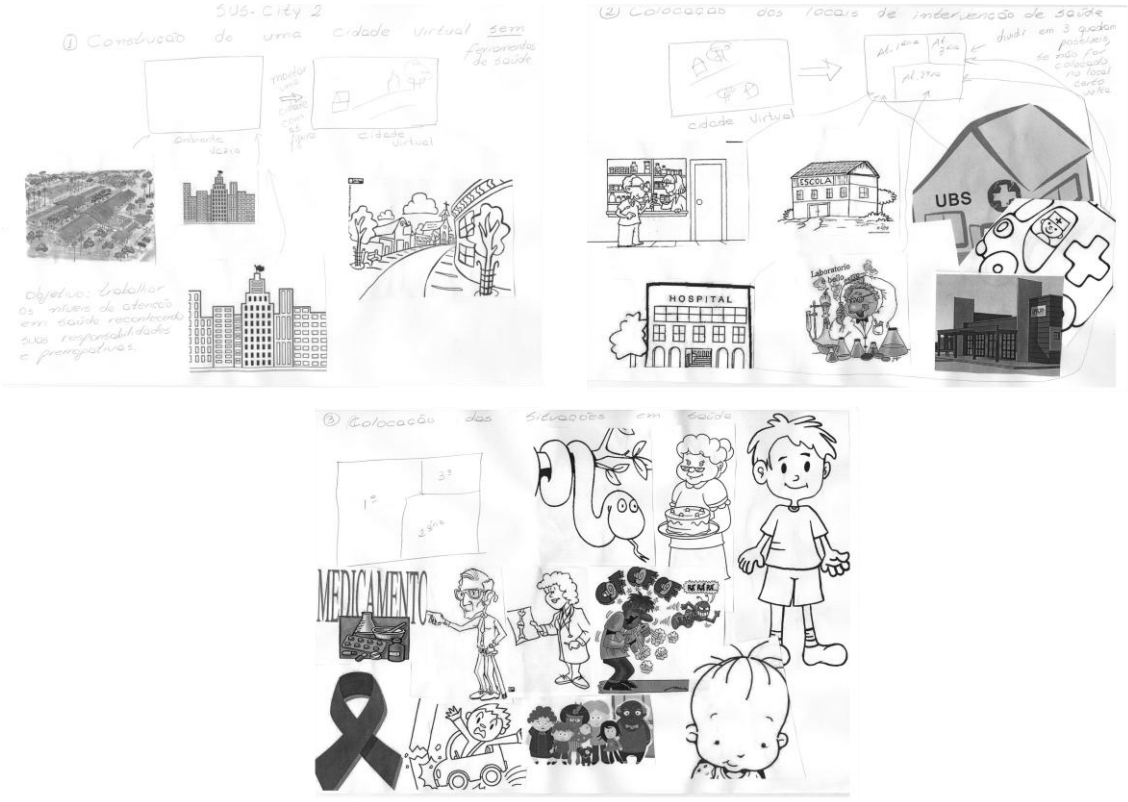

Figure 2 - A game about Brazilian's Public Health System, created for the December Workshop.

After analysing the documentation professors have produced, we realized that the demand to create structural/visual documentation would be much harder for some than for others, and that expressing ideas by hand-drawings would be a challenging task to some. We should recall that, after all, expressing themselves through drawings is not part of their daily work attributions. From this last workshop, we have come up with two conclusions, as follows.

First, if we intend to demand specific design documentation, we will have to offer workshops and professional development sessions more frequently.

Second, professors would greatly benefit from a collective presentation debating their projects, before final submission takes place.

Implementing the first conclusion (more frequent workshops) is quite simple, yet toilsome: it would just require a little planning, with a relatively lower commitment of our time. However, implementing the second conclusion could be - comparatively - much more costly for us – as, depending on the amount of professors interested, we would have to commit a larger amount of our time. As a benefit, it would be a great opportunity for our students/trainees to take part of the design process, which would make them understand the selected projects better. Maybe this will reduce the problems that today hold us for such a long time, and help us design better learning objects.

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