Design and telemedicine: a promising collaboration

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Abstract

This paper explores possibilities for designers' performance in the field of Telemedicine. It presents a pedagogical proposal for a Design Specialist Program in Telemedicine Projects. The academic structure suggested for the program is based on a learning process model conceived for integrating education, research and development. Through a trainee program grounded on practical experiences, a theoretical reflection towards the field to which the model is applied is encouraged. The proposal emerges from the collaboration between Design and Telemedicine. The pedagogical approach presented integrates the two fields, allowing the birth of a distinctive environment, which aims excellence in the production, the construction and innovation in telemedicine. To conclude, considerations concerning collaborative design, participatory design and human-centered design are presented.

Keywords

Design Education, Collaborative Design, Telemedicine, Interactivity

Introduction

The impact of interactive experiences and environments in our society presents itself as an interesting research theme nowadays. Many authors consider that we are living in an era that can be called the "image era", the "interactivity era". The fact is that in almost all our daily activities, we are invaded by images of different nature: images that inform us; images that help to form us; images that amuse; images that betray; images that explain and images that disturb us... In other words, the images are part of the contemporary world. In this image universe, the study of interactive experiences and environments involving the fields of Design, Communications, Information, Computing and Education allows the emergence of many innovative concepts, tools and media, such as Mobility, Convergence, Ubiquitous Connectivity, Online Collaboration, Virtual and Augmented Reality, Semantic Web, Intelligent Web, Social Networking, Podcast, Entertainment on Demand, E-Commerce, Digital TV, HDTV, Interactive TV, Distance Learning and Telemedicine among others.

Specifically concerning telemedicine, the World Health Organization – OMS defines telemedicine as the offer of healthcare services, in cases that distance becomes a critical issue; these services are provided by professionals of the health field, using information and communication technologies to exchange information needed for diagnosis, prevention and treatment of diseases and the continuing education for healthcare service renders as well as for researches and evaluations; all for the improvement of people's and community's health.

The goal is to integrate the telemedicine into transformed healthcare systems to improve quality, equity and affordability of healthcare throughout the world. Using a metaphor to illustrate the concept, telemedicine applies informatics and telecommunications resources to identify, analyze and transform interactive relationships that occur in the human body. In this framework, living can be considered an interactive

experience and the human being can be understood as a complex system, in which many interactive relationships between organs, molecules and cells are responsible for the good functioning of the whole. In this context the designer, for his/her ability and competence in dealing with systems, may play an important part in these interactive processes. Preliminary studies of solutions that can mediate these relationships, or in some cases restore them and the findings obtained along these processes reveal a fertile and growing field for researchers' exploration.

The analogy of the human being as a system and the world as a larger system, where the man lives, makes us think about the health of the whole. Sometimes systems can operate in harsh conditions. Most often belongs to the doctor the task of identifying, treating and maintaining the proper balance in the system. To the designer, increasingly, is reserved the task of developing and specifying equipments in the area of telemedicine.

The proposal presented in this paper aims to contribute to expand designers' participation in the telemedicine field, believing that a partnership between Design and Telemedicine can be responsible for innovative findings. Projects conceived in complementary ways, with the objective of prevention rather than treatment, exploring interactive situations that can change human habits and promote the understanding of healthy ways of living, are in the core of the proposal.

For many years the discussion about designers' role and responsibilities in society has been taking place, as well as about the ethical attitude of designers and its implications. One important author, concerned with these issues, is Jorge Frascara (2000) who presents in his book - *Diseño Gráfico para la gente - Comunicaciones de masa y cambio social* - the design as a discipline dedicated to the production of projects capable to affecting people's knowledge, attitudes and behavior. Frascara argues that (…) the understanding of design or any other complex activity, cannot be reduced to a list, since it is a multi-dimensional configuration of interactions, a space in permanent change. According to the author, the purpose of design resides in the intent to transform an existing reality into a desirable reality. For this reason, when developing design projects, one should take into account individual preferences, intellectual abilities and people's cultural values system.

Telemedicine

The use of technologies and tools as wireless systems, optical fibers, satellite communications, digital imaging, digital 3D modeling and printing, multicast systems, Internet and digital TV, among others in the field of telemedicine, increases rapidly nowadays, offering mobility, humanization and optimization for medical operating systems. These capabilities make possible the implementation of projects that discuss clinic cases, medical continuing education and high education for students, as well as the guidance and information on health quality of life in communities. These initiatives are of extreme importance especially in big countries like Brazil, for instance, with so many regions difficult to access.

As a consequence of telemedicine growth, a change in the doctor-patient relationship occurs and it raises a discussion over tele-consultants' responsibilities, the established practical standards and the associated risks to it. Due to this fact, identifying and analyzing design aspects involved in interactive experiences; the connection between interactive environments and the *interactors[1]*; as well as mediated interpersonal relationships in the telemedicine field can reveal new investigation opportunities for design researchers. In this

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[1] According to Janet Murray (1997), i*nteractor* is the former user/receptor that acts in a different form in communication processes, being invited to make decisions and to actively participate, interacting, interfering and transforming projects.

process, to reach a high quality design evaluation, many variables have to be considered. First, the designer should have the capacity of observation and identification, to select the best time and place to act, with a non-prejudiced look, and an approach free of already known and ready-made solutions. More than being able to reconfigure what's known, the designer should be open to the development of new solutions, meaning to give form to the unknown.

For instance, communication channels can be explored with a different agenda, bringing a novel aspect to them, at the same time with the guarantee of easy acceptance by the users. Electronic games with educational contents on health related issues are also examples that can be cited. But designers' vision should go beyond this level. To reach the proposed objectives in an effective way, designers should be prepared to conceive integrated projects uniting diverse media over one single theme, in a complementary action, increasing *interactors'* involvement in the projects.

Following the same principles, the exploration of non-conventional spaces, like waiting rooms in hospitals, health unities or doctor's offices, by offering in these spaces interactive experiences created to inform users about important health issues, might also be of great interest. Usually when people are in these spaces, since they are waiting their turn to be examined, they find themselves in a particular condition, in which they have available time to participate in the experiences that are presented to them. This means that their attention and involvement are available for these experiences, which can be designed to encourage participation and initiate an elucidative process that at last, can collaborate in patient's treatment understanding.

Another aspect that cannot be forgotten and has to be addressed in all solutions, objects, systems or experiences developed, is project sustainability. Initiatives that deal with communication and information technologies depend upon continuous maintenance and upgrades that become one requirement to be fulfilled in the project. On the other hand, in this respect, Stanberry (2000) emphasizes that from all the issues involved in telemedicine practice, in utilizing communication and information technologies in the medical field, the most important thing is not to become prisoners of our own technology, since it cannot substitute man's basic need for human and social contact, face-to-face communication. It should be an option, but not the only alternative.

A Design Specialist Program in Telemedicine Projects

Considering all types and levels of interaction identified in the telemedicine field, it becomes evident the need for design professionals prepared to face the challenges that are presented. Design professionals prepared to participate effectively in the health production chain, contributing with creative and original solutions.

A designer, specialist in the telemedicine field, has to have well developed competences that enable him/her follow technological transformations and updates. For this reason, he/she has to be encouraged to keep an active attitude in the learning process, to develop a strong capacity to articulate thoughts and the ability to synthesize information from multiple sources and make decisions.

Therefore, the proposal of a Design Specialist Program in Telemedicine Projects emerges as an opportunity, as a possibility for the formation of competent professionals to conceive projects of this nature. Besides informing and forming the students about the concepts and resources of the field, the program intends to favor the birth of a distinct collaborative environment, which aims excellence in the production, as well as in the construction and innovation in telemedicine.

The program's emphasis is centered in the formation of designers with a transdisciplinary point of view in project. A point of view that requires professionals with skills of theoretical reflection and critical-

thinking, a wide vision of the fields of Telemedicine and Design and a solid basis in planning and project development. The term transdisciplinary is adopted in this text in the same sense used by Brenda (2001) in the book *Utopian Entrepreneur*, meaning the ability to work across contexts or disciplines. These professionals, therefore, must have a hybrid profile that allows them to explore the technical, as well as the creative and artistic ways of thinking.

There are not many educational institutions that offer to the students courses committed to promoting a hybrid formation. At PUC-Rio's campus, the physical proximity between departments and research laboratories dedicated to different fields of knowledge provides an environment that facilitates and encourages transdisciplinary works and this hybrid approach. Therefore, the proposal that follows was originally planned for PUC-Rio's context.

Guidelines for a Design Specialist Program

The pedagogical proposal for a Design Specialist Program in Telemedicine Projects adopted as reference the study conducted by Izabel Oliveira in her master dissertation - *Pedagogical proposal for teaching design project: a case study*. In the study, Oliveira presents two different approaches for the concept of pedagogical project. The first approach suggests a more traditional point of view, with emphasis on the definition of an institutional profile in which all parties, stages and tasks are defined and planned. The second approach, presents the notion of pedagogical proposal, rather than pedagogical project, understanding it in a more dynamic way, as an expression of a political and cultural project, which is built and rebuilt in the day-to-day basis by all participants involved in the process.

The pedagogical project approach presented by Oliveira, more traditional, is based on Vasco Moretto ideas. Moretto defines pedagogical project as a group of principles that guide the teacher behavior and work, determining an identity for the educational institution, with a coherent set of activities in which the institutional behavior prevails upon the individual one.

Oliveira argues that in this approach the pedagogical project of the school is structured primarily within parameters as the definition of an educational vision; its mission in the social context; and the definition of its objectives. Only after setting these parameters, the theoretical foundation is generated, which includes planning principles, besides ethical and political values and epistemological and didactic references. Following this, the attention turns to specific project sectors, establishing principles for diagnosis initiatives; definition of objectives; methodological processes and evaluation criteria. Last, each course and class proposal is described, following the same process of diagnosis and identification of objectives, methodology and evaluation.

This concept foresees the participation of the teachers only at the end of the process, during the description of the classes and courses. The person responsible for setting the mission, vision and objectives that determine the fundamentals of the pedagogical project is the owner or manager of the school. The model is therefore, characterized by the adoption of a compartmentalized structure articulated in a hierarchical way.

On the other hand, the second approach that Oliveira presents in her study is grounded in the concept of pedagogical proposal, discussed by Sonia Kramer (1997), in the article *Curricular or Pedagogical Proposals: support for a critical analysis.* Kramer stands for the following idea:

> A pedagogical proposal is a way, rather than a place. A pedagogical proposal is created on the way, walking. Each pedagogical proposal has a history that needs to be told. Each proposal contains a bet. It grows from a reality that asks a question and also seeks an answer. Each proposal belongs to a location, and brings along with it the place from where it talks and a set of values inherent to it; it also exposes the difficulties faced, the problems that need to be overcome and the direction that guides it. And this talk is the talk of a desire, of an eminent political will in the case of an educational proposal, which is always human, a will that since it is social and human, is never a final word, it does

not point to "the" place, "the" answer, because if it brings up an answer, it is no longer a question. It actually points out a way to be built and explored.

(Kramer, 1997: free translation by Novaes)

Kramer (1993) considers important not to deny whatever exists, the cumulative experience and brings up Brecht's words, transcribed as follows "accepting that someone brings the new ready is to vanish traces and give up the ability to leave traces and marks. Therefore, it is giving up history. "

Kramer believes that pedagogical proposals may age rapidly, if they were not born from vivid questions of active and distinguished communities.

Oliveira considers Kramer's concept of pedagogical proposal the best to be adopted when elaborating a course, a program. The reason is that this concept allows a more permeable and flexible structure, built with the effective involvement and collaboration of all the participants in the process. Taking into account their needs, specificities and reality potentially increases the chances to reach good results. This way, teachers' participation is not only expected but also desired.

The pedagogical proposal is therefore understood as part of a bigger political project that implies concepts of citizenship, education and culture. It's a proposal built on the way, asking questions and finding answers, in opposition to adopting ready models and being reduced to a simple application of curricular grids.

Comparing the two frameworks presented, one can perceive that in the "pedagogical project", the emphasis is directed to the institutional identity, which is grounded in the educational vision and mission proposed. The vision and the mission are the main references for the ethical-political, epistemological and didactic-pedagogical basis for all the planning and faculty acting. On the other hand, the "pedagogical proposal" presents itself as an alternative to this rigid and hierarchical structure. It also has its fundamentals but they are explicit and put as a bet to be pursued and redefined by all the participants in the process, according to the needs encountered. This way reality is taken into consideration and its critical analysis can be provided.

Kramer's dialectic pedagogical proposal, concerning the value of the experience, the way and the history, rises therefore as a proper reference for the pedagogical proposal of a Design Specialist Program in Telemedicine Projects, a program that aims the interaction between theory and practice in the configuration of objects and/or visual information systems.

The academic structure proposed for the program can be described as a dynamics, in which contents from diverse origins are organized in modules in an interdisciplinary and multidisciplinary way. In other words, contents are presented as a net, where all subjects are intertwined in a complex system. Differently from the hierarchical and compartmentalized organization adopted by many other courses, in this proposal the contents concur simultaneously.

The dynamics is then developed from the combination of theoretical reflection and project practice, through an exploratory process, in which the core of the process is in student's ability to look for relevant knowledge and ways of thinking, for his/her experience, according to his/her needs.

Donald Schön's (2000) theory and practice on the "reflective professional learning processes", in which the knowledge inherent in practice is to be understood as artful doing, are brought as fundamentals to the dynamics. Schön's notions of reflection-in-action and reflection-on-action involve the looking to our experiences, connecting with our feelings, and attending to our theories in use. It entails building new understandings to inform our actions in the situation that is unfolding.

The following figure illustrates not only the structure of the program in question, but also a proposal for an apprenticeship process model. A process based on the interaction between education, research

and development that results in the production of objects and experiences. The model assumes that from the very beginning the student is engaged in a team that develops projects for concrete demands from the market. The goal is that the student, at the end of a continuous trainee experience in projects, indicated as a ring in the figure, becomes a project leader. Each student has an assigned supervisor all along the course, to help with academic decisions.
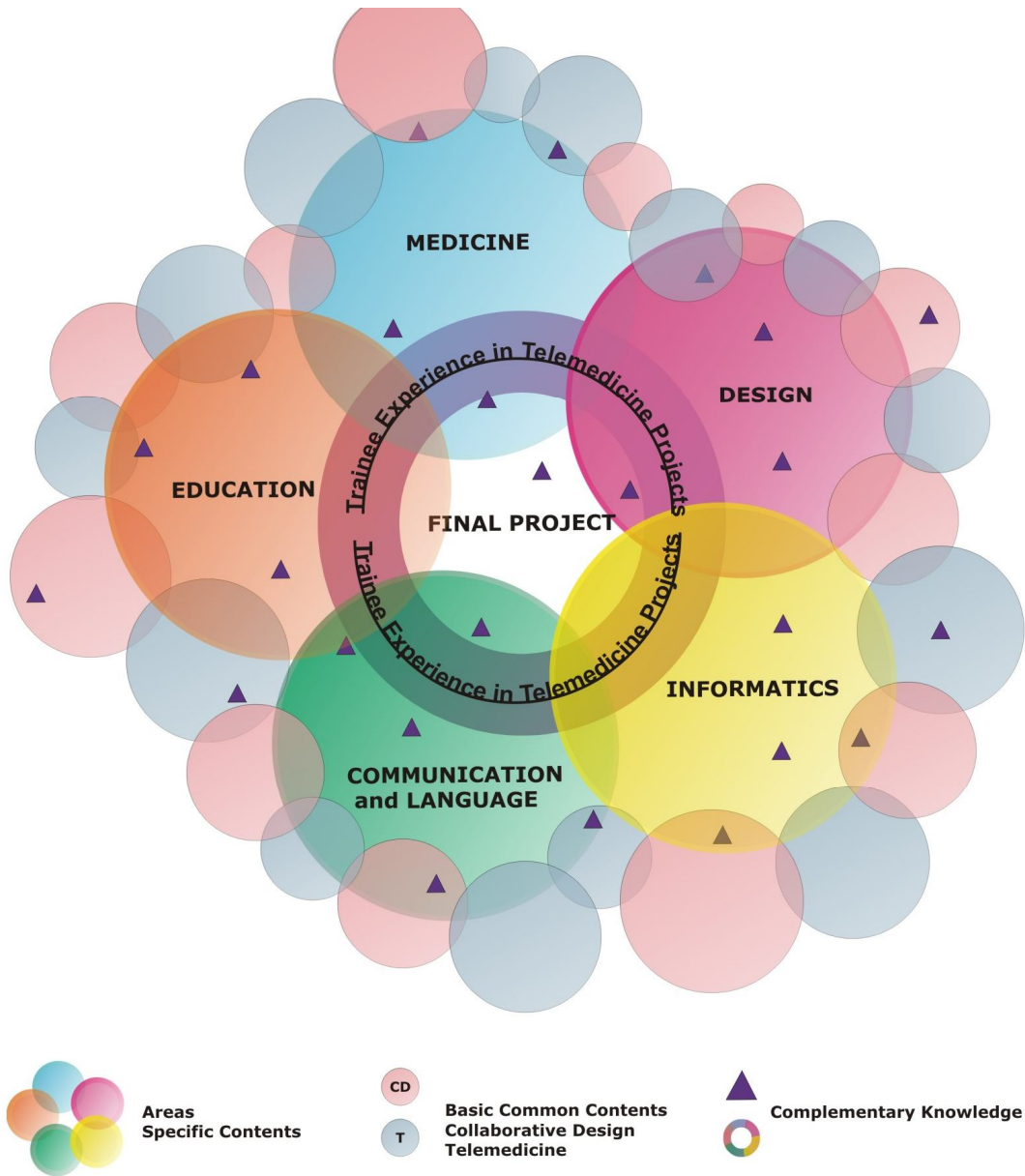
Apprenticeship process model applied to a Design Specialist Program in Telemedicine Projects

The figure must be read from the outside to the center point, when it is expected that a hybrid professional meets the synthesis proposed. The continuous "trainee experience ring" represents the interaction between theory and practice through the configuration of objects during the whole process.
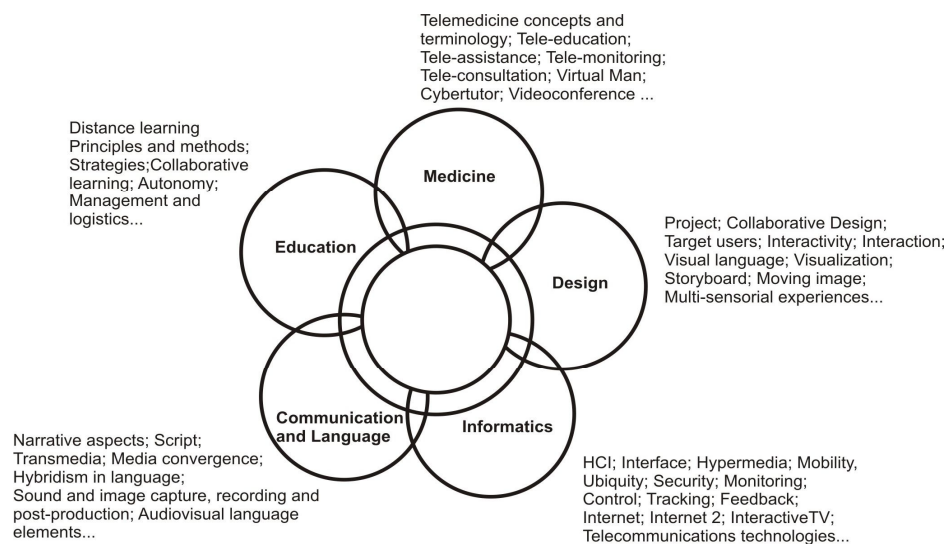
The model can be applied to different courses and programs, conditioned to content adjustments according to the specific situation. In the scheme it becomes clear that the proposal configuration is based in a design process, a concept. A process in which different thematic areas are presented, involving basic contents common to all, specific contents and complementary knowledge.

Basic common contents are responsible for foundational issues, philosophical, historical and anthropological contexts, among other topics pertinent to the process. Specific contents embrace technical and technological aspects; contents that prepare the student to perform in a certain field, always with a critical approach. Complementary knowledge brings dynamism to the whole, and the possibility of up-to-date mechanisms, distinguishing and including non-conventional teaching activities. The continuous trainee experience foreseen in the model favors the application and exchange of acquired knowledge in the real context, encouraging theoretical reflections on the activity.

To be implemented, the process requires a continuous production activity in the field, to be able to offer to all participants, practical experiences since the beginning. For that, the model requires the existence of a research and development laboratory in the field, and/or a partnership with some clients and production services providers, for the development of projects in the referred field. This way, different phases of the projects can be experienced, validated, studied, apprehended and internalized by the students as derivative knowledge that can be applied in other situations. Therefore new concepts are revealed through the systematization of this new acquired knowledge and by the establishment of the relationships between students and their accumulated repertoire and previous experiences. The process cannot be assumed as a simple repetitive movement.

The content specification for each module is detailed in collaboration with specialists from the basic areas defined to the process. In the case of a Design Specialist Program in Telemedicine Projects, for instance, the basic areas selected were: Design, Medicine, Informatics, Education and Communication and Language. Each area was then specified and detailed in contents that will be covered along the course. Participatory Design and Telemedicine are assumed as basic common contents for the guidance of the program. That's the reason why, in the scheme, they are represented in all the areas along the process.

The pedagogical proposal for the program also explores the concept of collective construction. For instance, when defining contents per area, specialists indicate, as a priority, contents that may function to support the projects in their fundamentals, development and implementation. The ultimate goal, however, is that the student gains autonomy and fluency through the lived experience. Professor Nilson José Machado (2004), from the Education Department at Sao Paulo University, considers that in an apprenticeship process, it isn't enough the fact that the student accumulates information; it is mandatory that he becomes capable of formulating derivative knowledge from the experience, and of articulating ideas. Knowledge should be understood as a net of significations. In this sense, academic considerations may contribute for the diversification of projects, bringing up themes that most of the times wouldn't be approached, due to economic or business reasons. Next, we present a scheme to illustrate the proposal, showing an example of the detailing of the contents:

Telemedicine concepts and
terminology; Tele-education;
Tele-assistance; Tele-monitoring;
Tele-consultation; Virtual Man;
Cybertutor; Videoconference ...

Distance learning
Principles and methods;
Strategies;Collaborative
learning; Autonomy;
Management and
logistics...

Medicine

Education

Design

Project; Collaborative Design;
Target users; Interactivity; Interaction;
Visual language; Visualization;
Storyboard; Moving image;
Multi-sensorial experiences...

**Communication
and Language**

Informatics

Narrative aspects; Script;
Transmedia; Media convergence;
Hybridism in language;
Sound and image capture, recording and
post-production; Audiovisual language
elements...

HCI; Interface; Hypermedia; Mobility,
Ubiquity; Security; Monitoring;
Control; Tracking; Feedback;
Internet; Internet 2; InteractiveTV;
Telecommunications technologies...

Pedagogical Proposal for a Design Specialist Program in Telemedicine Projects

Telemedicine projects usually require multidisciplinary teams, in order to fulfill the diverse demands of the field. The proposal of a specialist program in telemedicine projects is meant to be an answer to this scenario, undertaking responsibility for the formation of professionals capable of easily communicating and acting as mediators in processes that involve diverse knowledge from specific fields.

The possibility of collaboration between Design and Telemedicine, presented in this proposal, encourages not only the search for design issues related to healthcare but also related to media convergence, nowadays so in evidence. For instance, the use of telecommunications technologies in Telemedicine more and more explores image transmission besides audio features. Telemedicine, therefore, may become an important client for the audiovisual and communication industry. In addition, the proposal opens up possibilities to facilitate institutional exchange initiatives, in a national as well as international level, in the educational and research fields of Design and Telemedicine.

Taking into consideration these facts, it becomes urgent the necessity for professionals with a wide vision, dedicated to the investigation of technological and creative design aspects, applied to telemedicine.

The goal of the program is to offer a solid formation. A formation that cannot be evaluated merely by the amount of knowledge and information acquired by the students, but also by the development of his/her ability to plan and to project. Besides preparing workers for the market, for the development of fast solutions to problems presented by the industry, the course aims to become a distinct space for the production, conservancy and building of knowledge. It intends to promote theoretical reflection, debate and criticism contributing to the formation of a professional strong in planning, project and development in the area of Design for Telemedicine Projects.

The course focuses on mechanisms for the development of student's ability to think, to keep up-to-date, to work in teams, to organize information and to use new technologies. In this manner we can list the following objectives for the course: qualify individuals and teams for the production and development of projects exploring diverse media; promote an entrepreneur attitude in the student; promote the production for

the use of new technologies; make the designer capable of evaluating the market demands, keeping up-to-date and being aware of economical, social, cultural, technical and technological trends in the telemedicine field and last but not least promote research and theoretical knowledge on interactive media.

The main results expected, once this qualified professional formed in the program begins to act, are the enlargement of the market, the optimization and the encouragement of new areas of research and projects in related themes.

Student's profile

Because of the multi and interdisciplinary nature of the course, people from diverse fields may become interested in it. Although the course has been initially proposed aiming professionals and researchers from the fields of Design, Communications, Informatics, Education and Medical, professionals from other areas are welcome. It's desirable however that they have a consistent experience in their specific areas, since the course intends to work with the student repertoire, taking advantage and combining his/her knowledge in the development of projects.

One important premise, on the other hand, is that the student should have a proactive attitude, since ultimately he/she is the one to decide the way to go, especially when dealing with Design Projects, which usually demand the designers in their process, to visit different areas of knowledge, other than their own.

Conclusion: the collaboration between Design and Telemedicine, a contribution to the identification of new research opportunities

Buchanan (2001, 1998) exhorts young designers to be more humanist when dealing with complex problems in their professional lives. To the author the strength of design resides in the fact that it does not have one sole definition, what allows many changes in the field, in order to follow the challenges of the XXI century.

In addition, Design is the human possibility to conceive, plan and make products that help human beings achieve their individual and collective goals. Design, therefore, is investigated from many different points of view and perspectives, and one has to be aware of how to integrate all the findings and results in a clear way, so the plurality of the investigation can be understood.

It's important that designers know how to create visual symbols to communicate, and how to build artifacts, but only if these symbols and artifacts become part of human beings' experience of life, otherwise, visual symbols and things have no value or significance.

Following ideas presented in this article, the emergence of an area of study called interaction design is observed. An area where human beings' relationships to one another, mediated by products and objects makes evident the displacement of the system of the things, the material system, to a human system, which integrates information, physical artifacts, and live environment interactions, in work, games and apprenticeship.

The conception of products has changed over the years. In the beginning of the XX century, products were always thought from an external perspective. The focus resided in the form, in the function, in the materials and means of production and use of the product. Later, there was a shift towards the understanding of products from its inside, no longer from a physical perspective, but from the perspective of human beings' experience, considering the specific social and cultural environments from where they were projected. An investigation centered in aspects that make products useful, usable and desirable. This change in perspective,

undoubtedly, impacts the design education.   So, new programs and courses are no longer based on the teaching of materials, tools and techniques.   Projects and problems that belong to the students' everyday experience and motivation start to be in the basis of the process. Therefore, issues concerning strategic planning, collaborative design, participatory design and human-centered design are intensified. In this context, the need of new kinds of knowledge to reach successful solutions is inevitable.   Many content issues also emerge, forcing the search for content specialists in different areas, including the social sciences, humanities and arts. Therefore, knowing how to work with specialists, with people from specific areas, is something that the designer must be prepared to do. It's interesting to think that, today, content and structure are so intertwined that it's difficult to separate them.   The question is no longer, if one product functions, because besides functioning, it also has to be suitable to the hands and mind of the person that is going to use it. The big question becomes what is the nature of the discipline that brings together the knowledge of so many other disciplines, to integrate them in the conceiving process of successful products? Products capable of impacting our lives and helping us meet our goals. The challenge is to understand how designers can visit other areas and fields of knowledge to develop a productive work and come back with solutions concerning problems of design practice.

Buchanan argues that the true design knowledge is the ability to articulate design principles and methods, in a manner that activity happens and results in efficient products.

To complement the discussion presented, we bring Whiteley's (2001) vision, about the reality we are living in, of a sophisticated society that requires an also sophisticated designer, well informed, capable of critical reflection, besides a creative project attitude. In other words, a certain kind of professional that he called a "valorized designer", one that has an independent vision, and is prepared to act with knowledge, innovation, sensibility and consciousness.   A designer that has a critical understanding of the values that ground the design, but is also courageous, fearless, prepared to stand up for social and cultural ideals, which are much more important than consumerism in a short term. The author believes that the design schools and courses should be responsible for encouraging these qualities in the student, allowing him/her to establish relationships between theories that are being learnt, and his/her practice in design.

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