

Universal Design to a Learning Environment-Object Adding Network as Condition and Data Visualization as Framework to Provide Universal Access

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Abstract. This paper focus on grounding two elements articulated to design a Virtual-learning environment-object based in universal access and universal design. First, it proposes to understand a learning environment as a digital artifact itself. Secondly, it appropriates the principles of universal design to draw it. The investigation has the assumption to add the network as condition and data visualization as a framework to generate a universal design to learning space, modeling it in the online Educational Design course running by Universidade Federal de São Paulo (UNIFESP). The investigation is a qualitative research based in a combination of design, design thinking methods and netnographic. Expected result is a roll of conceptual and practical guidelines to multidisciplinary group to build a learning virtual environment-object based in universal design, networks and data visualization to provide universal access.

Keywords: Universal access · Universal design · Online education · Network · Data visualization

1 Introduction

The authors have a general understanding that Universal Design to learning is related with Educational Design (or Instructional Design) and Educational resources production to achieve the learning objectives of diverse profiles of students, boarding design centered in the user. The Educational Designer and multidisciplinary group responsible to prepare learning environments situated in different contexts should be aligning to build flexible material of learning. Diversity of languages, symbols, activities, challenges and understanding options, should giving choices to student to build his learning.

This paper has as assumption to understand a learning environment as a digital artifact itself once the object has the ubiquity principle as well:

- People, resources, and objects floating in a flux of learning into different education contexts, devices and scenarios.
- Mobility, autonomy to manipulate and learning from it.
- It appropriates the principles of universal design to draw it.

Universal Design has seven principles [1] developed in 1997 by architects, designers and design researches from North Carolina State university under Education department of National Institute of disability and rehabilitation Research financing (USA). The group aimed to find parameters to develop environments, products and communication in design for all without adaptation or specialized design to a segmented group. It emerged from barrier-free concepts, accessibility, adaptive and assistive movements blending aesthetics into this core of concepts and movements. They outlined the following parameters: equitable use, flexibility in use, simple and intuitive, perceptible information, tolerance for error, low physical effort, size and space for approach and use.

In a contemporary context, the universality of design in virtual environments produces a complex and contradictory scenario where the hardness of objects and builds meets malleable structures once it can adapt themselves in agreement with the device used; technology environment became part of agents and structures. Borrowing from Mario Costa and Fred Forest [2] their observations of artistic practical and their relations with technological environment, we understood technology as a base of social organization able to produce changes in physical environments as well as in our mental systems of representation. This context brings to designers new resources and tools to create. In addition, we are constantly reconsidering our perceptions as a condition to apprehend the world that we are living. Fluidity is the concept that emerges from these observations once formats and devices results in different settings or shapes. We can say that fluidity is a condition to permeability and aesthetics then follows a flow. "Flow of information from unfixed and often uncertain and unpredictable processes" [3, p. 10].

Thus, the pattern is the flow that brings together a dynamic set of driving forces that is in constantly update due to the exchange of experiences between the agents, structures and technologies themselves. Any proposal of universality that contends hardness could create barriers. An important issue emerges here: it is about how to break barriers to different disabilities in virtual learning spaces. The usual trend is to offer devices to attend each disability that browsers, operating systems and devices themselves barred. These study points the browser interface as a place to personalize the content. It is the first layer to be offer as a Design Universal. Browsers companies as Google, for example, provides functionality for each level of disability (visual, auditory, mobility, and mental) in the Chrome browser as a converted text reader for audio or a filter to improve color and contrast perception. To use them, you need to download the extension and configure it according to your need. This vision requires the project to have an open, collaborative and networked design to support students. Customization does not mean an opposition to universal design, it is part of holistic conception based in complexity and chaos theories that preconize contradictory, new relations between agents, structures methodologies and technologies.

The investigation has the assumption to add the network as condition and data visualization as a framework to generate a universal design to learning space. Thus, The Universal Design (UD) gets together with Universal Design for Learning (UDL). UDL is

a setting of strategies, techniques and flexible materials to help students to learn (with or without disabilities). It is a tripod formed by multiple means of representation, engagement, action and expression based.

Composed of the seven principles of universal design and complemented by two more: apprenticeship community – when educational environment promotes interaction and communication between students and between students and University; and the educational environment – where the instruction should be design to be welcoming and inclusive. UDL tells us about design of the curriculum as part of all design. It means have a collaborative work with professors and pedagogical group as well. Curriculum more universal means less adaptation needed. Research and innovation into practice is a base for providing guiding principles thinking to an entirely new system with flexibility at its core [3].

The design multidisciplinary group considered these concepts and principles during the planning of the Online Technological Undergraduate Course in Educational Design (TEDE), at Universidade Federal de São Paulo (UNIFESP).

2 The Online Educational Design Course

The online Educational Design course running by Open University of Brazil/UNIFESP Center (UAB) is a technological project-based course with five semesters. The Educational Design (DE) is a professional that works in educational spaces proposing methodologies and technologies that make feasible and potentiate the teaching and learning processes. In this sense, the undergraduate course of Technology in Educational Design privileges design-based methodologies in learning environments with digital mediations. It analyzes examples, models and educational platforms through experimentation and authoring productions about languages, methodologies, standards and digital formats in an active, integrating and transversal process. The student is also prompted to think about the innovation and impact of educational solutions in the social, economic and scientific spheres. The five semesters of the course contemplate practical actions and reflections in open and networked educational contexts (1o semester); Non-formal inclusive contexts (2o semester); Formal academic contexts (3o semester); Corporations contexts (4o semester); Students have to elaborate a short educational project during each semester and a complete educational design project as a course final work.

The design multidisciplinary team is a group formed by young people coming from diverse University online learning projects. They have different backgrounds, knowledge and experiences; and professors from The Open University of Brazil/UNIFESP Center. This group seeks to combine applied research, online learning experience and strategies, technology, communication and design creativity experience to the daily creation of virtual learning environments, didactic materials and resources. The challenges here are build a learning space to a course that the aims to prepare Educational Designers in their own field of action.

The first goal is inspiration. A clear interface was thought from the beginning to attend a Universal Design, where navigation, interactivity and accessibility would significantly facilitate communication, providing the student not only the experience of

becoming a professional capable of thinking about UDL projects but gives them a good experience as a virtual student. The team believed that such experience and the perception of the work of the production team in the search for a dynamic and easily accessible environment would serve as inspiration in the formation of this future professional of the area.

The second goal is do not have barriers to understand the learning environment. Students should be able to have available all resources, information and applications to access, navigate and be immersive in the environment; to understand what means study online organizing time, space and activities. Before they access is possible contact help-desk to solve technical or academic problems, more than this, they will provide well-being to our students.

The third goal is make online students part of the university. The learning environment has links to connect them to different sites of the UNIFESP, telling then about student life, undergraduate information, places and activities to students and so on. Social nets, web TV, podcast are some of resources at hand. Course has between three and five face-to-face meetings in the university campus to each semester.

The fourth goal is to draw a learning space to a project-based curriculum where interactivity and collaboration are basilar as far is a course in process; it means an open educational design as a principle. The project proposes scaffold knowledge in the exchange of experiences, learning and teaching strategies, given immersive use of tools and resources to the future professional. Student is invited to reflect about diversity emerging and create his own perspective developing autonomy.

The fifth goal is reach simplicity through a Moodle interface avoiding not necessary resources, working fluidity and interactivity, appropriate methodologies, strategies, language, design, technology, communication to support relations between students, teachers and learning.

3 Method

The investigation is still in progress and this paper spots first conclusions. It is a qualitative research. As are multidisciplinary team of researchers, with no designers in it, a combination of design, design thinking and netnographic methods was the first research draw. It proposes to build the research in the own field, having collection, analyses and interpretation of data during the process; data, cultural behaviors and decisions can be taken from insights as Ethnography indicates because it is short time execution project. Design thinking translates and synthesizes to no-designers the main steps from design creating methods: immersion to understand the problem; analysis and syntheses of people, needs, scenarios, technologies, environments, activities. Brainstorming of ideas, creation of forms, models, experiences. Evaluations take place any times during the process to give feedback.

It is a research process motivated by the following questions:

- Would decentralizing nets provide equality, less effort and flexibility in use?
- Is data visualization able to build the simple and intuitive use?

- Is data visualization able to provide perceptible information about the environment and about the learning process?
- Both network and data visualization are able to tolerate an error?

A first draw of research has the follow steps:

1. Immersion, experience - diagnosis, data collect and analysis for comprehension and syntheses using PACT (people, activities, contexts and technologies to design the environment main necessities) and Universal Design.
2. Evaluation.
3. Creativity – ideas, concepts, technologies, prototype and interaction.
4. Evaluation.
5. Implementation.
6. Evaluation.

As part of immersion and experience, the lieder proposed that team works the course identity and communication. A first challenger was motivating future students that will attend selective process. The logo designed using the articulation of four pillars of the course indicates in the curriculum: education, technology, design and communication (Fig. 1).



Fig. 1. Logo, 2016.

Words like innovation, creativity, classic, and elegancy, dynamic and modern were guidelines as well team created persona that represent the future students based in people who brings some of these characteristics: David Garrett, Germany classical musician who mix classic and modern music. Sheldon Cooper, Big Bang theory series character who is a doctor in physics working with highlights technologies. This persona was the baseline to create the first advertising piece, the course website: <http://tede.sites.unifesp.br> (Fig. 2).

de ead profs seletivo grade unifesp

designer educacional

também conhecido como DE, prazer!

é ponto: entre aluno e professor, é ponto: entre conteúdos e coordenador, é ponto: entre o tutor e o professor. É o cargo do aluno, sempre, o professor não vive não morto, não agitado, com fácil entendimento. Se ajuda o professor, se conversa com o conteúdo, organiza o curso, harmoniza a equipe, tudo para que o curso vá do vento em popa no caminho do conhecimento.

poético, né? Mas não vendosa, esse profissional, é dinâmico para interagir com as equipes, criativo para emergir além, trabalhar com as "anomalias" que tem a mão. Sempre curioso, busca novas soluções e caminhos no ensino a distância.

Se identificou? Inscreva-se aqui

ead

você acessa de onde estiver e estuda no horário que escolher

curso de graduação totalmente a distância com o selo Unifesp! Aprenda que é verdade.

profs

festa estranha, com gente esquisita...

Espera! Para ser esse profissional todo bacana, não dá para ser diferente. Das mais diferentes áreas de atuação, cada um deles vai te ajudar a entender um detalhe específico do mundo DE.

quer+?

acesse a grade processo seletivo

UNIFESP
UNIVERSIDADE ESTADUAL DE CAMPINAS

Fig. 2. Website model, 2016.

This concept generates others communication pieces articulated with a media plan running by DCI (institutional Communication department) and multidisciplinary team (Fig. 3).



Fig. 3. Banners to facebook

To complete information about the course the group posted a set of videos in the website (Fig. 4).

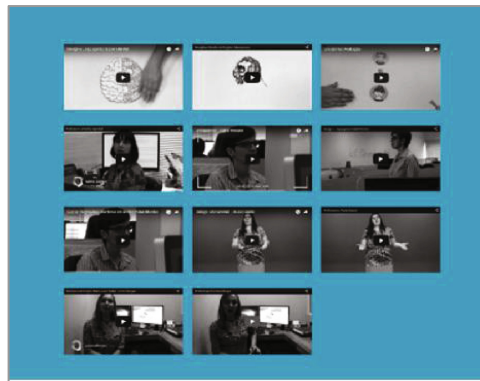


Fig. 4. Videos in the website, 2017

This immersion in the communication outlines the course design and languages conceptions. It is coherent with this first conception and with the process of universal design/universal design to learning, adding sketch illustrator technique. Communication plan helps comprehension by design team about form, design, language, conception to Learning environment.

Reception from the public resulted in 367 people attending the selective process that had 30 students' vacancies with only a month adverting. It was a first evaluation of the design process.

Creativity was explored from there given ideas, concepts, technologies, prototype and interaction to the learning environment as can be view below (Figs. 5 and 6).



Fig. 5. Moodle interface access, 2017

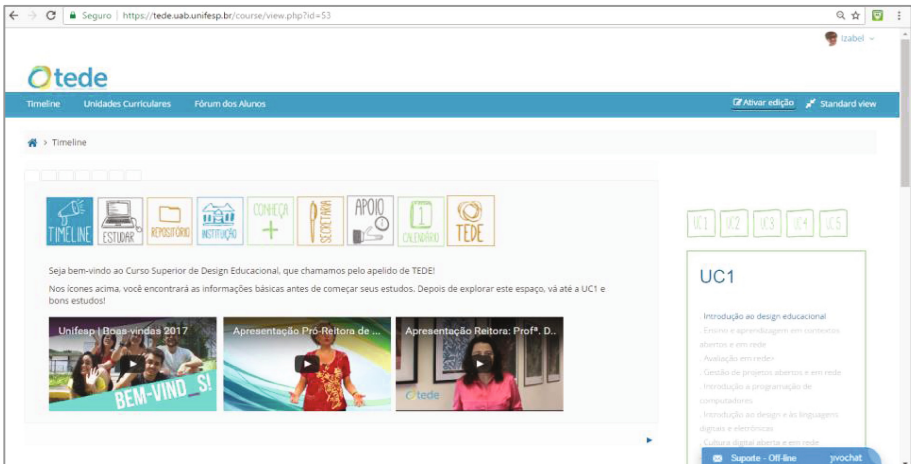


Fig. 6. Moodle interface logged, 2017

In a typical qualitative research, analysis categories are emerged from the research field. In this case, it means a review and articulation of Universal Design and Universal Design for learning to produce a Learning Environments Guidelines to design.

4 First Version of Learning Environments Guidelines to Design

Relating Universal Design (UD) and Universal Design for learning (UDL) team works the environment using UD and UDL parameters interpretation and appropriation to build a first version of guidelines to learning environments.

Conceptual principles:

1. Learning virtual environment-object based in UD and UDL, networks and data visualization to provide universal access are fluid, permeable, flexible and not predictable at all.
2. Learning virtual environment design should foster networks, interactivity and collaboration to provide immersion, engagement, self-regulation and permanence.
3. Data visualization and data analytics are able to create options to representation, comprehension and perception.
4. Affectivity, recognition and learning strategy building engagement, representation, actions and expressions.
5. Communication channels providing support and relations.
6. Technologies able to enlacing learning.
7. Design of learning environment understanding as an open and continuous process.
8. Design focusing on people and being able to break effects of stigmas and stereotypes for students.
9. Design contributing to make learning more inviting and effective to students mitigating student evasion.
10. Design and curriculum should provide choices of learning and environment organization to student transforming his perspective of learning space in a personal and collaborative learning environment.
11. Design and curriculum do not have to create barriers to understand the learning environment.
12. Design is a structured learning and communicational environment; it should not to be overwriting or create conflict with information.
13. Design and curriculum are part of the same process needing to build a dialogue.
14. Design and curriculum should incorporate others considerations such as economic, engineering, cultural, gender concerns into their articulate process.

Design parameters:

1. Equitable use: diversity is design essence and approaches it from science. Providing same means for all users working between identical and equivalent, making the design appealing for all. "One size does not fit all" [4, p. 70].
2. Flexibility in use: design has principles and not rules. It exists to create trends, solutions and process to people, accommodating a wide range of individual needs, preferences and abilities. Feedback is essential to flexibility to provide choice, adaptability, accuracy and precision use.

3. Simple and intuitive use: less is more (Ludwig Mies van der Rohe¹) is a mantra, but this paper suggest that less is more but should be effective; Complexity and chaos theories show us that is not possible reduce all to simple. In this context the investigation suggest change it to: clear and intuitive use, simple when possible. It means being consistent in importance to design information and be able to accommodate a wide range of literacy and language skills.
4. Perceptible information: design is not the main object, learning is. However, it cannot be transparent, should provide communicational elements to make easier, highlight or reinforce the understanding of information and support building knowledge. Using different modes for redundant presentation of information, promoting contrast between essential and not essential information, providing compatibility and legibility.
5. Tolerance for error: this element must be observes from two different perspectives. First, tolerance for error as a learning strategy reinforced by design and curriculum strategies to create different learning routes and feedbacks to transform error in learning experience. Secondly, tolerance for error as almost zero to navigation and interface bugs. A short research with two questions about hypotactic design environments developed by Tiago Paes de Lira, team designer, in 2016, highlights this perception. He asked around 30 people about how many times they will try to place a car in a car parking. A second question was about how many times they will click icons to find contact area in a site. Both answers told us about 70% will be frustrated at second try. Design should minimizes adverse consequences of accidental or unintended actions, in navigation and interface, material e resource, arranging elements, providing warnings of hazards and errors, fail safe features and avoiding unconscious action where vigilance is needed.
6. Low physical effort: provide comfort and less effort balancing body and operating forces, repetitive actions in addiction with curriculum for all, including access to disables.
7. Size and space for approach and use: providing an interface design can be understand as a composition of information and data, navigation, interaction and elements to support different learning needs, providing clear and intuitive use.
8. Learning apprentice's communities: the environment promotes interaction and communication between students and between students, teachers and university.
9. Educational environment: place where instruction is projects to be welcoming and inclusive (Fig. 7).

¹ German Architect.

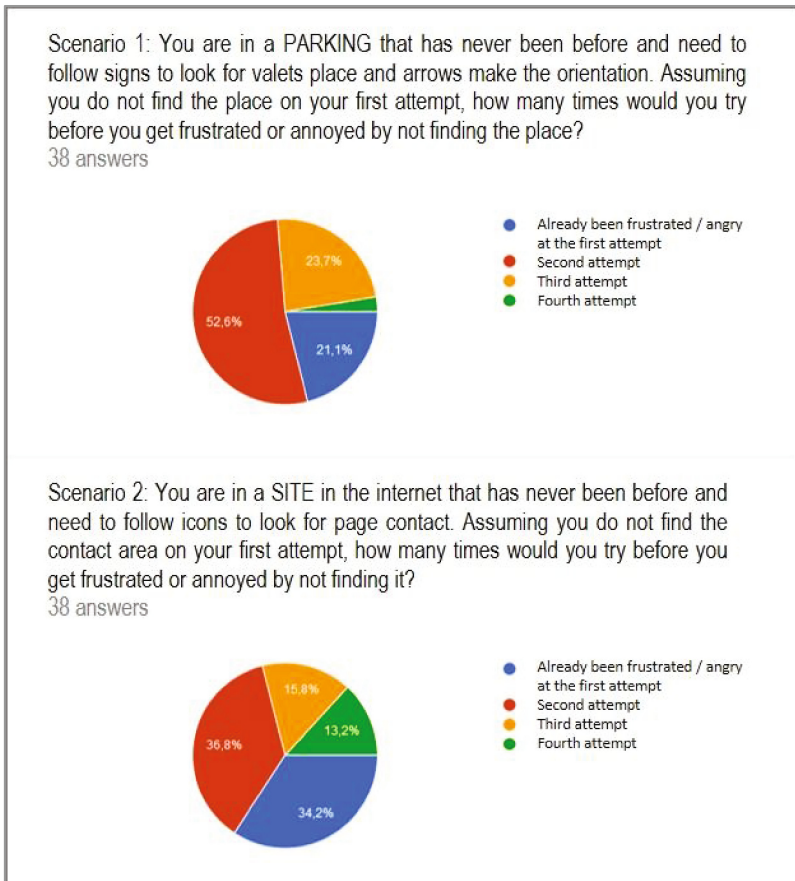


Fig. 7. Research running by Tiago Paes de Lira, team designer, 2016.

5 Conclusions

The investigation applied in the design of learning environments results in a team engaged and able to create learning spaces and educational design. The result was a roll of conceptual and practical guidelines to help multidisciplinary team to create a learning virtual environment-object based in universal design, networks and data visualization to provide universal access. Future proceedings aim to organize the first environment evaluation by students, professors, and online support group. Documentation and guidelines design review are expected as well.

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