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Design Committed to the Issues of Teaching and Learning

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Abstract:

Design in Education is the object of in-depth study and it has opened many doors for action by the designer, reaffirming the interdisciplinary vocation of this area of knowledge. This study intends to present Design as a field that can contribute effectively towards the creation of educational artifacts and cultural inventions, important aspects in human's cognitive development. This topic is one of the main objects of study at the Interdisciplinary Laboratory for Design/Education - LIDE, in operation since 1997, within the scope of the Graduate Studies Program in Design at Pontifical Catholic University of Rio de Janeiro, Brazil, This paper refers to the study, research and theoretical line of research Design in Teaching and Learning Situations through an interdisciplinary dialogue between Design and Education. Through methods and techniques of Design it was sought to identify how this area of knowledge can participate in the processes of teaching and learning at the setting of didactic materials and enhance the process of acquiring knowledge. The study was guided by the Multi-Tracks, which is a game to help the acquisition of a second language by deaf children. This game was developed in the light of methods and techniques of Design, under the LIDE, in partnership with the National Institute of Education for the Deaf in Rio de Janeiro - INES / RJ.

Keywords:

Design, Education, Interdisciplinary, Teaching and Learning, Game

1. Introduction

"Design in Education" is the object of this in-depth study, and it has opened many doors for action to the designers, reaffirming the interdisciplinary vocation of this area of knowledge. This topic is one of the main focuses of study at the Interdisciplinary Laboratory for Design/Education - LIDE, in operation since 1997, within the scope of the Graduate Studies Program in Design at Pontifical Catholic University of Rio de Janeiro, Brazil.

This paper deals with the study, research and theoretical line of research "Design in Teaching and Learning Situations through an interdisciplinary dialogue between Design and Education". Us-

ing design methods and techniques the researchers sought to establish how this area of knowledge could participate in the processes of teaching and learning and enhance the process of acquiring knowledge. The study was guided by *Multi-Tracks*, a game developed to encourage the second language acquisition with deaf children. This game was created in the light of design methods and techniques, under the supervision of LIDE and in partnership with the National Institute of Education for the Deaf in Rio de Janeiro - INES / RJ.

The study intends to present 'design' as a field that can contribute effectively towards the creation of educational artefacts and cultural inventions, important aspects in cognitive development of humans.

'Design' is an active process that influences society, creating its material culture. From this perspective, Meurer, cited by Frascara (1997), states that the world in which we live is more than the matter that has solidified as form and remained over time. Its form is defined by activity and action is its centre. If 'design' is conceived as action-oriented, understood as an active interaction and a creative change, it will not focus on the object only as form. On the contrary, designers shall be concerned primarily with developing interactive process models in which an object plays an indisputable core role as a means for action. According to this vision, 'design' relates to the totality of human interaction's concrete and intellectual spectrum, interaction among people, products and the world in which we live. (Meurer, *apud* Frascara, 1997).

Starting with a vision open to inclusion, which characterizes the area of design, this study defends the idea that the field of design has a great potential for joint works with education, aimed at meeting new demands of the contemporary society. It was precisely this understanding that led to the reflections found herein about the possibilities of an interdisciplinary dialogue between design and education as a basis for the conceptualization of the "Design in Teaching-Learning Situations" line of investigation.

This definition of design as a field, which in Meurer's words "relates to the totality of human interaction's concrete and intellectual spectrum", will be used to present the path taken for carrying out this research.

2. Research Process

In 2007 the LIDE team finished developing a research project entitled "Multi-Tracks: game to assist in the acquisition of a second language by deaf children". The public for this project were deaf children enrolled in the elementary school at the National Institute of Deaf Education of Rio de Janeiro - INES/RJ. This research project with a clear interdisciplinary approach received a "Scientists from Our State" scholarship from FAPERJ (2005-2007) and a Productivity in Research scholarship from CNPq (2006-2009).

The object is a path game for tables or floors. The path comprises regular polygons, and beside these, the *Multi-Tracks* game also has three sets of three scenarios each: Sugar Loaf, Fire Department and Zoo, action cards, bonus cards, command cards, support cards, pins and dice. *Multi-Tracks* concrete game is played as follows: students are divided into groups; each group receives a number of polygonal pieces to assemble the track. When the track is mounted, the cards bonus, cards command and scenarios must be put on the polygonal pieces white, black and green respectively. The cards-actions are placed on the floor face down. The first group rolls the dice and places the pin at the polygon piece according to the number that the dice showed. A card-action must be taken regarding the colour of the polygonal piece that is his pin. The goal is to construct sentences with the card-action, tell stories, find synonyms, in other words, work on issues of Portuguese and Libras (Brazilian Signs Language).

The 'multimedia object' is a game that consists of an outing in the city of Rio de Janeiro, initially starting at the three sets of three scenarios each, as per scenarios of the actual object. Each scenario has links to three tasks: a jigsaw puzzle,

a connect-the-dots and a word/image association puzzle.

With *Multi-Tracks* as a starting point we elaborate a study with the aim of conceptualizing, delimiting and grounding the "Design in Situations of Teaching-learning line of investigation".

The question that guided this study was: can design techniques and methods applied to "Design in Situations of Teaching-Learning" enhance and enrich the teaching-learning process for children? We conducted this study starting with the idea that the job of a good designer within the scope of education, which is largely seen as a project activity, at the same level as the one that leads to the configuration of maps, posters, books, etc. is somewhat restrictive.

In order to discuss these issues, our general objective became to ground the "Design in Situations of Teaching-Learning line of investigation" to form the basis for discussions we intend to carry out.

The methodological aspects that served as a guide to this investigation, which had a qualitative bias, are shown below in the synthesis table for the research process. Each of these phases is related to an objective. Notwithstanding the presentation in phases, the research process was founded on concomitant actions.

In this paper we shall present the issues related to teaching and learning, which correspond to the fourth phase of the research.

Table 1. Steps of the research process

Research Process				
1st Phase	2nd Phase	3rd Phase	4th Phase	5th Phase
Documental research case study	Bibliographic Research	Bibliographic Research	Conceptualization of the line of research	Results
Documentation and analysis of the *Multi-Tracks* game project process	Reading and critical analysis of texts	Reading and critical analysis of texts	Reading and critical analysis of texts	Identification of methodology for "Design in Situations of Teaching-Learning"
Operational objective	Operational objective	Operational objective	General objective	Operational objective
Conduct a systematic registry of the history of *Multi-Tracks* configuration.	Base and discuss Design questions in light of information and communication technologies, addressing cultural aspects, language, image and the construction of meaning.	Discuss the "Design in Education line" in light of opinions and reflections of designers that work in the academic area.	Present studies on design/education, discussing issues related to teaching-learning, games and visual pedagogical practices.	Ground the "Design in Situations of Teaching-Learning line of investigation".	Contribute towards the field of design and education in creating subsidies for planning educational materials and for improving standards of education, making learning more productive and interactive.

3. Design and the Model of Pedagogical Reasoning and Action

As a subsidy for defining the "Design in Situations of Teaching-Learning" field in this study we shall introduce Shulman's Model of Pedagogical Reasoning and Action (2008), so a designer can learn how to operate in the design/education field,

Although this model is presented in a sequential manner, the author states that it does not intend to represent a series of fixed phases, stages or steps. Many processes can occur simultaneous with the others. Some may not even come about during some teaching actions. Some may appear sectioned and others, on the contrary, defined in details. For example, it is probable that in teaching children some of these processes may be ignored or some may not be paid attention to in this model. However, a teacher should be able to demonstrate the ability to participate in these processes. Faculty preparation must provide the students with forms of comprehension and with performance skills they need to move forward by following an order and to carry out complete acts of pedagogy, as has been represented in the model of pedagogical reasoning and action.

We introduce the model of pedagogical reasoning and action to present the *Multi-Tracks* game as an object of study that belongs to the "Design in Situations of Teaching-Learning line of research", because in order to use it, the teacher must understand, transform, represent, select, adapt, teach, evaluate, reflect and obtain new manners of comprehension, which are the steps in Shulman's model of pedagogical reasoning and action.

We will thus present the proposal for a reasoning model for analyzing projects within the scope of the "Design in Situations of Teaching-Learning line of research" applied to *Multi-Tracks*, inspired by Shulman's model (2008).

Comprehension: refers to the comprehension of the goals, the structure of matter, the ideas inside and outside the discipline. *Multi-Tracks* aims at helping with the second language acquisition. Beside its concrete and multimedia support, the game has a variety of components that the teacher can use to achieve several objectives the teacher wants to reach; for such, he should prepare, interpret and conduct a critical analysis of the material. Understanding the relationship of diverse components of the game, such as the relation between the polygonal pieces and the cards, the functions of the cards, how to play, and etc.

Figure 1. Reasoning Model for the analysis of projects within the scope of the "Design in Situations of Teaching-Learning line of research" using the Multi-Tracks project, proposed by Portugal (2009).

Transformation: refers to the preparation, interpretation and critical analysis of texts, structuring and segmentation, creating a repertoire of curricular goals. The Multi-Tracks components can be transformed according to each class's or each school's program content. The teacher has the possibility to create new objects about themes, content he intends to teach, and for such he must prepare, interpret and conduct a critical analysis of the material. The teacher's function is to promote the student's experiences and actively assist in the knowledge construction process.

Representation: refers to the use of a repertoire that includes analogy, metaphors, examples, demonstrations, explanations, etc. In

Multi-Tracks, beside having a vast repertoire of representations, which includes analogies, metaphors, examples, demonstrations, explanations and etc., the teacher can also resort to diverse resources to represent their teaching-learning goals, and the child can represent the proposed tasks in several ways, for example: using LIBRAS, Portuguese, typing, drawings, mimic, etc. This enables a very big flow of information in the teaching-learning process through the elements of design. We can see that learning occurs from inside out in children. The students get physically and mentally involved in the activities and feel motivated.

Selection: relates to the choice from a repertoire that includes didactic teaching methods, organization, management and organization. *Multi-Tracks* offers the teacher the chance to choose from a didactic repertoire that includes modalities of teaching, management and organization. Game components include polygonal pieces, cards and scenarios, which can be selected in accordance with the class objective, for example, if the teacher wants to teach verbs and adjectives, he/she can select the polygonal pieces and the cards that refer to the purpose he/she wants to achieve.

Adaptation and adjustment of students' characteristics: refers to the consideration of concepts and prejudices, misconceptions, difficulties, language, cultures and motivations, social class, age, ability, aptitude, interest, self-concept and attention. *Multi-Tracks* have the city of Rio de Janeiro as its context. Its scenarios include the Pão de Açucar, the Zoo and the Fire Department. The bonus cards address three themes: means of transportation, food and clothing. The teacher can resort to these resources or make adaptations and adjustments in accordance with the characteristics of the students. It offers the possibility to consider concepts and prejudice, wrong concepts, difficulties, language, culture and motivations, social class, age, capacity, aptitude, interest, concept of oneself and attention.

Teaching: refers to the manipulation, presentation, interaction, teamwork, discipline, asking questions and other aspects of an active learning, instruction to the discovery or inquiry and ways of teaching observed in the classroom. *Multi-Tracks* is rich educational material that offers the teacher several ways to teach. By means of its components the teacher can make manipulations, presentations, interactions, group work, humorous stories , discipline, question formulation and other aspects of active teaching, instruction for discovery and/or enquiry, as well as forms of teaching observed in the classroom. It also promotes the interaction of deaf and hearing children by constructing the environment as they interfere in it, conduct their activities, play and construct knowledge.

Evaluation: refers to verifying the students' comprehension during interactive teaching. It highlights the need to assess students' comprehension at the end of lessons or units and to assess our own performance and adapt the experiences. During and after playing *Multi-Tracks* the teacher shall conduct an evaluation of the students' learning process. He/she can thus evaluate his/her own performance and adapt to the experiences. The teacher can verify students' comprehension during interactive teaching and evaluate students' comprehension upon finalizing lessons or units.

Reflection: refers to the revision, rebuilding, presenting and reviewing our performance, and performance of the class and explanations based on evidence. *Multi-Tracks* is complex material that has many components and in order to use them properly, constant revision, reconstruction, representation and critical analysis of the performance of the teacher and the class and student becomes indispensable.

New ways to comprehend: refers to a new understanding of the goals of the matter, learners, and teaching itself. The use of *Multi-Tracks* in the teaching-learning process helps the teacher comprehend new forms of teaching. It can consolidate new modes of understanding and learning. It offers the teacher a new form of understanding aims, content, students, teaching and themselves.

Multi-Tracks facilitates teaching of diverse pedagogical content and in different ways, not

Figure 2: The Multi-Tracks game

only due to its concrete and multimedia support, but also, as we addressed previously, due to its aspects that are common to both objects.

The model of pedagogical reasoning and action proposed by Shulman (2008), which we referred to in order to present *Multi-Tracks* as a project in the "Design in Situations of Teaching-Learning line of research", emphasizes the intellectual basis for faculty performance and not only teacher's conduct. The author states that if one intends to take this idea seriously, it is indispensable to revise teaching and the content of teacher training programs. These programs can no longer restrict their activities to didactics and to supervision alone, but they have to extend them also to the formation of teacher's capacity to reflect on teaching and to teach specific subjects, as well as their capacity to base their actions on premises that resist complete analysis from the professional community. Figure 2 shows the *Multi-Tracks* game:

4. About the Multimedia Multi-Tracks game

Several prototypes were made until reaching the version 1.0 of the game, which is the topic of this paper. The final result was tested on different computers, on monitors of diverse sizes and in various different operating systems, aimed at anticipating problems in running the CD. It is available online: http://www.multi-trilhas.com/

Game Elements and How to Play

1. Opening screen – map of the city of Rio de Janeiro.

2. HOME Screen – characters images and a board for writing the player's name. This information is also available on videos at Libras. Icons are available for the drawing activity screen; Libras dictionary; score; presentation of the game; exiting the game; choosing the background colour for the screen.

3. After choosing a character, the player goes to a screen where the 9 scenarios are available. These scenarios call up three activities each:

a) Make ghost images present in the scenario visible. These lead to screens where the player positions the image over the name that represents the image, a word association activity. If correct, an animation of a celebrating character appears and a screen with the score enters automatically.

b) Make ghost images present in the scenario visible. These lead to screens where the player enters a numbered connect-the-dots activity. If correct, an animation of a celebrating character appears and a screen with the score enters automatically.

c) Make ghost images present in the scenario visible. These lead to screens where the player enters a jig-saw puzzle activity. If correct, an animation of a celebrating character appears and a screen with the score enters automatically.

In every situation the words worked on in Libras (dictionary) and in written Portuguese appear.

Beside various sensitive elements on the screen where the player learns Portuguese and LIBRAS by clicking them, the game also provides a free art activity. This activity enables children to draw, paint and create scenarios with characters, just by using the mouse.

4. Congratulations screen – after finishing the five tasks in each scenario a celebration screen appears congratulating the player.

5. Score screens – these screens compute the player's points in all activities, except for free art.

5. Concluding remarks

Throughout the elaboration of this research study, by means of an interdisciplinary dialogue between 'design' and 'education', we sought to identify how the activity of design could participate in the teaching-learning processes and in the configuration of pedagogical materials, with the aim of enhancing the knowledge acquisition process through the configuration of artefacts, environments and analogue and digital systems.

The design in "Situations of Teaching-Learning line of research" served as a basis to expand the knowledge of the relationship between the two main areas involved. It was defined as an area preferably included in the academic field, an area that agglutinates works where designer participation in projects geared towards education at any level – nursery school, elementary school, high school, higher and advanced education – but it also suites for studies and research related to the teaching of design in the extra-university, technical, extension, undergraduate and graduate ambits. Its basic principle is to enhance the knowledge construction process. In this perspective each design solution represents the search for equilibrium between interests and needs of the teacher and student, as well as of educational institutions.

In this research we sought to create subsidies for planning educational materials from a multiple perspective, which observes the educational specificities and its dialogue as well as the transit with neighbouring reality, aimed at the creation of more productive and interactive teaching-learning processes.

The option of using an artefact developed in light of design as the object of study for this research, registering and discussing its configuration process and the experience that took place in its development process was decisive for understanding the diverse issues involved in the "Design in Situations of Teaching-Learning project".

We also verify that the practice of "Design in Situations of Teaching-Learning" enables designers to deal with complex problems. In this particular point, the formation of interdisciplinary teams is indispensable, since they provide for the creation of efficient educational artefacts, promoting and sustaining educational relations, providing dialogue between the teacher and the student in the teaching-learning process.

A more detailed theoretical study conducted on teaching-learning issues, accompanied by Shulman's ideas, helped us understand that so as to obtain the results in the teaching process, it necessarily has to be conceived as an activity that implies joint work between teachers and students. This work implies exercising thought, as well as action by all players.

The proposal for a pedagogical reasoning and action model to analyze projects within the scope of the "Design in Situations of Teaching-Learning line of research" was conceived using the *Multi-Tracks* project as a case study. This led to the conclusion that the application of design methods and techniques in objects directed towards teaching deaf children to read and write, may, for example, not only help make this task

more productive and pleasant, but could also contribute towards delimiting a multidisciplinary field comprised of design, education, art, psychology-pedagogy, information technology and so on.

From this research it was possible to create an outline for a "Design in Situations of Teaching-Learning" methodology comprised of cyclical actions where methodology steps, that is, information, experience, data, evaluations, decisions, conclusions, etc., are in interactive movement, covered for understanding, fitness and development of the project one intends to carry out.

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