Development of Digital Educational Resources for Education for Sustainable Development: the Courseware Serē

Patrícia Sá, Cecília Guerra, António Pedro Costa
University of Aveiro, Research Centre on Didactics and Technology for the Education of Educators (Portugal)

Abstract

The lack of courseware for primary sciences’ teaching and learning, conceived according to Education for Sustainable Development (ESD) approach [1], was the reason that determined the organisation of a multidisciplinary team with different competences (on Science Education, Educational Technology and Design) for the development of the Courseware Sere “The Human Being and natural resources”.

Adjusting some principles of software’s development, as far as User Centred Design (UCD) is concerned [2], as well as ESD approach [3] and science education perspectives [4], the multidisciplinary team collaboratively developed the digital educational resource, which integrated several software typologies within the educational activities.

Taking into account the UCD and usability premises, the team looked to find answers for two research questions: “What are the positive and/or negative perceptions of external evaluators concerning the Courseware Sere?” and “What are the potentials and constraints that emerged from the methodology adopted in the development of Courseware Sere?”.

A qualitative method, of a descriptive and exploratory nature, was adopted in order to develop and evaluate the technical and didactical quality of Courseware Sere (question 1), as well as, the potential and/or constraints of the methodology adopted in its development (question 2). The development and research study was divided in two research phases, selecting for each one of them, different techniques and instruments to collect and, consequently, analyze the data.

Following its technical and didactical evaluation, this educational resource was used for an in service primary teachers training program. With the financial support of British Petroleum, it was possible to include, at this teacher training program, primary teachers all over the country.

A full presentation of the development process of this digital educational resource will be done throughout this paper, as well as the presentation of the results emerging from the in service primary teachers training program.

1. Introduction

The world’s present day situation, which show deep social, economic and environmental asymmetries, are plagued with conflicts that disregard Human Rights as the world faces multiple and multicausal socio-environmental issues. The proclamation of the Decade of Education for Sustainable Development (DESD) by the General Assembly of the United Nations emerges as the ultimate recognition of the planet’s emergency situation.

The understanding of the relationship between the environmental issue and the current non distributive and non generalized economic development models, on a planet that is limited and finite in terms of natural resources, is fundamental to the survival of all and to overcoming the present planet’s situation.
It is within this framework that the importance of individuals’ personal and social education is placed, without neglecting scientific and technological education. Science is an essential vehicle in the education towards sustainability. The awareness of this permanent presence in the diverse contexts and dimensions allows a more complete and wide-ranging understanding of the reality.

However, according to a report by the European Commission [5] in recent years, many studies have highlighted an alarming decline in the interest that young people show for key areas of science. The same report recommends that each Member State promotes new strategies for teaching science, innovative approaches that will motivate young people to choose scientific careers.

ESD implementation through information and communication technologies (ICT) used as new learning spaces is recommended by UNESCO (2005). These technology tools, since they allow the exchange of views and sharing of experiences, can be integrated by teachers as a resource of interaction between students and between students and teachers, as mediator and facilitator of sciences learning.

The realization of the lack of quality resources for sciences’ teaching and learning according to ESD perspective, led to an effort towards methodologies development, which in turn imply a continuous and intrinsic assessment so that they match the user’ needs and capabilities, and this is the action line that fits the Courseware Sere development.

The Courseware Sere was designed by a multidisciplinary team of researchers from the University of Aveiro, in partnership with Ludomedia. Created within the framework of ESD, in the context of Science Education, it responds to a need for quality computerised educational resources for primary level (children from 6 to 11 years). The educational resource was designed to students and teachers classroom use, although its exploration can be adapted to other levels of schooling and education contexts, such as non-formal and informal. This educational resource includes a set of educational activities on the relationship between human activity, the natural resources use, energy and the environmental, social and economic future consequences of such use.

## 2. Development and Research Methodologies

Courseware Sere development process included four main steps:

- **Step 1**, Educational guidebook planning: the first stage demanded science didactics and educational technology researchers the drawing up of a document with the definition of the students level, thematic and didactic purposes, as well as aspects relating to architecture, navigation and resource screens design. This phase also demanded the trade mark and patent, as well as, amongst others, agreements concerning authorship rights.

- **Step 2**, Storyboard design: at this stage, educational activities and disciplinary content, defined in the previous step, were harmonized with the software interaction aspects, particularly the navigation and interface, and the Ludomedia’ designer and programmer collaboration.

- **Step 3**, Didactical resource implementation: this step was divided into two stages that took place simultaneously. The technical part, corresponding to software’ design and programming, as well as its user’ manual, and the didactical part. The last one requested detailed specification of several aspects, in addition to those already specified in the storyboard, as the initial animation and students and teachers’ guidelines. During this task, the multidisciplinary team has tested and adjusted students and teachers’ guidebooks contents holding to that wanted with software displays, which involved standing collaboration of all elements, made either in person or online.

- **Step 4**, Evaluation: seeking to assess both the didactical resource as its development process, evaluation occurred transversely to all stages listed above. At the end of phase 2, the storyboard’
assessment was carried out by external elements: primary level students, basic education teachers and science didactics and technological education researchers. The first Sere’ version evaluation was, also, made during hands-on workshops (with a maximum duration of 120 minutes) prepared and implemented by team members.

The Courseware Sere development process was guided by a reference theoretical framework, especially centred in Primary Science teaching and learning, oriented by ESD guidelines, and used a method of User Centred Design (UCD). These were both essential to carry out rigorous research and to guarantee that the usability principles of the software conception were respected.

Taking into account the UCD and usability premises, we looked to find answers for two research questions: “What are the positive and/or negative perceptions of “external evaluators” concerning the storyboard?” and “What are the potentials and constraints that emerged from the methodology adopted in the development of Courseware Sere?”.

A qualitative method, of a descriptive and exploratory nature, was adopted in order to develop and evaluate the technical and didactical quality of Courseware Sere (question 1), as well as, the potential and/or constraints of the methodology adopted in its development (question 2).

Data analysis allowed us to identify the positive and negative aspects of Courseware Sere, which are related to the educational potential of such a resource.

The evaluation of the first complete prototype was carried out by primary teachers and students. The results will be presented later in this article.

3. Courseware Sere Structure

Courseware Sere aims to: 1) promote understanding about humans’ activities impacts on natural resources and 2) awareness about the humanity’s future dependence on the adoption of attitudes and behaviours more conscious and responsible, mainly regarding with energy sources use.

This courseware integrates several software typologies, with didactical activities specified in teachers’ exploration guidelines. It’s constituted by: i) an educational software (CD-ROM and on line versions, demo version in http://sere.ludomedia.pt/); ii) teachers’ exploration guides; iii) students registers and iii) users’ technical guide.

The online version enables a social networking platform (Moodle), where users can access a scientific glossary and a database, specifically created to provide access to multiple documents. This platform was developed in order to allow user’s communication and collaboration between each other and between the multidisciplinary team.

Teachers’ exploration guidelines suggest several activities to work with the Courseware and are structured as follows: i) presentation and educational activity purpose; ii) exploration context and, iii) exploration methodology. These guidelines were developed in order to provide several educational activities towards sciences classrooms courseware integration.

Courseware Sere is organized, essentially, in two interrelated Phases that represent moments of transition between specific problems caused by energy natural resources unconscious uses, concretely oil and forest.

In Phase I one intends that students search oil production and consumption related aspects, point out oil reserves and consumption levels in worldwide map, as well as identify this natural resources uses in diverse daily situations. This energy resource finitude and the impossibility to generalize to all some nowadays consumption levels will raise subsequent problem and the forest use appears as an alternative energy resource (Phase II). However, the social and environmental impacts emerging from
this energy resource use, the forest bad management and the renewable resource scarcity raises the third question/problem: What are the alternative future energy sources? (Phase III, in development)

In between Phases there are Discussion Forums, which allow not only sharing information gathered by each group, but also to make a next Phase coherent and contextualized transition.

To conduct this research and guide the establishment of relationships and interactions between population and resources use, were created 8 characters that can play different roles throughout the entire situation.

4. Courseware Sere Evaluation

During the development process, the team focused on the technical and didactic evaluation of the first Courseware version. The process involved mainly primary teachers and students.

To evaluate the first version of the courseware it was developed a questionnaire, targeted to teachers and students. The questionnaire consisted of 3 parts: the first part was divided in two groups with closed questions about the educational potential of Courseware Sere: (a) the first list of issues related to user interaction with the software; (b) the second concerns aspects on activities designed for didactic use. The second part was targeted at open answers and aimed to achieve a synthesis on the relevance and potential evaluation of educational Courseware Sere. Finally, the third part, was seeking comments about the working session and evaluation tool.

The first evaluation was performed using a group of 35 teachers.

By the analysis conducted, 74% of the teachers surveyed considered that most students can use the software alone or in pairs, with only a small help. 57% of the inquired teachers agree that the software interface is intuitive and appealing.

In what concerns didactical aspects, 71% of the inquired completely agreed, and 29% agreed, that the software activities enabled the student to gain the new competences suggested in the curriculum. 94% of the inquired considered that the activities were appropriate to the student’s age. Another interesting result is that 51% of the teachers believed that the lack of automatic feedback during the activities is appropriate. However, only 54% strongly agree that the activities are adequate to the student’s age.

Courseware Sere evaluation, in its generality, was very positive. However in the open questions answers some less positive remarks are made by some of the teachers: i) some graphical elements are not very perceptive; ii) the interactivity of some screens should be increased; iii) some contents presented may be too complex for students of the first cycle; and iv) the vocabulary used may be difficult to understand for some students.

Students performed the courseware evaluation after the resource exploitation under the guidance of their teachers. For this evaluation were asked 41 students. The evaluation focused on what students did and technical aspects of this educational resource. Of the total number of students participating in the study, 85% use a computer all day. Of these, 67% can navigate without help and 37% need help at times. Although in this group, there are students who use the computer infrequently, no student needed help on an ongoing basis to explore the Courseware. All the students surveyed considered the design of the windows nice. 93% of students also liked the pictures. Of the 41 students surveyed, 83% found the activities interesting for their age. Of the remaining 17%, 71% would like to develop the proposed activities.

5. Conclusion

In this paper the development methodology of Courseware Sere was briefly presented.
The evaluation process, using the questionnaire mentioned above, provided a clear measure and objective user view about the suitability of the software to their tasks, since it was done contextualized in real conditions and with representative elements end-users to whom it is intended.

After the courseware’s development and evaluation processes, the research team conceived a teacher training programme, with the support of BP Portugal. This program is aimed at the dissemination of courseware and intends to contribute to innovation in science teaching practices. This training programme involved, so far, a total of 500 Portuguese primary teachers and will be implemented over the next two years.

References


