Darwin's wiki. A web 2.0 tool to learn evolution with the classics

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2. Author and Institution

António Faria, Marta Caseirito, Ondina Castanheira, Sandra Medeiros, Susana Lemos, Isabel Chagas
faria.a.nuno@gmail.com, martacaseirito@gmail.com,
ondinacastanheira@gmail.com, lemosusana@gmail.com,
sandrapaulavalentim@gmail.com, michagas@fc.ul.pt

University of Lisbon, Portugal

3. Abstract

This case-study is framed in a project developed within a graduate course on ICT (Information and Communication Technologies) integration in K-12 curriculum. It is centered on the creation process of a wiki (WikideDarwin – Darwin's Wiki in English) dedicated to Darwin's work and its contributions to science in general and Biology in particular.

The purposes of the case-study were: (i) to present the wiki's features that enable the infusion of History of Science in science learning; (ii) to describe science education activities based on the WikideDarwin addressed either to formal settings (in-school) and informal ones (e.g. at home, at the cyber-café); (iii) to discuss possible procedures for the wiki's evaluation and students' assessment.

The WikideDarwin is in continuous development. It is a repository of resources as well as a site that visitors can explore, share, and build collaboratively. Proposed activities are designed in order to facilitate access to the vast information available on Internet, namely historical issues and classic works as guidance and motivation to meaningful learning about Darwin's work and its contributions to science and society.

4. Case Study description

"We live in a time of short memories. Only few papers nowadays cited in the scientific literature are more than three years old. And many of the younger generations are regrettably unaware of the revolutionary contributions made by the great men of the past. One can hardly find a better illustration for this than the work of Charles Darwin. Nearly all of his great innovations have become to such extent an integral component of Western thinking that only the historians appreciate Darwin's pioneering role." (Mayr, 1988, p. 168).

An assumption of the project described in this case study is that young people today, in general, well acquainted with Internet, especially with Web 2.0 tools, can overcome the lack of historical perspective in science learning, regretted by Mayr, through guided access to the large collection of classical works currently available on WWW (e.g. The Complete Work of Charles Darwin Online) and collaboratively redesign texts, arguments, points of view informed by the history of science.

The project involved the conception and development of a wiki dedicated to Charles Darwin, his voyage and his contributions to science in particular to Biology. The *Wiki de Darwin* (Darwin's Wiki in English) was designed in order to facilitate the access to the vast information about Darwin and Evolution available on Internet, such as historical issues and classic works as guidance and motivation to meaningful learning about his contributions to science and society. It is a repository of resources as well as a site that visitors can explore, share, and build collaboratively. In this sense, the project in question will interest not only students and teachers, but also the entire educational community. Thus, the WikideDarwin is a truly useful artifact in terms of formal learning, but also in the informal context can be used in different areas.

The WikideDarwin is in continuous development. The initial format was published in January 2010 using the online tool Pbworks. The home page contains a picture of Darwin and the route of the voyage of the Beagle, a brief explanation about the content and objectives of the project and some references that served as the basis for the construction of the wiki (fig. 1).

Figure 1. WikideDarwin frontpage

Link to the WikideDarwin
(to visit in read-only mode type as username and password "ver"; to comment or edit type as username and password "experimentar")

In the Navigator box one can have access to online resources such as several links to websites dedicated to the work of Darwin that have been selected according to their educational value, and mainly because they contain copies of original texts, illustrations, notes and letters attributed not only to Darwin but also to other contemporary authors. In this Navigator box it is also possible to access students' contributions posted during the month of January 2010 as part of a pilot trial of the wiki.

Different kinds of activities and projects can be developed based on the WikideDarwin and taking into account current curriculum Biology topics. Each activity can start with a suggestion or a problem posed by the teacher or the students, which leads to literature search, discussion, information processing, posting, in a whole process of collaborative knowledge building.

During the month of January five themes were posted by students with the guidance of their teacher (who accepted to participate in the pilot trial of the wiki): Darwin in Galapagos, the Darwin's theory, Darwin's friends, Biography, Curiosities: Darwin working. Each topic is written by a student who individually consulted some of the links available in the wiki and wrote the text under the supervision of the teacher whose commentaries and suggestions are visible in a specific box. Most posts include pictures reinforcing some aspects of the text. No collaboration among students is seen.

More effort is needed in order to promote collaborative work, to design activities with different levels of structure and complexity, and to clarify the role of the teacher in support to students' productions.

5. Historical and philosophical background, including the nature of science

The theory about the origin of species by means of natural selection that Darwin built over many years of his life caused a revolution in biological thought. Today is a paradigm that extends to other sciences besides Biology.

Presently anyone can follow Darwin's work. Reproductions of his books, letters, thoughts, notes, drawings, pictures are available in dedicated sites on the Web. Issues contemporary to Darwin and current controversial ones, discussions, and implications of his theory are also accessible giving to Internet users a vast repository of resources useful to learn Biology contents and to understand the nature of science, how it evolves and its relationships to technology and society.

In Portugal the latest curriculum reform enhances the relevance of the History of Science in science teaching, particularly in support of teaching strategies based on historical examples. The knowledge of ancient ways of thinking, held back at certain times of scientific development, coupled with understanding and appreciation of historical episodes that reflect a conceptual change, helps to

identify the structural concepts and can also be an important tool in attaining them (Amador, 2001, p.12). Therefore secondary level programs have been given explicitly or implicitly the importance of using the History of Science in order to help the student to understand current approaches to knowledge.

Sequeira & Leite (1988) explain that the History of Science in education can help students feel more comfortable not only to present the teacher and fellow students with their own ideas about the world but also to discuss and evaluate them, improving communication in the classroom and enabling the teacher to identify students' alternative conceptions about the topics in study and to adopt adequate teaching methodologies to promote meaningful learning. Research on students' previous knowledge about evolution and related issues evidenced several alternative conceptions that may hinder learning the theory of evolution by natural selection and showed students' tendency to submit more intuitive ideas which recall a Lamarckian perspective.

6. Target group, curricular relevance and educational benefits

Biology teachers, secondary school students (levels 10 to 12, ages 15 to 18). At this point the topics addressed in the WikideDarwin are tuned to 11th grade Portuguese Biology curriculum themes concerning biological evolution such as the contributions of different sciences (e.g. anatomy, cytology, chemistry, paleontology) for the development of the concept of evolution, the differences between the explanations of Lamarck and Darwin about how species have evolved, and Neo-Darwinist approaches to this issue. Specifically the following objectives are addressed: - To collect, organize and interpret different kind of data related to evolutionism and the arguments that supported it as opposed to fixism; - To analyze, interpret and discuss cases/situations involving mechanisms of both natural selection and artificial selection. - To relate the adaptive capacity of a certain population with its variability. And the following attitude-based contents: - Recognition that the scientific-technological progress is constrained by contexts (e.g. socio-economic, religious, political), generating controversy, which may hamper the establishment of consensus views; - Construction of opinions based on different scientific and social perspectives (historical, philosophical, religious) for the evolution of living beings; - Critical reflection on some human behaviors that may influence the adaptive capacity and the evolution of beings. The use of the Wiki has the potential to provide a wide range of situations, including students' access to a variety of documents that are not usually available in regular science classrooms. These historical documents give more authenticity and enrich the discussions in the scope of the study of the theory of evolution. Moreover, through collaborative writing, enabled by the development of the Wiki, students remain active and motivated. Learning occurs through discovery and problem-solving where all class members participate while building their knowledge, independently and at the rhythm of each one. Thus, the use of this tool allows students to share their knowledge and ideas, encourages writing as well as collaboration and cooperation among them, with an impact in developing skills

and promoting learning in school context. Many authors defend the idea that students have a better understanding about the nature of science as well as a greater development of mental models, through the use of such tools in which the contexts of discovery and the strategies of questioning and interaction among students are valued. Exploiting the Wiki in the classroom allowed the construction of teaching materials (historical texts and experiences), providing teachers with "tools" necessary to accomplish didactic transposition and influence how students think about science, valuing a more humanized perspective about science.

7. Activities, methods and media for learning

At this point, the wiki contains a page (online resources) with links to websites dedicated do Darwin's works, the voyage of the Beagle and the theory of evolution. Different kinds of activities and projects can be developed based on the WikideDarwin and taking into account current curriculum Biology topics. Each activity can start with a suggestion or a problem posed by the teacher or the students, leading to literature search, discussion, information processing, posting, in a whole process of collaborative knowledge building. The main strategies used are collaborative writing, discussion activities (e.g. controversial issues), interpretation of historical documents, internet research, problem-solving, science inquiry and student-centred project work. Projects are developed within an interdisciplinary approach. The WikideDarwin can work as a promoter of a variety of activities; such has reproducing historical experimental work in the school Biology lab. Access to multimedia computers connected to Internet is needed. Classroom discussions based on the WikideDarwin can be illustrated by the wiki itself on an Interactive whiteboard.

8. Difficulties in teaching and learning

Main difficulties identified so far: - Teachers' difficulties developing meaningful projects with the WikideDarwin resources. - Teachers' difficulties applying the technology – using the computer, accessing the Internet – with their students. - Teachers' difficulties implementing student centred strategies. - Stud ent's difficulties grasping the historical texts, because they are difficult to understand and are written in English. Student's difficulties in processing information available on Internet in order to write a meaningful document.

9. Pedagogical competencies

To carry out meaningful and fruitful activities with the WikideDarwin requires a teacher with computer skills and experience with web 2.0 tools. Moreover, teachers should be interested in source historical materials and be convinced of its pedagogical importance.

10. Documentation research evidence of studies

During the month of January (in general this is the period in which evolution-related issues are taught in secondary schools in Portugal) five themes were posted by students with the guidance of their teacher (who accepted to participate in the pilot trial of the wiki): Darwin in Galapagos, the Darwin's theory, Darwin's friends, Biography, Curiosities: Darwin working. Each topic is written by a student who individually consulted some of the links available in the wiki and wrote the text under the supervision of the teacher whose commentaries and suggestions are visible in a specific box. Most posts include pictures reinforcing some aspects of the text. No collaboration among students is seen. More effort is needed in order to promote collaborative work, to design activities with different levels of structure and complexity, and to clarify the role of the teacher in support to students' productions.

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