INDEXING TEMPLATE

Indexer Reference List for

Encyclopedia of Networked and Virtual Organizations

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Chapter Title: Distance Education – The Experience with Environmental Sciences

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Term 1 - Environmental Sciences

- **Also known as: "**Sciences of life and earth"
- **Similar to:** "Study of pollution"
- **Associated in the manuscript with: "**Ecology" and "Environmental Education"
- **Notable appearances of this term can be found on:**
  Page 1 **-** refers to the group of subjects that study environmental processes
  Page 8 **-** refers to the group of subjects that study environmental processes

Term 2- Open distance learning

- **Also known as: "**Distance education", "Distance learning", "e-learning"
- **Similar to:** "On-line education", "b-learning", "Open learning"
- **Associated in the manuscript with: "**Universidade Aberta", "self-learning", "multimedia", "distance education"
- **Notable appearances of this term can be found on:**
  Page - 1 **-** Distance education
  Page - 2 **-** Distance education
  Page - 4 **-** refers to the teachers of distance education

Term 3- Citizen participation

- **Also known as:** "Citizen involvement in the community"
- **Similar to:** "Citizen responsibility"
- **Associated in the manuscript with: "**Environment"
- **Notable appearances of this term can be found on:**
  Page - 2 **-** Citizen involvement in community environmental problems

Term 4- Evaluation

- **Also known as:** "Assessment", "Value"
- **Similar to:** "Performance-based assessment", "Determination of merit"
- **Associated in the manuscript with: "**Evaluating students", "Summative evaluation", "Formative evaluation"
- **Notable appearances of this term can be found on:**
  Page - 5 **-** Assessment
  Page - 6 **-** Assessment
  Page - 7 **-** Determination of merit

Term 5- Self-evaluation

- **Also known as: "**Self-assessment", "Testing yourself"
- **Similar to:** "Self-determination of merit", "Self-determination of knowledge"
- **Associated in the manuscript with: "**Evaluation", "Formative evaluation"
- **Notable appearances of this term can be found on:**
  Page - 6 **-** Self-assessment

Term 6- Background knowledge

- **Also known as: "**Prior knowledge", "Self-knowledge", "Personal knowledge", "Subject-matter knowledge"
- **Similar to**: "Metacognitive and conceptual knowledge"
- **Associated in the manuscript with: "**Environmental sciences"
- **Notable appearances of this term can be found on:**
  Page - 8 **-** Prior knowledge

Term 7- Broadband

- **Also known as: "**High speed internet"
- **Similar to: "**DSL", "Cable modem", "Dial-up modem"
- **Associated in the manuscript with: "**Distance learning"
- **Notable appearances of this term can be found on:**
  Page - 12 **-** High speed internet

Term 8- Wireless technologies

- **Also known as: "**Wireless networking"
- **Similar to: "**Mobile IT equipment"
- **Associated in the manuscript with: "**Distance learning"
- **Notable appearances of this term can be found on:**
  Page - 12 **-** Wireless networking

Distance Education - The Experience with Environmental Sciences

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INTRODUCTION

Educational systems should warrant learning needs of the population they serve offering a diversity of educational agents, strategies and answers to the needs of those that seek knowledge (Caeiro *et al.*, 2004). In Portugal the experience of teaching subjects related to **Environmental Sciences** via **open distance learning** started in 1995 at Universidade Aberta (a Public University specially dedicated to the **open distance learning** of graduate and undergraduate courses). This experience began with General Ecology, and in view of the interest showed by students (and in fact by a wider public) the University later offered other subjects such as Environmental Education and Water Pollution. Today we have a number of different subjects within the vast area of Environmental Sciences and are preparing an undergraduate programme in view of the recent Bolonha agreement. The University also offers post-graduate programmes that bring together the environment and the **citizen participation**. The aim is to heighten the interests of our students in scientific subjects related to the environment as well as providing a practical perspective of what they can do as active citizens. The programmes are supported by necessary tools that enable

students to critically analyse and discuss press articles about the environment, protocols that are designed to make industries "greener" as well as government decisions.

BACKGROUND

"Open distance education" is the teaching of subjects without the physical presence of the teacher and at the same time implies that, because it is "open", any person may have access to it. Restrictions are made when the student wants to follow an academic degree; otherwise the "open distance education" should be what we can call the most democratic way of passing knowledge to those who really want to possess it. In fact, learning is a social activity that is included in a certain context, that inspires a decision and an action and that is integrated in a meaningful project (Debry *et al*, 1998). Therefore the best way to promote **open distance learning** is by creating international interactive networks. In this way, it is possible to respond to the ever-increasing demands of long life learning, promote the cooperation between scientists and the industry as well as contribute to a better-informed society.

Distance education is a methodology directed to adults (Blandin, 2000) and it is based on the assumption of self-learning (Carmo & Ferreira, 1998; Blandin, 2000). The structure of this model of education is characterised by the student's autonomy and requires the use of multimedia teaching materials (Goasguen, 1990; Hazemi *et al*., 1998). At its most basic level distance learning happens always when the lecturer and the students are separated by a physical distance and it is the technology (e.g. voice, videos, data and the printed word), sometimes in conjunction with some face to face communication that is used to overcome some breaches in knowledge. Research on this subject has already proven that distance

learning can be as powerful as traditional teaching in a classroom provided the methods and the technologies used for the purpose are correctly chosen according to the variables present at each moment. In addition, it is necessary that the interaction between teacher and student is effective and done within periods that we can call as “useful time” (Moore & Thompson, 1990; Verduin & Clark, 1991). If this type of communication is delayed it will not be profitable. In fact, a major disadvantage of distance education in the early days was the lack of communication between the students and the lecturer (Sherry, 1996). Nevertheless, can we say that open distance education is effective and beneficial for any student or do we need to draw a profile of the distance learning student if we want this method to be successful? This question arises not because of the student himself but because in a scenario of distance education the process of learning is a very complex one. Schuemer (1993) carefully outlined the motives that make distance learning more difficult than the traditional way of learning. In short, these problems may arise owing to: the age of the students, their involvement in professional and familiar life which will leave them with less time and peace of mind to dedicate themselves to the study; the real aim of the students when they start distance learning (just to get a degree or because they really are interested in widening their knowledge); the isolation of the students (and in this aspect the interaction with the teacher is fundamental); the problems that both students and teachers have to overcome when they start using a new piece of technology that is new for them. Until they are at ease with it communication will not be very successful.

MAIN FOCUS

Why does a teacher wants to use this method of open distance education? Why not to continue with our traditional tried-and-tested ways that are good enough to build our society? Many lecturers feel that the opportunities that are offered by this innovative way of teaching largely compensate the difficulties the system presents. In fact, being an **open distance learning** lecturer implies that we must prepare the subject we are going to teach in an organised and global way. This may be seen as a hardship of distance teaching but, on the other hand, it improves the general way of teaching and promotes empathy with our students. It is rewarding to feel that we are reaching a vast public that otherwise would not have the chance to improve their knowledge and that we are contributing to shape better, more informed human beings. However this may seem rewarding and appellative it is necessary to meet the students' needs. As students must feel at ease with this way of learning as soon as possible, teachers need to ensure they are motivated not only in relation to the taught subjects but also to this way of learning. Therefore it is worth paying attention to some important points:

1- Have a real feeling about how much we can teach our students in the time we have for doing so (in general distance learning takes more time than learning in a classroom);

2- To be aware that our group of students have different forms to understand what we want to teach them (this is inherent to this type of teaching);

3- It is always interesting and motivating to mix theoretical subjects with discussions using the several possibilities that technology offers today;

4- When designing a new course teachers must keep in mind their students instead of focusing their attention in the new technologies (despite their appeal to the teacher);

5- If the lecturer feels confident and shows enthusiasm about this way of teaching / learning, this certainly will help his students to build the same feeling and to have more success.

Morgan (1991) suggests that distance education's students that are not confident about the knowledge they have acquired will tend to memorize facts and details rather than thinking about the subject in a global way. All types of materials that we can use in distance learning will present advantages and disadvantages and we need to carefully consider when making our choices. We may analyse the use of written materials, the use of TV, the *internet*, videoconferencing, and maybe some others and still we will not find the perfect "instrument" for distance education.

Evaluating our students is another demanding task. The first question that we may pose is "why evaluate students?". Another important question will be "what type of **evaluation** should we use in distance learning?". There is a variety of methods to evaluate not only the amount but also the quality of knowledge that a student acquired. When we are involved in distance teaching we do not have a traditional classroom, we do not have a homogeneous group of students to evaluate, we do not have any feedback during the period we spent teaching (facial expressions, comments, etc.). We also do not have complete control of the means we employed to reach our students (the best technology will fail whenever we don't expect) and we do not have the opportunity to speak with a student in a particular moment that we feel he may need extra help. These are only some reasons why the process of **evaluation** in distance education is more difficult than in the traditional way of teaching. This is also why we must be more careful when evaluating our students and must pay attention to certain specific aspects.

We may use a type of **evaluation** that is formative, hence a formative **evaluation**, an **evaluation** that is conclusive (a summative **evaluation**), or a combination of both. The first type of evaluation helps the teacher to improve its own way of teaching, helps in the adaptation of the subjects to be taught to real situations and helps in the identification of the main flaws of the study plan. In distance education the formative evaluation may be carried out using different techniques that are very simple but in general very effective. As an example, we may think about the electronic messages that we can send to our students, the use of the telephone or even the use of pre-paid cards that the student can use to pose questions to his teacher or to answer questions posed by him. Since in the system of distance education we are dealing with students that are adults, the formative evaluation may be changed into **self-evaluation**. Some students prefer that the system works in this way especially when they do not feel at ease to expose themselves and show their difficulties in learning any subject (exactly because they are adults and may feel that are being incompetent).

In the majority of cases the final evaluation, which is summative, will be done in a classroom rather than using distance methods. The written testes will be very similar in their structure and degree of difficulty to those that the students have used before in their formative evaluation. Hence, they will serve only to quantify the degree of knowledge that was acquired as well as the capability to relate the several themes that composed the subject or the course in question. Nevertheless, it is not compulsory that the final evaluation of our students should be done under the format of written testes. Many lecturers choose other techniques according to the nature of the subject they teach or according to the number of students enrolled in their subject. Wiggins (1998) has used the expression “education **evaluation**” to describe the techniques and questions that teachers should consider when

preparing several forms of evaluation of knowledge. Whichever the case a well programmed evaluation will help the teacher in identifying the flaws and, in this way, will help him to correct and conceive new strategies of teaching.

Since the process of distance education is a two way "route", the process of evaluation will not be complete unless the lecturer himself is also subject to evaluation. This may be done, as it happens at Universidade Aberta, through a "Study Centre of **Evaluation** and Pedagogy" that allows the teacher to receive the evaluation that his students make of himself, of the study materials he uses and of his type of teaching. Only with such an interaction it is possible to make distance education evolve and become a successful way of teaching and learning.

In this short article I would like to present the results (success *vs.* unsuccess) of our students in relation to the two oldest subjects that are taught in the area of Environmental Sciences: General Ecology and Environmental Education, as these are the longest running subjects with more available data and it is possible to see the evolution of distance teaching. This implies not only the experience of the teacher as well as the background preparation of the students enrolled in them, but also the experience they acquire about this method of studying. The analysis here presented refers to the success rate of students that have submitted themselves to final evaluation since 1994/95 for General Ecology and since 1998/99 for Environmental Education.

Figures 1 and 2 show the behaviour of our students during final evaluation of these two subjects. Note that in each academic year there are two distinct moments of final evaluation. In figure 1, corresponding to the Student's Success Rate in General Ecology,

the last evaluation period (2004/2005) has different colours because there was a change in the teaching materials. It is, nevertheless, important to stress that the majority of students that enrol in these two subjects have no **background knowledge** of any subject related to **Environmental Sciences**. This may, at least in part, explain the fluctuations in success rate although they are within the parameters of other open distance education institutions in Europe. The reason why people with no scientific background choose these subjects reflects the growing interest in environmental problems in Portugal. This, once again, justifies the benefits of open distance education.

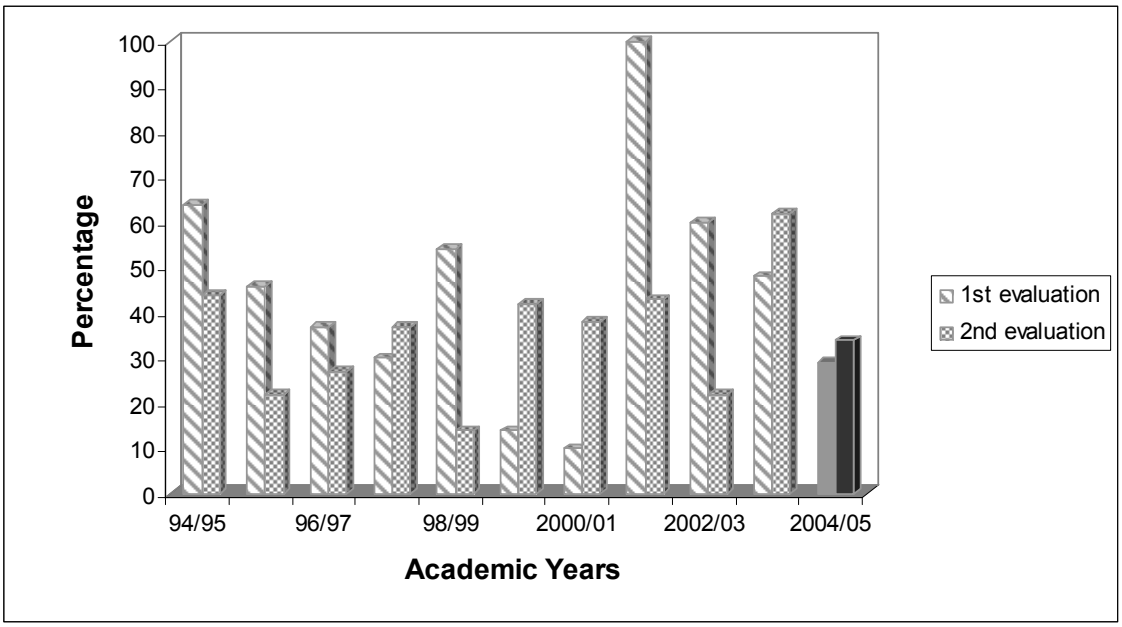

Fig.1 Student's Success Rate in General Ecology

In General Ecology it does not seem to be possible to find a trend in relation to the students' adaptation to distance education. In 2001 Caeiro *et al* had argued that lower success rates observed during the second evaluation period could be attributed to intellectual tiredness, frustration if previous evaluations had also been negative or an overload of study work owing to other subjects where the student could be enrolled.

However, throughout the years we can find examples of better and worse performances. Academic years like 2001/2002, where in the first final evaluation there was a 100% success rate, most probably reflect an unconscientious will of the lecturer to compensate the particular unsuccessful previous years. Nevertheless, it may be observed that, in a slow way, success rates have improved since 1994/95 to 2003/04. This may be related to the frequency students contact their teacher to question him about several issues (data not available), it may also be related to the fact that new forms of contact have been created (there is now a www page for General Ecology and it is known that information given on the web is a powerful factor to reach people (Silveira *et al*., 1998)) and also the experience lecturers acquire with the years.

The academic year of 2004/05 cannot be included in this evaluation since study materials were completely changed and it is only natural that a period of adaptation will be reflected in the results of the students.

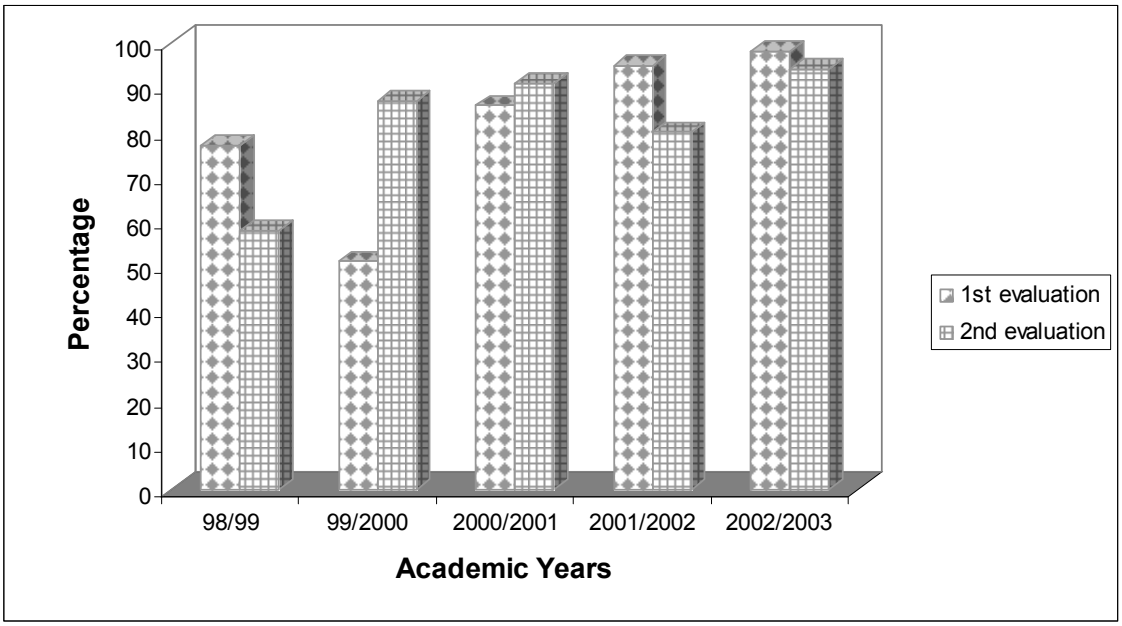

Fig.2 - Student's Success Rate in Environmental Education

The case of Environmental Education is completely different. Already Caeiro & Azeiteiro (*in press*) had noticed a positive evolution in the success rate of their students. They have related this fact with the type of students that enrol in the subject although the majority are still school teachers (though from different areas).

Environmental Education is a subject that is very appealing especially for school teachers. Both teachers of primary and secondary levels benefit from this subject since it is included in the programmes they are supposed to teach their students while they, themselves, have had no preparation for that. In general, the success rate of this subject is higher in relation to other subjects of Environmental Sciences, namely Ecology, either because students that choose it are highly motivated or because they feel the subject is important for their own professional performance or yet because they feel the subject is easier to grasp. However, the scientific background that students need to be successful in Ecology is more demanding than for Environmental Education which maybe makes comparisons unfair.

In future works it may be important to have data to evaluate students' interests and their expectations in relation to these subjects as well as how much the knowledge they have acquired have help them in changing attitudes towards environmental issues. This type of enquiries will be useful in the improvement of course programmes (Mayfield *et al*., 2003).

FUTURE TRENDS

What does the future hold for open distance education? Knowing that lifelong learning today not only is a requirement but it is also becoming a competitive necessity, the answer to the above question could seem obvious. However, if there is a good number of reasons for distance education become the best way to meet the learning needs of a world growing population, there are also some drawbacks and some forces against its wide spreading.

Demographic and economic predictions are essential in planning distance learning but they alone are not sufficient. One must take into account the rapid advances of technology, shifts in higher education audiences and learner profiles, faculty member's reactions, adapting campus cultures, and unsettled tensions between administrators, faculty members and distance learning leaders (Howell *et al*., 2003). In many countries, colleges and universities are looking to distance education to enable them to handle an increasing number of students. The online courses reduce the need for classrooms and provide the ability to handle a larger number of pupils without expanding the physical campus. In addition, because educational costs are always growing and university budgets are usually short, distance education may be seen as a solution for this problem. Nevertheless, with the economy in recession there are fewer resources for distance education initiatives (start-up expenses for distance education programmes are usually high).

One of the most apparent trends affecting distance education is the advancement of technology. The growing availability of **broadband** at home and new **wireless technologies** have the potential to improve the quality and availability of distance learning courses to students anytime and anyplace while, at the same time, reduce the costs of delivering information to learners. Infrastructures are growing stronger as computers double their speed and decrease cost, and high-speed network connections expand. Computer, fax,

picture phone, duplication and other modalities are merging and becoming available at cheaper prices (Centron & Davies, 2003). It is evident that there is a huge growth in the use of internet and technological fluency is becoming a graduation requirement.

Students are also putting pressure on institutions since they are requiring more flexibility in programme structures to accommodate their life responsibilities (full-time jobs or family needs). Knowledge and information are growing exponentially and instruction is becoming more learner-centred and self-directed.

From the faculties' side one must consider some important issues that may influence the future of distance education. Some faculty members are resisting technological course delivery. As long as distance education contributions are not considered in tenure and promotion decisions, and as long as professors have their own traditional ways of delivering their courses, many faculty members will be reluctant to participate in online courses (Oravec, 2003). Overall, faculty members that participate in distance education courses develop better attitudes towards distance education and also towards technology but lecturers who are dedicated to this system of education can feel isolated which will affect their satisfaction, motivation and potential long-term involvement.

For science related subjects, as is the case of Ecology or Environmental Education, these last drawbacks may be felt in a more acute way since lecturers are used to deliver practical lessons along with theory. From the students' stand point this is also important. One way of overcoming this problem will be the organization of practical sessions for small groups of students that will be repeated by other instructors elsewhere, or the creation of special

computer programmes with which students may have virtual practical training of different themes.

In summary, many trends in higher education will influence the future of distance learning. Howell *et al*. (2003) have enumerated 32 different ones focusing several aspects of the issue. In the end distance education has to rise to meet students' needs and expectations and the technological advances together with the increased fluency will contribute to open new opportunities for distance education.

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KEY TERMS AND DEFINITIONS

1 -Course design: setting learning objectives, media applications, planning evaluation.

2- Distance education: an educational methodology that makes use of a set of teaching materials, methods and resources that are available to those who want to learn in a self-learning regime, aiming to widen their knowledge or academic / professional qualifications.

3- e- learning: learning that is facilitated by the use of digital tools and content. Typically, it involves some form of interactivity, which may include online interaction between the learner and their teacher or peers.

4- Evaluation: both qualitative descriptions of pupil behaviour plus value judgments concerning the desirability of that behaviour. Using collected information (assessments) to make informed decisions about continued instruction, programmes, and activities.

5- Formative evaluation: refers to tests that are designed to measure students' achievement of instructional objectives; these tests give feedback on the extent to which students have mastered the course materials.

6- Open distance education: one of a group of terms that overlap with each other, including open learning, flexible learning, correspondence courses, and even supported self-study and resource-based learning. The main point about distance learning is that there is geographical distance between the learner and the teacher.

7- Pedagogy: the strategies, techniques, and approaches that teachers can use to facilitate learning.

8- Summative evaluation: refers to a test that is given at the end of a course or course segment; the aim of summative evaluation is to give the student a grade that represents his/her mastery of the course content.

9- Videoconferencing: communication across long distances with video and audio contact that may also include graphics and data exchange.

Fig.1 Student's Success Rate in General Ecology

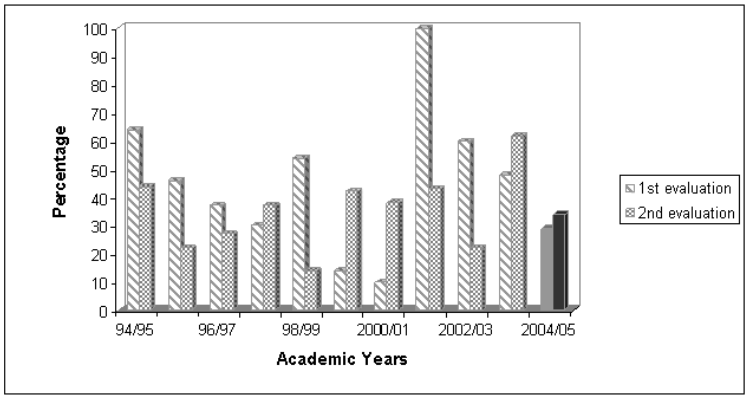

Fig.2 Student's Success Rate in Environmental Education