

A case study of successful e-learning: A web-based distance course in medical physics held for school teachers of the upper secondary level

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Abstract

Learning activities and course design in the new context of e-learning, such as in web-based courses involves a change both for teachers and students. The paper discusses factors important for e-learning to be successful. The development of an online course in medical physics and technology for high school teachers of physics, details of the course, and experience gained in connection with it are described. The course syllabus includes basics of radiation physics, imaging techniques using ionizing or non-ionizing radiation, and external and internal radiation therapy. The course has a highly didactic approach. The final task is for participants to design a course of their own centered on some topic of medical physics on the basis of the knowledge they have acquired. The aim of the course is to help the teachers integrate medical physics into their own teaching. This is seen as enhancing the interest of high school students in later studying physics, medical physics or some other branch of science at the university level, and as increasing the knowledge that they and people generally have of science. It is suggested that the basic approach taken can also have applicability to the training of medical, nursing or engineering students, and be used for continuing professional development in various areas.

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1. Introduction

This article concerns an online course in medical physics that upper secondary school teachers in Sweden can take and the ideas behind it. The major aim of the course is to provide teachers the knowledge and skills required for teaching physics in what for most of them is a new context, that of medical radiation physics and its applications. Since even many students of higher education do not remember much of the science they had in school, there is a common lack of concern for science and of understanding of it on the part of many adults. This is a genuine problem at a time when science is having an increasing impact on our daily lives, and when society is more in need of scientists than ever before. Physics is often considered a difficult and highly abstract subject and interest in it appears to have been on decline for

some time [1,2]. There is also a clear gender difference in the degree of interest students show in physics and how well acquainted they are with questions concerning it [3]. It is important that teachers endeavor to find means of counteracting this [4]. Many initiatives have been taken to enhance interest in physics and in science generally. An example is that of *Physics on Stage*,¹ a programme for European science teachers initiated by CERN, ESA and ESO in 1999 in response to the Call for Proposals for the European Science and Technology Week in the year 2000, which the European Commission sponsored. A current project announced by *The International Union of Pure and Applied Physics* is the *World Year of Physics 2005*,² a global celebration of physics and its importance in our everyday lives. Alongside these international ventures, there are a variety of domestic and local initiatives aimed at encouraging the study of physics.

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¹ <http://www.physicsonstage.net>.

² <http://www.physics2005.org/>.

An approach often employed has been to show how applicable physics is to real-life problems and problem solving [1,4–6]. A physical phenomenon that can be used to elucidate this is that of *radiation*, with the practical applications it has in the areas of medicine and healthcare, e.g. diagnostic imaging and cancer therapy [7]. Medical imaging involving the use of ionizing or non-ionizing radiation can serve as a point of departure, for example, in providing students access to large segments of contemporary physics [6].

For the interest of young persons in physics and engineering to be enhanced, it is important that there be high school teachers with the motivation and knowledge for teaching contemporary physics in a manner that is exciting and stimulating. The National Agency for Education in Sweden has made efforts to encourage interest in science in the schools by letting pupils study themes and topics not offered in the normal school curriculum. To give students the encouragement and support they need in this respect, it is important to provide teachers appropriate training, not only in teaching methods but also in specific school subjects not covered in the ordinary education and training of teachers, an approach termed continuing professional development, CPD.

2. The Net University

In view of the rapid advances in e-learning during the last few years, the Swedish government established a Swedish Net University³ recently, a multimodal university offering some 2500 e-learning courses held by different universities and university colleges in Sweden. Many of these courses are given by Lund University,⁴ one of Sweden's oldest, largest and most comprehensive universities, with eight faculties and a variety of research centres and specialized departments. Students can choose between some 50 programmes of studies and over 800 separate courses on campus. In 1996, Lund University initiated an intensive, target-oriented project involving both distance education and continuing education, establishing The Office for Continuing and Distance Education (OCDE), which has played a central role in the development of the online distance courses the University has provided. In the last few years, Lund University has gone from holding only a few traditional distance courses to offering more than 150 online courses. These are a mixture of pure online courses in which students meet only virtually, and of courses given in a blended mode [8] in which online learning is supplemented by a number of face-to-face meetings and various other activities. Expansion in this area was spurred by extra resources being made available to encourage separate departments and individual teachers to develop or improve online distance courses. The university has also established The Learning and Teaching Development Centre⁵ (UCLU),

thorough integration of the two former units for IT and education and pedagogical development, providing consultation and support for the university teachers involved.

One of the first online learning courses that was held at Lund University was “*Radiation in Medicine and Healthcare*”, developed and given by the author and his colleagues. The course was intended primarily for science students, engineers, medical students, nurses and those with a technological profession who wanted to obtain more thorough knowledge of radiation and a certain orientation to the medical use of it. The fact that medical radiation imaging is such an excellent source of applications within the area of modern physics led to the idea of a new course, “*Medical Physics for teachers*”, held in collaboration with The National Centre for Education in Physics,⁶ located at the Department of Physics of Lund University.

Although the major target group for this course was that of physics teachers at the upper secondary school level (also referred to here as “high school teachers”), the course is also one that could serve as an introductory course for healthcare professionals. There are some 100 persons, most of them teachers and some of them engineers, who have completed and passed the course thus far. The results have been very gratifying, particularly since many of the participants teach and supervise the work of high school students on special study themes within this area.

As teachers they work either alone or in teams often composed of physics and biology teachers. One direct result of the course that has already been observed has been an increase in the number of high school students who show an interest in the Medical Physics Programme in their university studies. The number of students applying to that programme in Lund as their first choice has increased by a factor of 7 (6–42) within the past 4 years and this fall (September 2004) a majority was females (60%). The remainder of the paper concerns in large part how the *Medical physics for teachers* course is given. It is one of the many e-learning courses which Lund University provides, one that can be seen as highly successful.

3. Learning and teaching online

Online learning is so effective and well provided for today that it is difficult to argue against its being successful, as was done at the very start. It is obviously moving more and more from representing an instruction paradigm to becoming a learning paradigm, a distinction made in pedagogical theory [9]. In an instructional paradigm, a specific methodology and a specific body of knowledge determine in large measure what the teacher does, including planning, choice of content, the lessons given and the tasks assigned. On the contrary, the teacher with a learning perspective provides students support, the students themselves actively discovering knowledge and

³ www.netuniversity.se.

⁴ www.lu.se.

⁵ www.uclu.lu.se.

⁶ www.fysik.org.

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