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Numerical Methods: An Online Course

Rogelio Ramos Carranza.*, Armando Aguilar Márquez., Frida M. León Rodríguez, Omar Garcia León, Miguel N. Pineda Becerril, Juan R. Garibay Bermúdez.

Universidad Nacional Autónoma de México, Av. Universidad 3000, Colonia UNAM, 04510, México

Abstract

The purpose of the present investigation is the design and implementation of an ***on line*** Numerical Methods course for the college level (undergraduate), to students from different areas of engineering.

The investigation sets out to prove that the course will give good results in achievement, considering the fundamental theoretical aspects of online learning.

Well as classroom courses the main element is the interaction, so too, the treaty course the key element here is the interaction, in its different types: student - teacher, student - content, student - student, teacher-content, etc.

Overall, this proposal is based on the theory and practice of online learning [1].

The implementation of the educational experience will be held at the Faculty of Higher Studies Cuautitlan (FESC by the letters in Spanish of: Facultad de Estudios Superiores Cuautitlán) of the National Autonomous University of Mexico (UNAM by the letters in Spanish of: Universidad Nacional Autónoma de México), with students of university degrees in Industrial Engineering, Food Engineering , Chemical Engineering , and Technology; university courses where the subject of numerical methods , which is being considered here, is studied.

It is noteworthy that the FESC currently there is no curriculum online course, that's why we are proposing an on line course, which can be used to support classroom courses (Face to face) or as a course that conducted online only.

It is also important to note that this investigation is a proposal that has been started and is currently in development and expected that the benefits and disadvantages can be registered.

Another aspect highlighted is the fact that possibly exist thousands of courses numerical methods, then the justification for this work will be done on the basis that each course will be designed according to the beliefs and needs of the population which is directed in this case refers to a Mexican rural context, corresponding to the city of Cuautitlán Izcalli in the State of México.

* Corresponding author. Tel.: +55-5518740522; fax: +55-56231886.
E-mail address: egorrc@gmail.com.

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Keyword: On line, course, numerical methods

1. Introduction

The numerical methods course online is designed in accordance with the plans and curricula for the various university programs that have been proposed. Importantly, the issues considered here, entirely covering the contents of the subject of numerical methods for each and every one of the careers who attend the said subject.

In general, all programs of the subject corresponding to the careers of Industrial Engineering, Food Engineering, Chemical Engineering and Technology college career; topics are considered:

- Numerical Solution of Algebraic Equations
- Methods of solving Linear Algebraic Equations Systems
- Interpolation, Differentiation and Numerical Integration
- Methods of solution of Ordinary Differential Equations
- Methods of solution of partial differential equations

So, the course proposed here contains the topics mentioned above.

The course content is supported with material consisting of a lesson with the mathematical development to obtain the formulation of the method, a presentation with a worked example and an executable program built in programming language C + +, that solves the corresponding method and these elements are considered for all items on the content of the subject that is being studied.

Another fundamental aspect to be considered for the design of the course is that the activities include three groups of learning modes, ie, we consider resources and activities of the own platform that has been selected (MOODLE) for completing the course.

These resources and activities are designed in such a way to support the content in the "what" you want to learn (the facts), the "how" can be learned (procedures) and the "why", which justifies the use and application of method, such supports are rooted in different theories of learning in general and specifically online.

The research was conducted by a team of researchers teachers belonging to the department of mathematics at the Facultad de Estudios Superiores Cuautitlán (FESC, for its acronym in Spanish) of the National Autonomous University of Mexico (UNAM, for its acronym in Spanish).

2. Problem

There has been the need to provide a form of support to students in not having to travel to campus in preferential schedule according to the needs of each student.

3. Hypothesis

Considering a course designed based on theories of learning, students can achieve a better use in the course of numerical methods due to the support received from the online course.

4. Methodology

The theoretical reference used to substantiate the course components is related to the role and function of learning theory (or even the theory of education) online, as well as the development and delivery of numerical methods online course.

Two essential aspects are considered, the foundations of educational theory for online learning and vision or approach towards a theory of online learning,.

It may be that the students to whom the course is aimed to benefit significantly from learning to see, when they learn by audiovisual and computer, which has already been found by other researchers [2], likewise, he believes that technologies are only means by which instruction is delivered, but have no effect, by themselves, on student achievement. These studies also determined that the explanation of benefits is not the medium of instruction, but rather are the instructional strategies used in the development of instructional materials for the course.

Learning is more influenced by the content and instructional strategy of learning materials, which by the nature of technological resources used for the delivery of instruction. [3]

What it has to do with the quality of learning depends on the instructional strategy rather than technology [4], therefore instructional design must consider challenges in activities through which students can relate new information to old and thus acquire useful knowledge and allow use their metacognitive skills.

What allows the student to learn is the instructional design, i.e. the design of models of reality, simulations and interactions with the students. The medium influences learning, but is not the computer that allows the student to learn [5].

It has been vital in the design that online learning should have high demands on authenticity, i.e., students should learn in the context of their workplace. High demands on interactivity and high collaborative demand.

A notable aspect is referred to the idea that online learning has to be used here and which you can find multiple definitions. A definition is understood as educational material presented on a computer [6] is defined as an innovative approach for delivering instruction to a remote audience, using the Web as a medium [7].

Learning strategies have been selected in order to motivate students, to facilitate processing depth, attend to personal differences, promote meaningful learning, encourage interaction, provide feedback, facilitate contextual learning and provide support during the learning process.

Learning schools are classified broadly into three or four, the Behaviorist school, Cognitivist, Constructivist and Humanist. Behaviorists say that learning is a change in an observable student behavior through the stimulus it receives from the environment. Cognitivists ensure that learning requires the use of memory, motivation, thought and reflection that plays an important role in learning. Constructivists ensure students interpret information and the world according to their own reality, and learning by observation, processing and interpretation and then personalize the information within personal knowledge.

Have been considered in the design of the online course basically three schools listed, to include different learning styles or abilities .

The strategic elements of each of the three schools of learning considered, can be used to teach the "what" in the case of the behaviorists, the "how" in the case of the cognitivist and the "why" through strategies constructivists, in this case to promote meaningful learning, situated and contextualized, using a high level of thinking.

Behavioral strategies allow teach the facts and are used in the implementation of the course to show the formulations, algorithms or mathematical expressions of the methods discussed in the course. Cognitivist strategies will be used to teach the processes or procedures to be followed in the development and application of numerical methods included in the course. Constructivist strategies aim to develop a high level of thinking.

Namely a model based on the educational theory showing learning components of fundamental importance is proposed, which can be used in the design of materials online.

It is understood that online instruction occurs when students use the Web to browse through the sequence of commands or instructions to engage in learning and achieve both learning outcomes and objectives.

5. Expected Results and Conclusions

A good online educational theory allows us to observe basically 3 functions [8]. First, it helps us visualize new conceptual universes. A good theory helps us to do things, so it is expected that the theory considered in this work allows accessing an overview ("Big Picture") to help make sense of the methodological suggestions. A good theory can produce a work with honesty.

An online course is more flexible at least in time and space than education on campus (face to face). The Web provides more quality and quantity of access to all nearby users. It is understood that asynchronous interaction defines text-based environment. The theory of online education needs to educate teachers for making decisions about which technology options are best placed for application.

The largest capacity of the Web for educational purposes is deep and multifaceted development of communication and interaction opportunities that this provides. Communication technologies are used in education to improve the interaction between all participants in the educational transaction.

We can expect good results of online learning, as all forms of quality learning that are focused on knowledge, assessment, and student community.

The task in this investigation for development of the online course was to select, adapt and refine educational activities that maximize the potential of the Web.

The models used in this study do not represent a theory of online learning, but they are expected to help deepen our understanding of the complex educational context and lead to hypothesis, predictions and continued improvement in our professional practice.

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