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Model for the development of Interactive Computer-based Educational Environments Learning Objects for the area of mathematics

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Abstract—Development of Interactive Educational Computer Environments (for its acronym in Spanish, EDIC) allows to complement the teaching and learning process as these have the functionality of a support tool in this specific case of mathematics, besides being based on Learning Objects (LO) that have been experienced in the upper level. In this paper we present and specific development model based on the Unified Process (UP) which leads to the implementation of a DTIS also the roles that have been considered to develop a virtual scenario of this type.

Index Terms— Virtual Learning Environment, Development model, Learning Objects, Software engineering.

I. INTRODUCTION

In recent years the integration of Information Technology and Communication (ICT) in Virtual Learning Environments (EVA) has become a need for the development of new educational tools as well as process using ICT is add other pedagogical elements from sociocultural theories of learning. ICT has encouraged the development of these approaches that provide good support for learning achieving student and teacher interaction with the scenario so that become necessary in the process of teaching and learning [1].

Virtual environments known materials or tools for teaching and learning based computer systems are part of academic training at different educational levels and that analyze, teach and learn in different spaces and times [2]. EVA concerning different topics that are intended to address are set in academia, in this work specified in the study of mathematics so it is considered that mathematics has a certain degree of difficulty, however, is the science more importance to the study of any career so currently it requires different tools and learning strategies. Generally, ie, taking into account that for any subject upper level is necessary to use tools to stimulate awareness and considering that each person holds and learn information with different study techniques, said before been required virtual scenarios as support during the process of teaching and learning. Considered as an example of the above, the Centro Universitario UAEM Valle de Chalco of the Universidad Autónoma del Estado de Mexico has seven degrees of which at least four of them is highly required the intervention of mathematics for training.

There are various educational materials to solve problems related to the learning of mathematics in various educational levels. In this paper an educational tool based on real and simple situations to interact, so that the subject taught are seeking to obtain because of student interaction with the scenery and activities described in the scenario analyzes, this tool is called EDIC (for its acronym in Spanish) which has its beginnings from the didactic proposal.

One of the characteristics of an EDIC is the exploitation of paradigm based learning as it is considered that learning is activated when the student discovers knowledge during problem solving. For the development of this type of education, skilled digital resource Centro Universitario UAEM Valle de Chalco, in contribution with the Center for Advanced Research of the National Polytechnic Institute (CINVESTAV-IPN) have worked in different models and processes which seeks development EDIC [4].

To develop the EDIC the minimum elements to be considered and that characterize a EDIC then take into account the following defined [3].

- Instructions for Teachers. Teach the concepts specified. Description of development activity, and proposed times for their development.
- Instructions for the student. The student activity performed is explained further shows the time available for such activity.
- Theme. Some definitions and concepts that students must know to understand the issue are explained.



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- Questionnaire. Questions for the student to be able to respond through interaction with the Virtual Stage standing.
- Learning Objects. The concepts that the student must know to understanding the issue is defined. Examples that illustrate the subject are placed.
- Proposed exercises. An extensive set of graded exercises and laminates are placed, whose solution is directly and inversely and in different registers of representation.
- Auto-evaluation. A number of problems are placed for selection. The review of the self-assessment should highlight areas that are suggested to review the student.
- Resources. Web applications such as learning tools are proposed. Electronic bibliography of books, programs, software, blogs, etc. are presented.

Each of the above sub-items are considered elements of the EDIC as proposed by [3]. It was suggested from the beginning of the project users interact on stage, which refer to each section that can intervene as shown in Fig. 1. The user named visitor is having restrictions on the EDIC as it considers that a self-assessment and some exercises are required to be supported by a teacher, since the EDIC is used to support learning and teaching, students and teachers are those who do not have any restriction on stage as shown below.

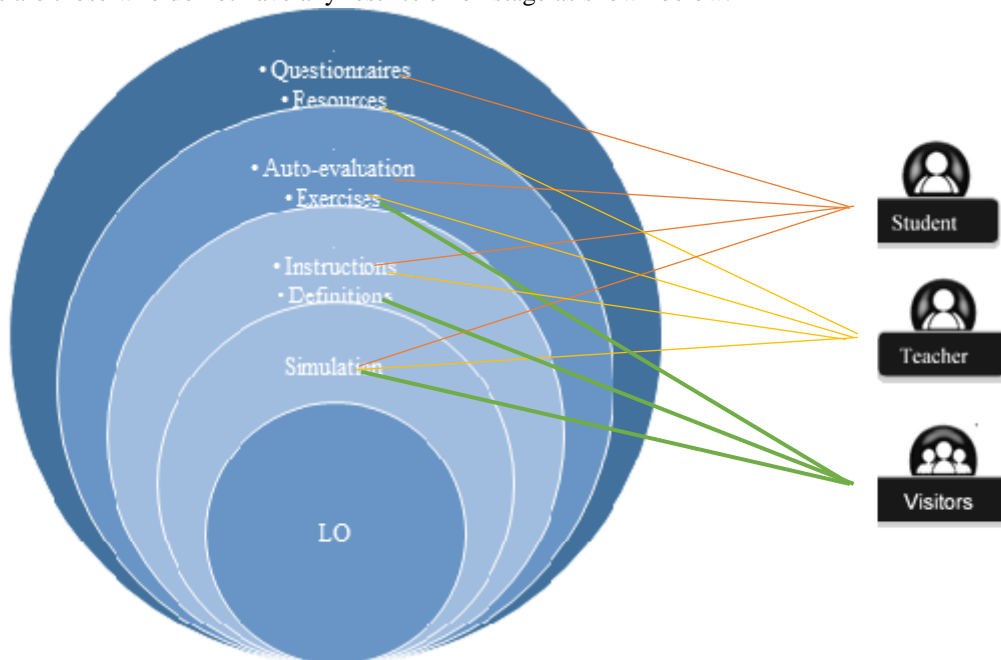


Fig. 1 User of EDIC.

Learning Objects

As part of the elements of a EDIC a section where simulations or animations on the subject you want to understand will have set, so that finding these OA that were incorporated into the virtual stage for this is done they selected three OA that meet the following characteristics:

- Simulating the real world: Simulation on an interactive environment aims to facilitate users to obtain response to questions. By integrating simulation in the EDIC allows students to learn by doing through real world experiences and testing the knowledge of the same object.
- Unit exercise. Through exercises related to the subject you are studying, students can interact and perform actions and practices with the simulator.
- Providing a higher level. Meets the needs according to the degree in which the EDIC focuses.
- Relationship and thematic content. Allows students to focus on one subject and use different concepts related to knowledge as a resource.
- Usability quality. Quality of Service presented by LO aims that the user does not have problems interacting with the object.



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As a result the following LO which meet the above was obtained:

Learning Object	Objetive	Description
Air Balloon	The LO done inFlashaims to introducethe concept of realrootsof a function.	Theappletis to simulatea cylindrical containerandglued to thebottom of the containerwhere the mainactionis to inflateanddeflate the balloonandfill or emptythe containerspherical globe. It is proposedthat containinstructions forthe studentand the teacher.The conceptsdiscussedinthisappletare:water depth, globe and containervolume andradio.
Pulleys	Understand the subjectmatterpulleyDifferentialand Integral Calculus.	The LOhasPulleysviews fromthe simulationinstructionsdescribingtheactivity whichhas threedifferent exerciseswithin the samethemepulleys.
Barrel	The LObarrelwill be necessaryto address the issueofmaxima and minima ofdifferential calculus.	The LObarrelcontain theinstructions to thestudentwhere the activityinwhich you mustfind thebase diameterand height of thebarrel so thatthe maximumvolumeisdescribed.

Table 1. LO in the EDIC.

Once obtained the above role model to develop an EDIC is established. A model is defined as a representation of a portion of the functionality, structure and / or behavior of a system of [5]. Development of Model Driven Software (DSDM) is a discipline that works as outstanding to conventional methods of producing software alternative, more oriented to the space of the solution space of the problem. According to Ana the DSDM encourages the use of models during the development process, and allows that can be processed to obtain the source code of the software product [6].

II. DEVELOPMENT MODELS

The model [5] defines it as an abstraction of the system, specifying the modeled system from a certain point of view and at a certain level of abstraction. For good results used a methodology for development, we have variety of methodologies that can be considered when developing software for the efficient outcome is considered that a model is developed with the following [7]:

- A model must present a series of approximations and assumptions and consequences, which must present reality.
- A model is developed for a specific purpose and must be done to be useful for this purpose.
- A model is developed for the need to collect and establish all major aspects system.

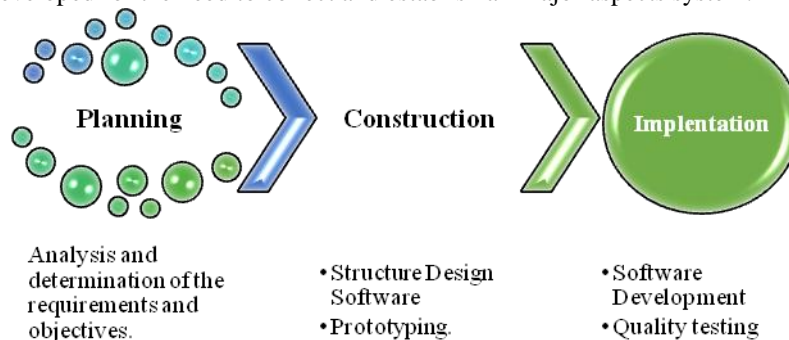


Fig. 2: Development Process EDIC.

Basically a methodical framework for the development follows the stages of the life cycle of software development, as they are; analysis which allows to answer the question what software is to build? To answer this question, it determines the type of software being developed, analyzed the problem to solve, in the next step requirements are determined and specified to be performed by the system where the question is resolved, what can

the system?, continues with the design stage where the question is asked, how does the system?, as the name implies designing prototypes in this way makes the architecture of the proposed system is obtained by [8], later to carry out the implementation stage is achieved by executing the data stated above. In Fig. 2 shows the steps that will be used for modeling the EDIC.

III. RESULTS

Detailed Development Model

Stage of planning and preparation of DTIS. This phase of the development process to set the plan that guides, plus get the issues that will form part of the scenery as well as obtain the necessary requirements and implement prototypes for structuring the virtual environment, in the diagram below details each one of the points that make up this stage, in the fig. 3.

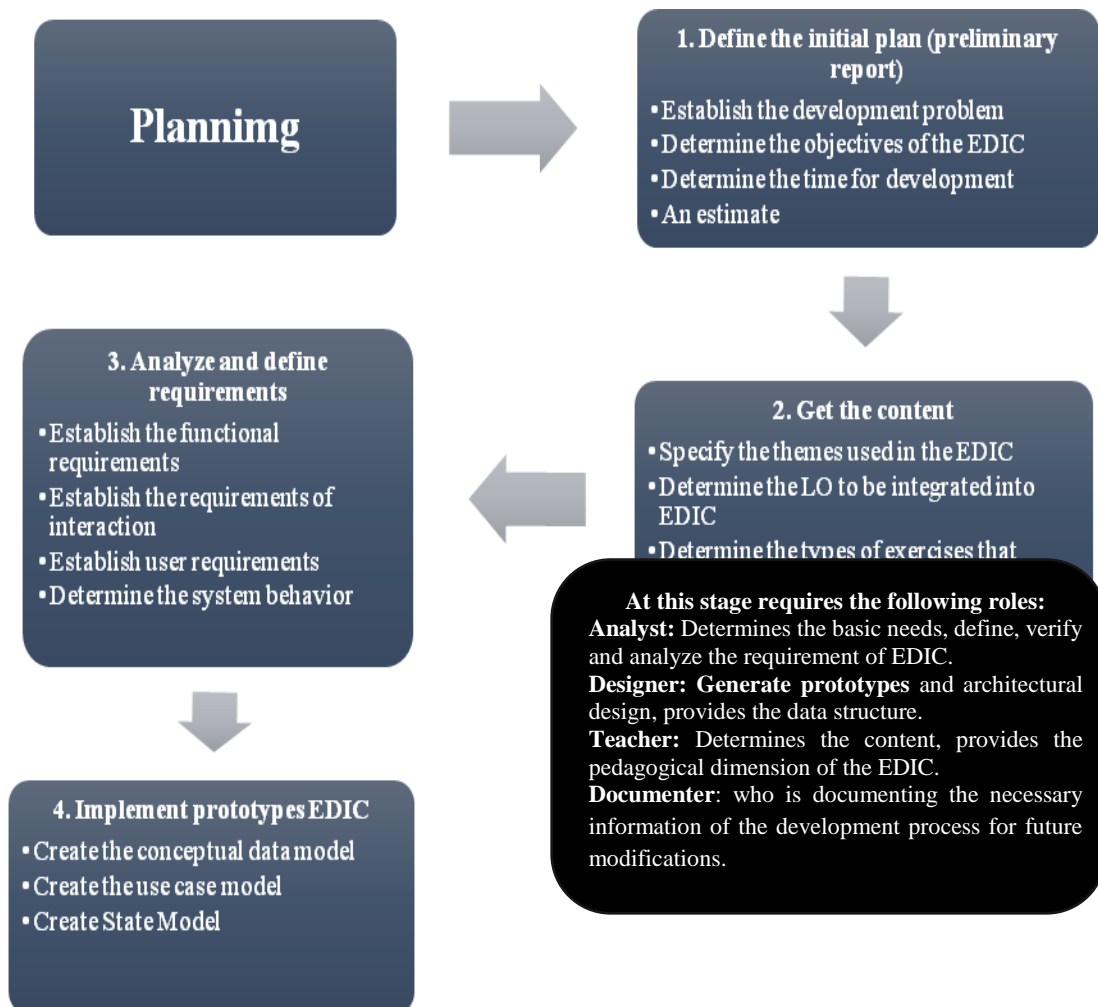


Fig. 3. Planning of EDIC

Stage of construction: construction is a very important step which determines whether the above process has been successfully established, begins with the analysis of technological tools for the development of prototype set also design different high-level diagrams and design database which enables to control not only user authentication called visitor, teacher and student, but also on the results of self-assessments that teachers can consult the student, this show in the fig. 4.

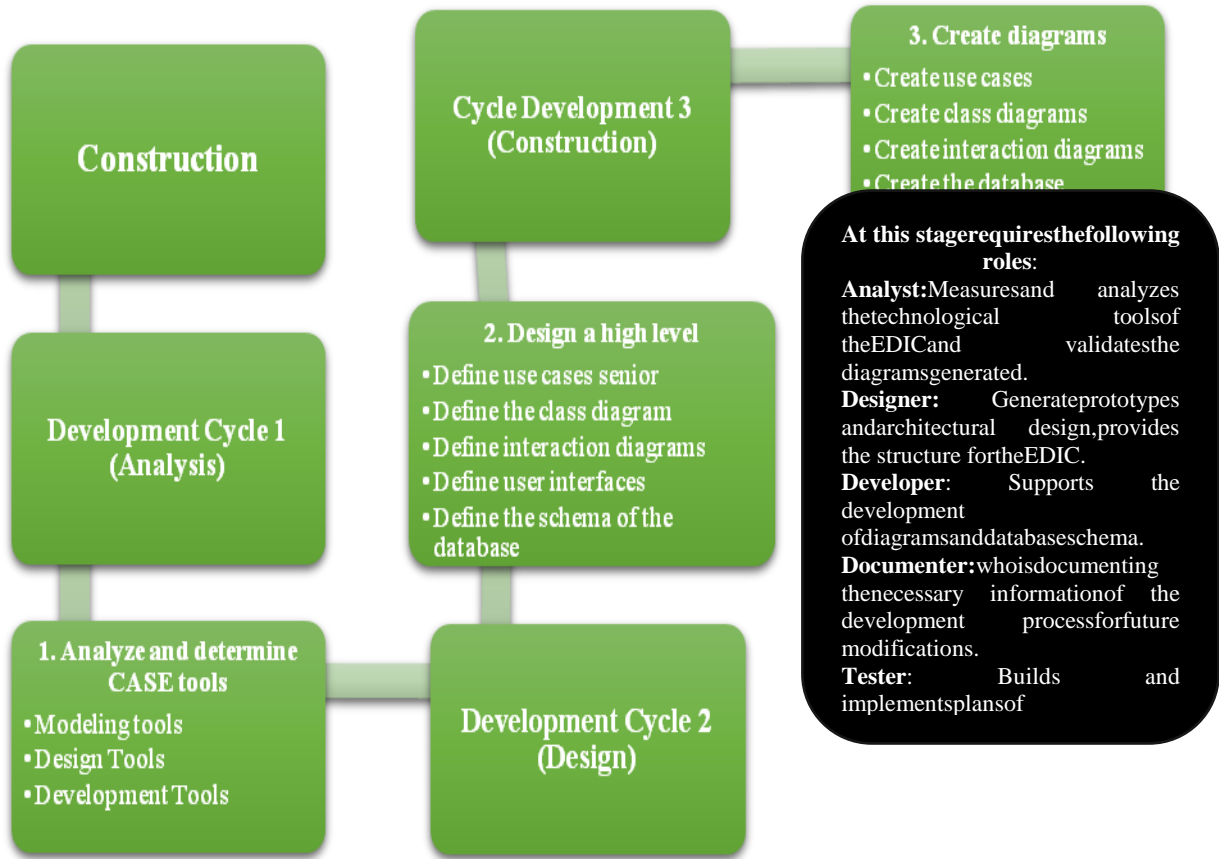


Fig. 4. Construction of EDIC.

Implementation stage. Carried out the implementation of the provisions of the previous stages. Once completed the final draft EDIC tests to later make changes and improvements are made EDIC, this is presented in the fig. 5.

IV. CONCLUSION

It is noteworthy that all the roles that arise are related and interaction between each of them, though mostly they are all related to the analyst because it is who is involved with the user and besides being who determined through an analysis requirements that software must meet.

The EDIC is considered a not very long project so it is convenient to perform the unified mainly be iterative and allowed to plan step by step creation of prototypes exploring the functional areas or techniques so that it has reduced risks of process implementation.

After obtaining the results of this evaluation is intended to carry out the project to different platforms, thanks to development tools that are compatible with mobile devices were used is to focus on the availability of this educational resource Smartphone, since in the technology currently focuses primarily on these devices.

As future work should proceed with the development of the EDIC, and subsequently proposed to carry out the assessment to students, teachers and general users to confirm operation of interactive learning environment to further integrate academic training.



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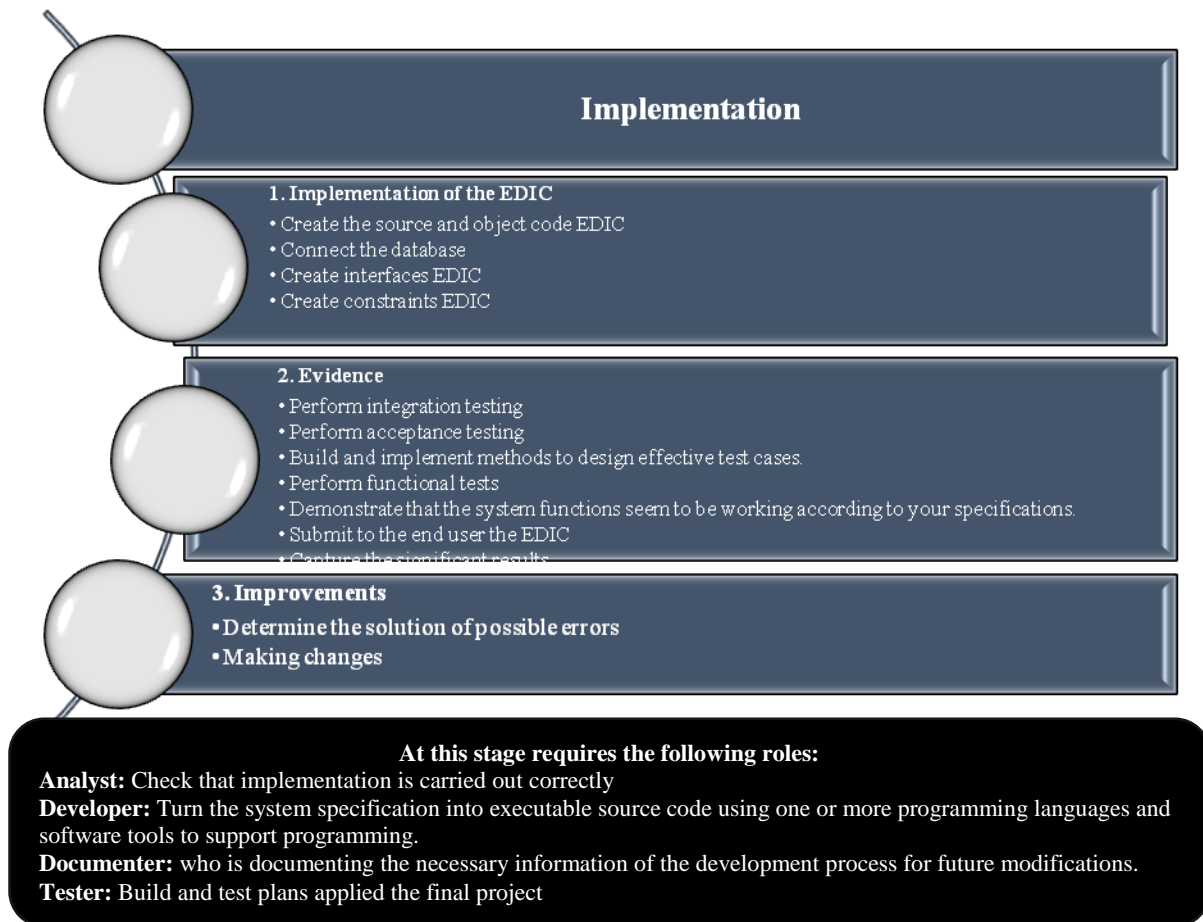


Fig. 5. Implementation of EDIC

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