

IDEL - A simple Instructional Design Tool for E-Learning

A. Zimnas, D. Klefouris, and N. Valkanos

Abstract—Today's Information and Knowledge Society has placed new demands on education and a new paradigm of education is required. Learning, facilitated by educational systems and the pedagogic process, is globally undergoing dramatic changes. The aim of this paper is the development of a simple Instructional Design tool for E-Learning, named IDEL (Instructional Design for Electronic Learning), that provides the educators with facilities to create their own courses with the essential educational material and manage communication with students. It offers flexibility in the way of learning and provides ease in employment and reusability of resources. IDEL is a web-based Instructional System and is designed to facilitate course design process in accordance with the ADDIE model and the instructional design principles with emphasis placed on the use of technology enhanced learning. An example case of using the ADDIE model to systematically develop a course and its implementation with the aid of IDEL is given and some results from student evaluation of the tool and the course are reported.

Keywords—Education, E-learning, Instructional Design.

I. INTRODUCTION

EDUCATIONAL institutions, teachers and teaching procedures influence the pedagogic process and the learning context, as well as the broader societal context [1], which is the environment outside educational institutions including political, economic, technological and socio-cultural aspects [2]. On the other hand the societal context influences institutions in their structures, strategies, management processes and means of operating including technology and individuals [3], as well as the context of learning.

A review in the literature of digital learning cases reveals that most tertiary educational institutions acknowledge the importance of using Web-based learning. We are witnessing a paradigm shift in the ways in which the transfer and management of knowledge is handled. Traditional learning approaches are no longer effective in developing, acquiring and disseminating knowledge continuously and in a timely

A. Zimnas has graduated from the Department of Informatics of Alexander Technological Educational Institute of Thessaloniki, Greece (phone: +30 2310 791299; fax: +30 2310 791290; e-mail: zimnas@it.teithe.gr).

D. Klefouris is a professor in the Department of Informatics of Alexander Technological Educational Institute of Thessaloniki, Greece (phone: +30 2310 791299; fax: +30 2310 791290; e-mail: klefouris@it.teithe.gr).

N. Valkanos is an assistant professor in the Department of Informatics of Alexander Technological Educational Institute of Thessaloniki, Greece (phone: +30 2310 791298; fax: +30 2310 791290; e-mail: valkanos@it.teithe.gr).

fashion needed today [4].

Recent rapid advancements in ICTs have contributed towards an immense growth in global computer networking. E-learning is a positive shift in the academic knowledge management world. A widening of the principles and concepts of the learning process is required. Technology should not only support the co-ordination of work processes; it should, additionally, serve the learning needs. The available information and communication technologies tend to be facilitators for more student-oriented applications and for more participation in order to implement empowerment. Scientific knowledge and skills regarding the tools used, the methods, the administration and the evaluation of education and technology should be taken into account. Furthermore, the compatibility of the working experience of the applicant should be included in the requirements, in accordance with the goals of the course. During the last years there is an increasing emphasis put in the specification of objectives and learning outcomes of academic courses.

Many universities and learning organisations have been developing courses using a variety of media, multimedia and hypermedia, with most common the World Wide Web (WWW) and the Internet, to deliver distance education programmes, with e-learning being the most popular form. In parallel, Learning Management Systems (LMS), like WebCT, Blackboard and Desire2Learn, have been advanced in order to enable educational institutions and corporations to manage their networked learning delivery.

E-learning refers to the use of Web-based technologies and applications in order to deliver a broad range of on line learning solutions where the learning context can be accessed from the web via computer and the educators/learners can communicate with each other using e-mail or discussion forums. However, if we focus too much on the technology aspect of the e-learning system and less on pedagogical and educational issues we are unlikely to be able to deliver solutions of a high learning quality. The potential benefits of e-learning in facilitating "always on" learning can only materialize when learning solutions are introduced as part of a well-planned, specific goal focused and adequately supported educational environment.

Designing e-learning is a combination of instructional design, usability, and information architecture. These principles are important for creating student-focused learning materials. The knowledge background of every person involved in the development process needs to be placed in a

suitable context.

Tested and successful face to face teaching practices do not translate and transfer easily to successful interactions inside the e-learning environments. Online courseware and communication tools are not as accessible for the learner as they claim to be, due to the technologies involved being not as natural or intuitive to use. It is necessary therefore to study the contribution made by the Computer Supported Cooperative Work (CSCW) and Communities of Practice (CoP) movements [5] - [7] (and develop the mechanisms for the realignment of human and technology resources across institutions and organisations, and a realignment for the development of the environment with their particular needs in order to improve efficiency and quality, enriching, thus, previous works of other researchers to this direction [8] - [10] and in online professional development [11].

The structure of this paper is as follows: section II will briefly discuss Instructional Design, Instructional Systems Design and the ADDIE ISD model in an attempt to define the formal aspects for the development of the IDEL (Instructional Design for Electronic Learning) tool and the e-learning course. Section III will present the phases of analysis, design and development of the course. In addition, the various modes of operation available in the constructed tool IDEL and the relative screen forms that students and educators use extensively will be presented. More, some results of evaluating the learning impact of the course as well as the quality of operation of IDEL will be reported. Finally section IV will summarise with concluding remarks and ideas for future work.

II. INSTRUCTIONAL SYSTEMS

To achieve active and meaningful integration of technology in the everyday teaching and learning process, it is important that technologies are integrated pedagogically and harmoniously by using Instructional Systems.

Instructional Systems aim to support and partially automate the instructional process on a knowledge area, such as a course, a seminar or a series of lectures [12]. The instructional process refers to the combination of all the actions that

educators and learners perform to achieve best learning objectives. Instructional Systems consist of resources that are classified in three categories: human, educational and technological ones. According to the educational philosophy and the available learning resources, instructional systems differ from each other. Of particular importance is the one that is open, in the sense that learners are at the centre of the system and around them are all the resources and tools facilitating the learning process.

A. Instructional Systems Design

To build a successful Instructional System a teaching and learning design methodology which facilitates the process of course design with an emphasis on the use of technology enhanced learning must be adopted. The most widely used methodology for developing new learning programs is called Instructional Systems Design (ISD). It is also known as Instructional Systems Design & Development (ISDD), the Systems Approach to Training (SAT) or just Instructional Design (ID). This approach provides a step-by-step system to the evaluation of students' needs, the design and development of learning materials, and the evaluation of the effectiveness of the learning intervention. The application of a systems approach to learning insures that educational programs and the required support materials are continually developed in an effective and efficient manner to match the variety of needs in an ever rapidly changing environment.

Instructional Systems Design combines instructional practice, research and theory into a methodology for learning development that is systematic (inputs produce outputs which in turn, become inputs) and systemic since the components have a symbiotic relationship [13]. The goal of ISD is to create successful learning experiences and to create transfer of learning. ISD provides a road map to guide designers and instructors through analysis, design, development, implementation and evaluation to the goal as it appears in Fig. 1 [14].

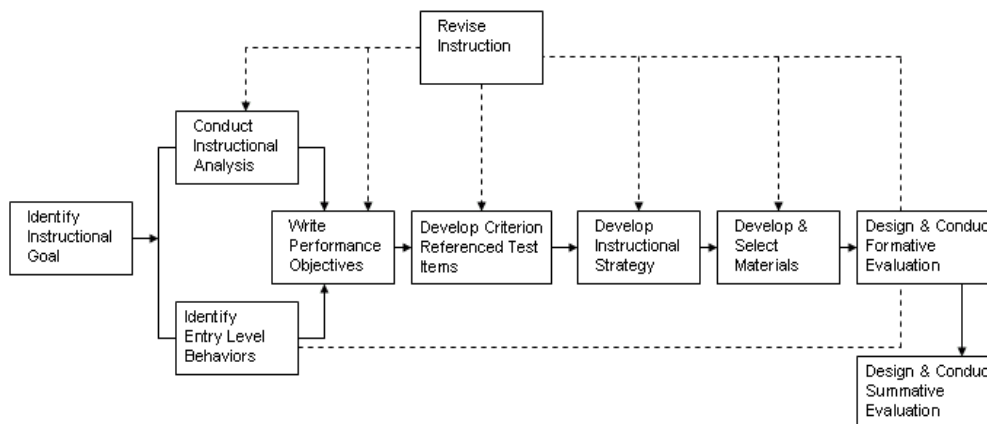


Fig. 1 Dick and Carey Model (Systems-oriented)

ISD is based on an instructional design model which is a representation of a view on how people learn. The main goal of an ID model or process is to construct a learning environment in order to provide the learners with conditions that support the desired learning processes. They normally cover the five phases of developing an ISD, while formative evaluations are embedded in each of the five phases for judging the value or worth of that process and while the program activities are happening. Most model creators subscribe to one or more learning theories which shape their model. If the creator is a behaviourist, a cognitivist or a constructivist the model will reflect that theoretical background. According to [15], instructional design models have the ambition to provide a link between learning theories and the practice of building instructional systems. According to the taxonomy defined by [16], models are described as being classroom oriented, product oriented or systems oriented. Systems oriented instructional design models aim to provide "a complete instructional system for managing learning needs" [17].

People with a relevant background in Information and Communication Technologies (ICTs) are normally responsible for developing an e-learning system, or designing suitable tools for developing an e-learning system. It is reasonable to assert that they need to be guided by people who have appropriate knowledge and suitable background in Instructional Systems Design Methodologies, since the deliberate and intentional act of communicating content to student (educational communications) and the technologies in which they are encoded are conceived, analysed and designed by educational analysts [18]. Effective instruction in any mode (traditional or networked) is a result of careful planning that follows a transparent process from the project idea to evaluation and review. Thus, in developing an e-learning system there is a need to face the matter in a systemic (holistic) approach.

B. The ADDIE Model

In delivering instruction various models have been proposed. The most well-known and frequently used models in Instructional Systems Design are usually based on the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) concept. The ADDIE model is a generic and systematic approach to the instructional design process which provides instructional designers with a framework in order to make sure that their instructional products are effective and that their creative processes are as efficient as they can possibly be [14]. This fundamental model consists of the five steps mentioned above which are found in almost all ISD models. Each step has an outcome that feeds the subsequent step. During the phase of analysis, the designer identifies the learning problem, the goals and objectives, the learners' needs, existing knowledge and any other relevant characteristics. Analysis is also concerned with the learning environment, any constraints, the delivery options and the

timeline for the project. The design phase documents specific learning objectives, assessment instruments, exercises and content. The actual production of learning materials is completed in the development phase. During implementation, a procedure for educating the learner is developed and the materials are delivered or distributed to the student group. After delivery the effectiveness of the learning materials is evaluated.

The ADDIE ISD model covers the whole process of development of learning programs from the minute the question "what must the students learn" arises to the minute the question "did the students learn what they needed?" is submitted and also provides a complete linear process which manages the development of a course's design. Its methodology consists of the five phases mentioned already and each phase is characterised by a set of activities and a project output in the form of a tangible deliverable. The deliverable for one phase is the input for the next one. Each phase of the ADDIE model is an important element of the instructional design process. In each phase the instructional designer makes decisions that are critical for ensuring the effectiveness of the instructional experience.

An adaptation of the basic framework structure and, subsequently, its transformation in order to satisfy the needs and requirements posed within a Networked Learning Environment could be made in a way that follows the principles of Information Systems (IS) development, since e-learning is an IS itself.

III. USING THE ADDIE MODEL FOR DEVELOPMENT OF AN E-LEARNING COURSE

IDEL is a web-based learning framework which was developed to facilitate course development and implementation in accordance with the ADDIE model and the instructional design principles. It aims at providing the educators with facilities to develop their own courses with the essential educational material and manage communication with students. The implementation of a course is given as an example case of how a teaching and learning system design can be materialized and utilized.

The IDEL tool was applied at the Informatics Department of the Technological Educational Institute of Thessaloniki. One of the department's objectives was to provide students with a simple environment suitable for e-learning. The first course that was developed and applied on IDEL was Web Programming to help students to acquire the basic knowledge and skills in developing web-pages. Achieving such a goal, the students were benefited by the acquisition of basic principles and suitable knowledge, and programming skills regarding the programming languages HTML and JavaScript, the techniques of XHTML and DHTML and the use of XML and CSS (Cascading Style Sheets).

A. The Analysis Phase

It was not required students to have any previous

knowledge in developing web-pages. Thus, the lessons provided were focused both on introductory issues and more advanced ones, as the course proceeded. In the end of the course, students were able to develop their own web-pages, either simple or more complicated interactive ones, using CSS for their formation.

B. The Design Phase

The lesson materials existed in electronic form. The subject's content was organized in autonomous units. The order of these units was critical in understanding the subject. Self-evaluating tests helped students to rank the level of understanding they achieved either during the course or as a summative evaluation. The results of either form of evaluation became part of their final grade. These tests were composed with multiple choice questions, blank completion and multiple answers correspondence. Project assignments were provided in the form of homework that students were able to complete throughout the application. Students were, also, able to try their programs code throughout the development of the application. Any information needed by students to know was provided through suitable bulletins and a diary. Forums and chats took place, and educators' e-mails were at students' disposal, so that they could communicate with their tutors and raise any additional questions. Finally, all lesson's documentation and useful links were provided to students throughout the application.

C. Use Cases

From the moment a student logs into IDEL, he/she can choose one of the following options:

- Start a lesson.
- Study a unit.
- Move onto the next unit, after completion of the current unit.
- Test a particular piece of code.
- Answer a self-testing questionnaire, after completion of a unit.
- Look at the course's assignments.
- Communicate with his/her tutor through the e-mail service.
- Visit any given course's links.
- Search through the diary for any part of the course he/she is interesting in.
- Deliver an assignment.
- Check his grades.
- Be informed about the discussion matters of the forum.
- Add a new subject.
- Use the chatting facility to communicate with his/her tutor and peers.
- Give an answer concerning a raised question.

Accordingly, an educator is able to intervene in order to add or erase any of the following:

- Documentation about the course.
- Assignments regarding the course.
- Information relevant to the course.

- Bulletins about the course.
- Links referred to the course.

D. The Development Phase

Based on the design specifications, IDEL begins with a main menu that provides, on the left hand side of the screen, the necessary buttons for navigating through the application. There is also a help menu, at the top of the screen, which includes only the basic choices. The course's materials exist in an electronic form and so, through a reasonable use of a suitable button, any part of the course can be visited. The prototypes (screen forms) available regarding the course are the following:

- Announcements.
- Documentation.
- Assignments.
- Communication.
- Discussion.
- Forum.
- Chat.
- Units.
- Self-testing.
- Code testing.
- Assignments delivering.
- Diary.
- Grades checking.
- Control Table (used only by educators).
- Maintenance.

E. Evaluation

During the reviewing phase some errors were detected regarding the cross browser operation of the tool. Also, some others were related to the letter fonts used. All types of errors were faced effectively. During testing, students from various other departments located some errors in the lesson texts used and some inconsistencies in questions and the evaluation system, as well. All types of errors and inconsistencies were faced and corrected.

IDEL, was used and tried with success by four students. Two of them were registered with the department of Informatics, while the other two were registered with other departments. The usage of the system delivered good results and gave a hopeful message regarding its effectiveness. The students from the department of Informatics, who were aware of some basic principles regarding the web-page development process, found the advanced parts of the lesson particularly interesting. The students from the other departments considered of particular value the system interactivity features, as well as the navigation facilities and the feedback possibilities the system offered.

The following figures display screen forms regarding prototypes about lesson information, lesson documents, lesson assignments and various lessons, respectively.

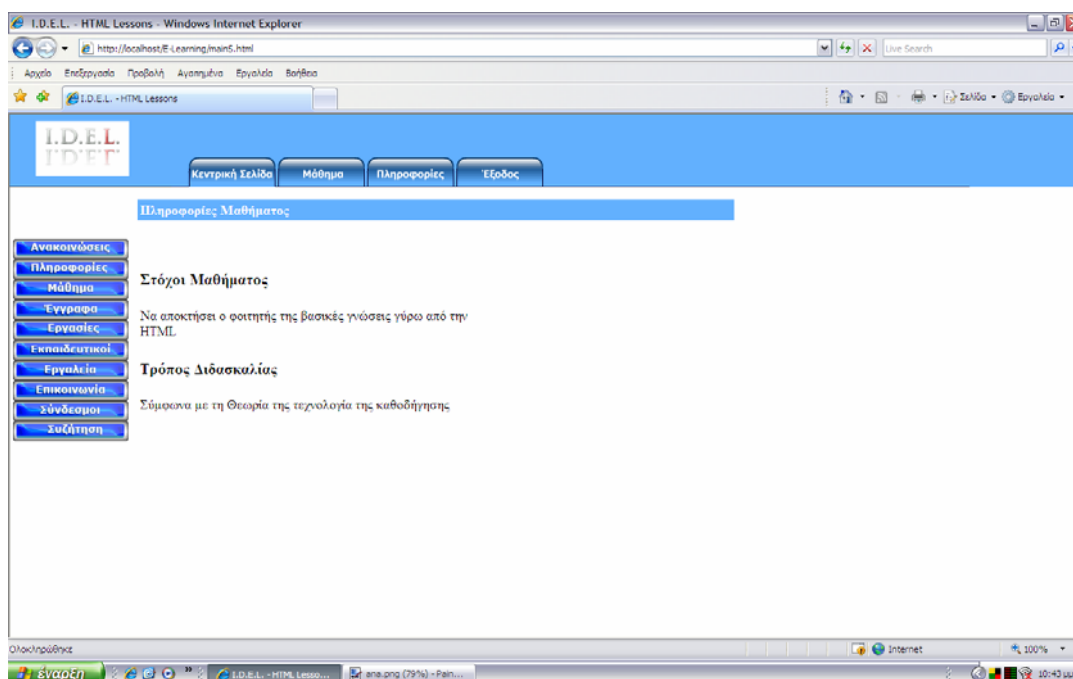


Fig. 2 Lesson Information Prototype

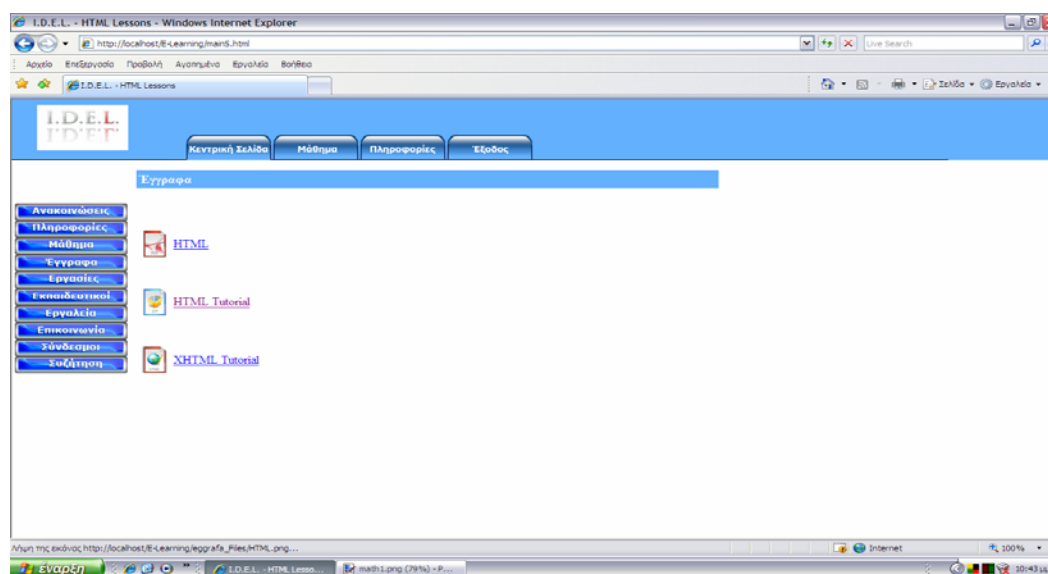


Fig. 3 Lesson Documents Prototype

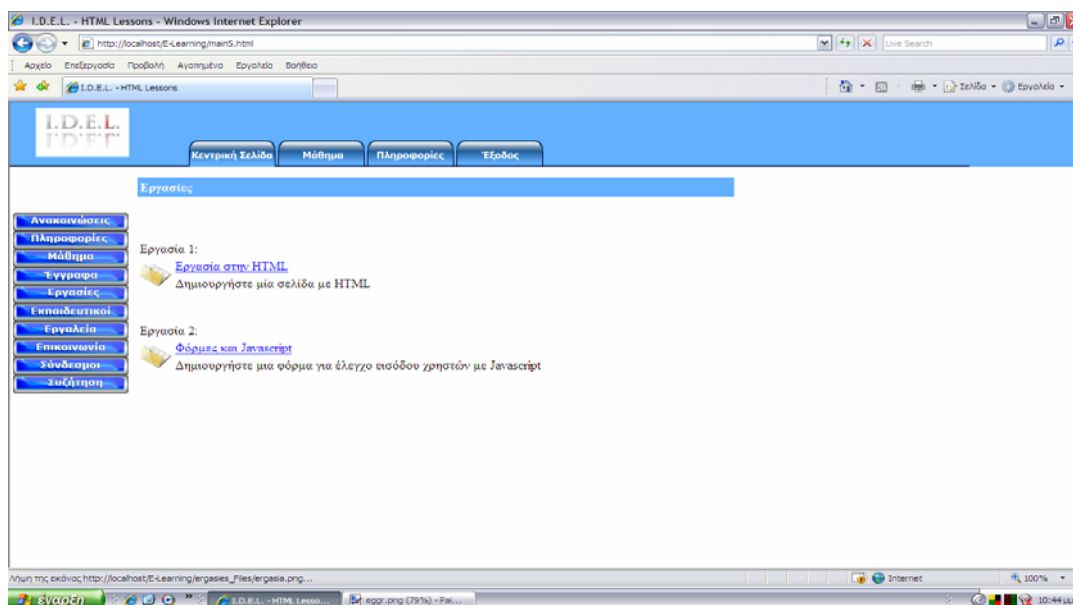


Fig. 4 Lesson Assignments Prototype

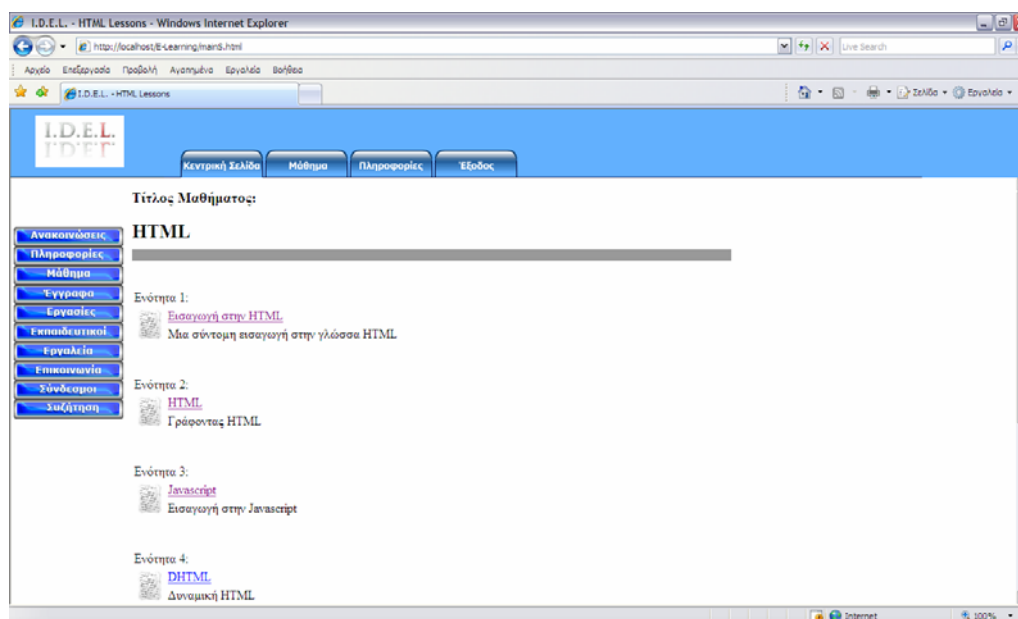


Fig. 5 Various Lessons Prototype

IV. CONCLUSION

In recent years, many universities and learning organisations have been developing courses using a variety of media, multimedia and hypermedia, with most common the World Wide Web (WWW) and the Internet, to deliver education programmes, with e-learning being the most popular form. However, the task of transforming a lesson plan from a description to a complete learning design is not trivial and requires a thorough knowledge of techniques and instructional systems design practices. Approaches which support E-learning need to be complemented with tools allowing educators, researchers and learners to organise their learning material and actions into a comprehensive framework.

IDEL is a simple ISD framework that facilitates the learning process of e-learning courses with the emphasis placed on the use of technology enhanced learning. Learners, with the many screens available in the tool, can easily satisfy their instructional and learning needs and collaborate with tutors and fellow students. Educators can easily draw useful conclusions about the effectiveness of the learning system design or the use of selected educational content and if needed can proceed with useful modifications. We intend to continue our efforts to improve IDEL, so that eventually it becomes a useful tool for designing and implementing successful and effective e-learning courses.

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