Developing Situated Learning Teaching Courses: A practical experience at the University of Bari


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Abstract: - The quality of learning objects depends on the strength of the instructional design; the success in use of learning modules depends on the capability of involving learners in e-learning; the utility of electronic didactic materials depends on the capability to provide effective learning environments; learning ability depends on the possibility of applying theories to the real problems of everyday life. This paper, by considering constructivism a useful model to provide learning by doing, and also considering learning by doing better than learning by studying, presents a new solution to provide better e-learning teaching courses to university students. The realized prototype considers in a whole a coaching phase, an exemplification studying phase, a problem solving phase, and a feedback based phase. The analysis of the learners’ satisfaction and of the time spent in using the learning object, show that situated learning teaching modules represent an enhancement in respect to previous implementations and a further step toward the ICT knowledge based society.

Key-Words: Situated Learning, E-learning, Academic Education, Knowledge Based Society, ICT.

1 Introduction

The design of e-learning teaching courses is in the midst of a revolution in which its foundations are being strongly modified.

In the past, in an effort to supplement or replace live face-to-face instruction, distance learning has more often merely replicated the face-to-face classrooms methods. In this way potentially strongly interactive technologies like computers and networks have been simply used to present one-way lectures to students in remote locations.

Indeed, a good learning experience is one in which a student can "master new knowledge and skills, critically examine assumptions and beliefs, and engage in an invigorating, collaborative quest for wisdom and personal, holistic development" [1]. Technology used in distance education should facilitate these "good learning experiences" rather than broadcast teacher-centered lectures and demonstrations [2].

Well-designed learning objects, to implement the good learning experiences, should move the teacher from podium to sideline, from leader to coach, from purveyor of knowledge to facilitator of personal meaning making [2].

Constructivist principles provide a set of guiding principles to help designers and teachers create learner-centered, collaborative environments that support reflective and experiential processes.

Starting from these considerations the paper presents a learning object based on the principles of situated learning and shows its usefulness for the learning process. The paper is organized as follows: the section two presents main principles of constructivism; section three describes the role of the context in situated learning and illustrates the critical characteristic of the paradigm for the instructional design; section four presents the properties that situated learning environment should own; section five presents the developed learning object in terms of contents and organization; and at the end section six deals with conclusions and final considerations.

2 The Constructivism

According to Constructivists the mind is the instrument of thinking which interprets events, objects, and perspectives rather than seeking to remember and comprehend an objective knowledge. The mind filters input from the world in the process of making those interpretations. Each person conceive of external reality somewhat differently, based upon a unique set of experiences with the world and a belief about it.
Constructivist educators strive to create environments where learners "are required to examine thinking and learning processes; collect, record, and analyze data; formulate and test hypotheses; reflect on previous understandings; and construct their own meaning" [3]. Constructivists engage the learners so that the knowledge they construct is not inert, but rather usable in new and different situations. The purpose is "to discover and to describe formally the meanings that human beings create out of their encounters with the world, and then to propose hypotheses about what meaning-making processes were implicated" [4].

Constructivists consider experimental and reflective knowledge. Both experiential and reflective knowledge emerge from our interactions with the world, and they both are required to perform most real-world tasks. Real-world situations embed learning, and learners participate to solve problems [5]. Context includes features of the "real world" in which the task to be learned might naturally be accomplished.

Construction of knowledge results in an active process of articulation and reflection. Through the process of articulating covert processes and strategies, learners are able to build new, and modify existing, knowledge structures. This planning involves reflecting on what is known, what needs to be known, the viability of various plans, and their potential effectiveness.

The process promotes knowledge construction through the procedural facilitation process. Procedural facilitation also provides a scaffolding effect by providing learners with temporary support processes until they are prepared for more complex strategies and information.

Making knowledge construction activities overt contributes to this process through internal negotiation and deliberate actions such as goal setting, identifying and solving problems, and connecting old and new knowledge [6].

The use of situated learning as an approach to the design of learning environments has significant implications for the instructional design of computer-based programs.

Many of the researchers and teachers have accepted that the computer can provide an alternative to the real-life setting, and that such technology can be used without sacrificing the authentic context. Indeed McLellan points out that context can be:

- the actual work setting;
- a highly realistic or 'virtual' surrogate of the actual work environment;
- an anchoring context such as a video or multimedia program [7].

In terms of the instructional design of interactive multimedia, the critical characteristics of situated learning can be examined in terms of three elements: the learner, the implementation and the interactive multimedia program. It is important, when designing interactive multimedia programs, to consider all the three interacting elements. It is not enough to produce a program without considering how it will be used by the students or how it will be implemented to support the learning process.

A number of important aspects need to be considered while developing learning objects:

a. Provide authentic context;
b. Provide authentic activities;
c. Provide access to expert performances;
d. Provide multiple roles and perspectives;
e. Support collaborative construction of knowledge;
f. Provide coaching and scaffolding;
g. Promote reflection;
h. Promote articulation;
i. Provide for integrated assessment.

A) A situated learning environment need to provide an authentic context that reflects the way the knowledge will be used in real-life, that preserves the situations without fragmentation and decomposition, that invites exploration and allows for the natural complexity of the world [8, 9, 10, 11, 12, 13].

B) A situated learning environment need also to provide authentic activities which are ill-defined, in which students find as well as solve the problems. It is an environment where tasks provide the opportunity to detect relevant and irrelevant material [8, 10, 11, 13, 14]. Steps, procedures, hints, suggestions, clues and facts, which neatly add up to the ‘correct’ solution, are interspersed within the program, waiting to be discovered and solved by learners.

3 Situated learning

Situated learning emphasizes the role of context in learning. The situated learning paradigm argues that most learning is context-dependent. What is learned is matched to the experience surrounding the learning, which assigns meaning to what is learned. As a result, the process of solving real-world problems is much richer and better understood.

The model requires the adoption of problem solving techniques wherein students must acknowledge the problem, identify resources, set priorities, and explore alternative solutions.
C) Situated learning environments need providing access to expert performances and the modeling of processes, allowing students to observe the task before it is attempted. Such access enables narratives and stories to be accumulated, and invites the learner to absorb strategies [5, 8, 9]. Short movies of experts performing skills give students the opportunity to observe the experienced practitioner at work.

D) A situated learning environment needs to provide the learner with the opportunity to investigate multiple roles and perspectives [8, 11, 12, 13, 14, 15, 16]. Giving the learner multiple roles and the opportunities to explore the program from a number of perspectives means that the resource must have an integrity which enables close scrutiny and examination, and may yield fruitful information and rich learning situations.

E) A situated learning environment should support the collaborative construction of knowledge [8, 14, 15]. Also the interaction with computer can lead to a constructive form of interaction and construction of knowledge, and a verification and or confirmation of previous knowledge and assumptions.

F) A situated learning environment should promote reflection to enable abstractions [8, 10, 11, 17, 18]. The learning environment should require students to reflect upon a broader knowledge base to solve the problem.

G) The environment should promote articulation to enable tacit knowledge to be made explicit [10, 15, 17].

H) A situated learning environment should provide for coaching at critical times, and scaffolding of support, where the teacher provides the skills, strategies and links, that the students are unable to provide, to complete the task.

I) A situated learning environment needs to provide for integrated assessment of learning within the tasks [14, 19, 20] Assessment of situated learning products can also take the form of a number of evaluation measures that do not include necessarily formal tests: portfolios, summary statistics of learners’ paths through multimedia programs, diagnosis, and reflection and self-assessment can also be taken in consideration [19]. Young notes that ‘assessment can no longer be viewed as an add-on to an instructional design or simply as separate stages in a linear process of pre-test, instruction, posttest; rather assessment must become an integrated, ongoing, and seamless part of the learning environment’ [14, 20]. The implication of this for instructional design is that software engineers need to design an assessment which is concerned with the process as well as the product.

4 Situated learning environments
The learning process can be best facilitated through the design and implementation of learning environments that simulate real world situations. The designers shift from creating prescriptive learning actions to developing environments and situations that engage learners and require them to construct the knowledge that is most meaningful to them. These environments will emerge from authentic tasks, engage the learners in meaningful, problem-based thinking, and require negotiation of meaning and reflection on what has been learned.

New technologies can effectively contribute to a movement away from the duplication of traditional instructional methods, both in the classroom and at a distance, toward a more resource-based approach to instruction that no longer emphasizes the teacher as the main source of knowledge [21].

According to Wiggins, situated learning environments should have the following characteristics [22]:
- be centered on engaging and worthy problems or questions of importance in which students must construct knowledge for effective performance;
- include tasks that are either replicas of, or analogous to, the kinds of real-world problems faced by citizens, consumers, or professionals in the field;
- provide access for the student to resources commonly available to those engaged in analogous real-life problems or activities;
- present problems requiring a repository of knowledge, judgment in determining appropriate application of knowledge, and skills in prioritizing problem classification and solution phases.

5 The developed Learning Object
A prototype of learning module has been realized according to the principles of situated learning. The learning object is entitled “Introduction to Processing Systems”. It describes the main components of a PC: CPU, Main Memory, I/O Modules, and Interconnection System. University Students of the first year in Computer Science use it be introduced in the course on Operating Systems.
5.1 Organization of the product

The learning object has been developed by adopting Adobe Acrobat Presenter: a tool of the suite Adobe Acrobat Connect Professional, formerly known as Macromedia Breeze Presenter [23]. It is organized as follows: an introductory page presents the theme of the module and drives the learner to a video that briefly presents the assembling procedure of a PC (Figure 1); successively a list of themes is presented. The learner can select one or more topics to study or also leave the module. Each insight consists of a sequence of animated and commented slides that presents details of the specific selected subject. At the end of each topic a simple problem is proposed to complete the specific activity. On the base of the correctness of the solution an adaptive path is built.

When a topic is selected, the learner enters into a deeper presentation that explains the subject in more details. A sequence of slides presents the main aspects of the specific argument. A background voice explains the content of each slide. When the comment associated to the slide completes, the system automatically goes to the next slide. Each slide is enriched with images, schemas and animations that graphically illustrate the content of the page (Figure 2). The textual part is organized in dotted lists, provided with animations, and synchronized with the speaker presentation.

The coaching video presents the fundamental steps to assemble a PC. The video shows how to:
- Open the case;
- Prepare the elements to be mounted;
- Fix the I/O interface panel protecting panel;
- Bolt brass spacers;
- Install the electric feeder;
- Tighten the mother-board;
- Settle the RAM and the Video Card Adapter;
- Insert the hard drive(s);
- Arrange eventual other I/O devices;
- Realize the data interconnection system;
- Provide internal electric power supply;
- Put in order all cables;
- Close the case.

The list of choices offers the possibility to select one or more arguments to examine closely. The learner can select among:
- Mother board;
- Processing Unit;
- Main Memory;
- I/O modules;
- Hard disk;
- Interconnection system.

5.2 The contents of the module

The section on mother board shows a photo of a mother board, highlights the processor slots, the main memory slots, the AGP slot for video card adapter, and the PCI slots for I/O Interface adapters.

The section on the processor defines the CPU acronym, illustrates its main functions, the principal components, and the registers (Figure 3).

The section on main memory presents the cache, its function and organization, the transfer function between CPU, cache and RAM, the content and the organization of the RAM, the properties of the main memory and its structure.

The section on I/O modules presents different interface cards, their main functions, and structure.
The section on hard disks illustrates structure, properties and contents of secondary storage devices, their organization in sector and tracks, and their working principle.

The section on interconnection systems presents examples of interconnection systems.

### 5.3 The problems in the learning module

Each topic ends with a problem about the subject presented. The problem is presented in a graphical way and is organized as a simulation problem in which the learner is invited to perform tasks that simulate the operations to be realized in the real world. To complete the activity the learner should perform tasks like to select a component and locate it in the right place. The problem solving can result correctly completed or not. After a successful completion, the learner can select another topic. After a failure, the learner is introduced in a new more detailed exemplification which illustrates the actions to perform to solve the problem. The sequence of slides implicitly solves the problem, but does not explicitly provide the solution. When the explanation ends, the problem is newly presented to the learner. If the problem is correctly solved, he is immediately introduced into the following topic, otherwise he is sent back to the beginning of the topic and he is invited to visit again the subject under consideration. Finally the correct solution of the problem is presented. Successively the learner is automatically driven in the successive topic.

![Figure 4. Example of problem formulation](image)

### 5.4 The use of the learning module

The realized product has been published according the AICC/SCORM standards [24, 25], imported in the Oracle iLearning platform [26, 27] and offered to university students [28, 29, 30], which can access the LMS from classrooms, through a dedicated e-learning infrastructure [31], or from their domestic personal Internet connections.

They used the learning object in blended learning to repeat and deepen the classroom presentations.

They also had the possibility to compare this implementation with a former one that consisted of a sequence of presentation slides, without coaching video and problem solving sections [32]. They were invited to formulate a judgment on both products. They used a survey consisting of three main sections: quality in use, learnability and involvement [32].

The results shows that while the quality in use in the this product is nearly the same as in the previous implementation, learnability, that is to say the capability to acquire new knowledge and skills, and learner involvement of the new product obtain better results with an improvement of about 10% - 15% with respect to the previous implementation.

These results are also confirmed by the time spent by learners in using the different versions of the product. At this purpose, two test groups were formed. The first test group had the possibility to use only the previous implementation, while the second test group had the possibility to use only the new implementation. The time spent in using new version increases of values which ranges from the 50% to more than the 100%.

### 6 Conclusions

Developing products according to situated learning paradigm requires much more time and skills, but results show that the lesson is much more supportive for the learning process, and learners effectively use the product to acquire knowledge and skills. Each problem presents real situations and capture learner attention. The learner realizes that while providing the correct solution to the problem he effectively learns how to solve real situations of everyday life. The accessibility of the solution involves the learner to continue the use of the learning module and to visit the different topics. In this way learners became responsible of their learning and decide to continue to use the learning object. Exemplifications, investigations and practices capture learner attention and strengthen their curiosity. As a consequence activity completion, strictly related to the time spent with the subject, significantly grows.

In conclusion we can say that this experience, without any doubt, represents a step toward the ICT knowledge based society [34, 35].

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