

# Learner Centered Design Approach for E-learning Using 3D Virtual Tutors

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**Abstract**—Most of the existing E-learning system designs have focused on the development of feature-rich, but usable systems with little effort in motivating students to develop interest in the teaching-learning process. This paper discusses the learner centered design approach for web-based tutoring to motivate young learners using 3D virtual tutors in a requirement-based, flexible pedagogical model. Students can choose course(s) and the study-mode. In the guided mode, the student is mentored by a human tutor; whereas a student in un-guided mode is tutored by 3D avatar. The student has access to study materials, educational videos and applets that are provided by the tutors; the student also has access to forums for doubt-clearing and online assignments to be submitted for tutors' evaluation. Tutors can track students' progress using online quiz and reports modules. Further, tutors have access to teaching aids like online chat system and whiteboard-based teaching in a virtual classroom environment.

**Keywords**- E-learning; online tutoring; virtual classroom; 3D animated avatar; online whiteboard; online chat system

## I. INTRODUCTION

E-learning is commonly referred to as intentional use of networked information and communications technology in teaching-learning. Many E-learning ventures fail due to poor system design resulting in its inability to satisfy the users. Further, research [1] has shown that a Learner Centered Design (LCD) framework should be adopted over User Centered Design (UCD) framework in order to enhance the learners' satisfaction. Since majority of young learners often lack motivation and domain knowledge, hence a proper approach needs to be taken to address this issue while designing systems with such unique needs of users.

An avatar is a graphical character that represents the user in another environment. Some of the existing E-learning systems like CourseLab make use of 2D avatars, but not 3D avatars. This is an area we have explored by employing 3D avatars in the role of virtual tutors in our proposed system.

## II. LITERATURE SURVEY

Several E-learning platforms have been conceived and implemented in recent years. In [2], authors have tried to improve the well-known open E-learning system Chamilo by incorporating three novel Internet technologies: knowledge search and classification, instant chat system and an online compiler system. The benefits of achieving interactivity and low response times in E-learning systems to boost learners'

motivation levels and focus have been emphasized in [3]. In [4], the authors have tried to gauge the motivation levels of students based on their behavioral patterns on the E-learning platform. Collaborative learning through students interacting with each other on E-learning platforms, similar to the real-world concept of "group study" has been addressed in [5]. In [6], the authors have inferred the positive interest of students in using 2D avatars in an E-learning context. Moreover, we have looked at existing E-learning systems and incorporated some of their features into our proposed system which we found to be most relevant, such as Independent and Guided learning modes for students as well as the Online Interactive Whiteboard as teaching aid for tutors, besides several others.

## III. SALIENT FEATURES AND KEY CONTRIBUTIONS

### A. Salient features of our proposed system

Based on our literature survey, we have identified some functionalities to incorporate in our system which can make it effective in motivating young learners shown in Table I.

TABLE I. SALIENT FEATURES OF OUR PROPOSED SYSTEM

Features	Description
3D Virtual Tutors	3D animated characters which can narrate to students summarized versions of the study topics. Young learners typically prefer audio-visual learning modes, and 3D avatars can serve as fun and exciting virtual tutors
Guided & Independent learning modes	Independent learning mode for diligent, self-motivated students who want to engage in self-study at their own pace, without any intervention from a mentor, and Guided learning mode for those who feel they would benefit from mentoring
Whiteboard	Interactive Whiteboard shared between human tutors and their class through the Internet, using which they can explain concepts by drawing figures using suitable pointing devices
Chat system	Chat system integrated with the virtual classroom using which human tutors can directly interact with students for delivering lecture, answering queries and resolving doubts
Forum	Admin-moderated forum where students can involve in study-related discussions or for resolving doubts, as it has been found to be a very effective learning method for young people. Admin needs to monitor forum to prevent its misuse
Reports	Reports generated from data on student activity patterns in the system such as studying activity, forum activity and, of course, performance in quizzes conducted by tutors, to serve as feedback to the human tutors from which they can easily gauge student motivation levels and accordingly fine-tune their course contents, study materials and lecture delivery
Applets & Video lectures	Applets and video lectures on study-related topics which can supplement class lectures as audio-visual study media
Web search	Wikipedia and Google search integrated with the system to help students quickly look up any additional material

## B. Key contributions of our work

The following are the two key contributions of our work:

1. As per our knowledge, none of the major existing E-learning systems use 3D avatars to personify the human tutors and motivate young learners.
2. To the best of our knowledge, none of the existing E-learning systems incorporates the entire set of features present in our proposed system and follow such a holistic approach towards motivating young learners.

## IV. SYSTEM IMPLEMENTATION AND EVALUATION

### A. System implementation

We have implemented the proposed E-learning system (see Fig. 1) using JSP, Servlet, AJAX, HTML, CSS and an Oracle database. The user interface was enhanced through special effects on UI elements using JQuery. The 3D avatar animations were prepared using the online tool Sitepal.com.

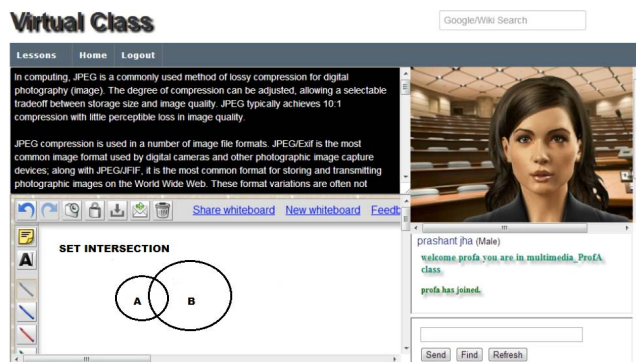


FIGURE 1. SCREENSHOT OF OUR PROPOSED SYSTEM SHOWING THE 3D VIRTUAL TUTOR, WHITEBOARD, CHAT SYSTEM AND WEB SEARCH MODULES.

### B. System evaluation

In order to perform a qualitative evaluation of our work, we circulated an online questionnaire among the students of our college who are using the proposed system, consisting of six questions which try to elicit their anonymous opinions on the effectiveness of its various features, on a five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree), as enumerated in Table II along with the results (in Fig. 2). The results clearly demonstrate the superior quality of our work.

TABLE II. QUESTIONNAIRE FOR FEEDBACK COLLECTION

No.	Opinion
O1	I find it easier to understand difficult concepts by referring to the Supplementary materials like video lectures, interactive applets etc.
O2	My system usage Statistics, like frequency of forum activity is a good reflection of my motivation levels.
O3	Having the option of Independent (self-study) or Guided (tutored) learning modes is essential to students' learning success, because each student has his or her own learning style.
O4	Presence of 3D avatars as virtual tutors, along with effective study materials increases my motivation levels by making the teaching-learning process fun and exciting for me.
O5	I learn better by using the discussion Forums to understand difficult study topics and develop effective learning strategies.
O6	I can grasp a difficult concept easily when my tutor uses the shared, interactive Whiteboard to explain it by drawing suitable diagrams.

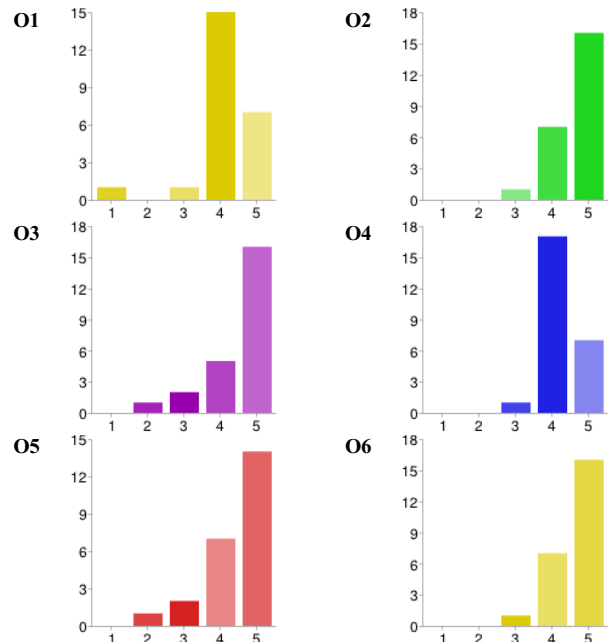


FIGURE 2. BAR CHARTS SHOWING THE FREQUENCIES OF RESPONSES RECEIVED FROM USERS OF OUR SYSTEM ON THE VARIOUS OPINIONS (O1–O6), WITH THE FIVE-POINT SCALE ALONG THE HORIZONTAL AXES AND THE FREQUENCIES ALONG THE VERTICAL AXES.

## V. CONCLUSION AND FUTURE WORK

In this paper, we have tried to propose a novel framework for E-learning following the LCD approach as opposed to the much-used UCD. Possible future works include simulating virtual classrooms consisting of 3D avatar representations of both human tutors and their students, generating reports to identify efficient tutors and introducing audio / video chat.

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