



Review of a Web-Based Mathematics Tutor for Nigeria Undergraduate

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Abstract

This work reports on the Web-based undergraduate mathematics tutor developed by the author for use by the undergraduates of Computer science department in higher educational institution. It briefly analyses the traditional method of teaching undergraduates mathematics and uses ideas so gathered to design a new one. The new method allows students to learn mathematics interactively, and at their own pace via technologically-based system. Their understanding in mathematics will increase as they learn interactively on their own, and consequently improve their performance in mathematics. The system was designed using top-down design methodology

Introduction

Mathematics education is one of the human disciplines that have influence on man's cultural, social and economic life. Mathematics is essential for the prosperity of a nation in providing devices for comprehending science, engineering, technology and other related subjects. According to the author in [1] mathematics provides students with great and powerful ways to describe, analyze and transform the world. It is defined as the science of numbers and shapes [2]. Mathematics is the study of quantity, structure, space and change.

As important as mathematics is, the research has found out that many undergraduate students still find mathematics a hard nut to crack. And this results in their poor performance in the course. If this situation continues unchecked, it will affect the future development of science and technology in the nation since mathematics is one of the key contributing factors. For this reason, different efforts are geared towards making mathematics a simple, enjoyable and interesting course so that students can learn with keen interest to understanding it.

As a contributory effort in fighting the decline in the success rate of the undergraduate students in mathematics, this study is carried out. It focuses on developing a web-based undergraduate mathematics tutor for the undergraduates which is believed to help them learn mathematics interactively and at their own pace.

Literature Review

Web-based instruction is a rapidly growing instructional format that is challenging the traditional learning model in higher education. Many institutions of higher education are on the bandwagon, or are running furiously to jump on the bandwagon [3]. The widespread availability and access to the Internet, a student population that is increasingly non-traditional, and occupational forces that require worker re-education, have fueled the avalanche of Web-based courses in higher education.

For the purpose of this study, Web-based instruction is defined as instruction via the World Wide Web that features hyper-linking as well as communication capabilities [4]. Computer technologies used to develop and deliver Web-based instruction vary depending on factors such as learning goals, pedagogical

approach, and instructor expertise or access to expertise in using these technologies.

Courses that include presentation of content and structured learner interactivity are typically developed using Web authoring software, programming language, multimedia, and communication tools such as e-mail and bulletin boards [4]. The range and sophistication of content presentation via web courseware varies from "the provision of lecture notes and lecture support material through to integrated and interactive tutorial packages" [5], although advanced learning environments are not supported [6]. Other Internet-based courses rely predominantly on communication tools (i.e., bulletin boards, chat, email) that provide learners with opportunities to engage in reflective dialog [7].

Communication in Web-based Courses

There are two interrelated forms of communication in Web-based learning environments: instructor-learner communication and learner-content communication. Instructor-learner interactions include those between the instructor and groups of learners (i.e., one-to-many), the instructor and individual students (i.e., one-to-one), or among students (i.e., many-to-many). These communication configurations reflect those found in a typical classroom. These same configurations are possible using computer technologies such as conferencing, e-mail, and other collaborative support tools as communication vehicles for connecting participants [7].

The second, but less obvious, form of Web-based communication is that which occurs between the learner and content. There are two general ways in which the learner can engage in the subject matter: the learner can attempt to accurately acquire knowledge presented via Web presentations or s/he can construct personal

meaning by engaging in dialog and reflection. These two types of learner-content interactions reflect two cognitive paradigms: cognitive processing and cognitive constructivism. These paradigms are based on different assumptions about the nature of knowledge and how individuals learn about their world. They result in different instructional approaches (e.g., Cognitive Flexibility Theory) and different types of communications. This study will address the influence of these two paradigms on communication practices in Web-based courses.

Instructor - Learner Communication

Computer-mediated communication involves using computer communication technologies such as bulletin boards and e-mail to connect learners at a distance. Interactions commonly occur asynchronously, with participants responding at different times, although synchronous interactions are possible [7], [8], [9], [10]. Such communications can supplement or be the primary mode of course delivery.

The major characteristics of computer-mediated communication are time and place independence, interactions among various combinations of individuals, and an absence of communication cues found in face-to-face interactions [11]. Web hyper-linking is included as a feature of computer-mediated communication [10]. Learners can use the Web hypertext environment to access information that they can use in collaborative discussions. Web-based databases and news groups are also included as aspects of computer-mediated communication [8].

There is a proliferation of communication technologies that can be used in Web-based courses. Examples of synchronous and asynchronous communication tools that are currently and readily available to most instructors are e-mail, bulletin

boards, chat, instant messaging, voice messaging, and listservs. In addition, video and audio conferencing, shared editors, and imaging programs are available to support synchronous communications [4]. Collaborations conceptualized as "communities of learners" are supported by communication tools ranging from decision support systems to computer-supported intentional learning environments (CSILEs) that permit learners to build knowledge databases ([8], [6], [12]).

Decisions regarding the form and configuration of interactions include whether interactions should occur synchronously or asynchronously, and between/among which participants (i. e., instructor to student, students to students). Technology is available to support just about any decision an instructor makes regarding communication. Given these circumstances, questions arise as to what criteria should be used to make such decisions. On a practical note, decisions are likely to be guided by the availability and ease of access of certain communication tools (i.e., e-mail, bulletin boards), by the instructor's level of expertise and understanding of communication technologies, and by the instructor's willingness to experiment with new and more complex communication tools.

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