Abstract

This paper presents the use of multimedia tools in teaching engineering courses, in particular we will discuss the use of “courseware” in conducting classroom teaching for the first electrical engineering circuits course. Some of the questions and/or concerns that have been raised regarding the use of a courseware package and advantages and disadvantages of using such an approach including the developer's comments and students' reactions are included. A brief summary of the steps required to produce a courseware is also provided. The results presented in this paper are based on an on going project that has been partially funded by the Pennsylvania State University and Lenohard Engineering Center of Excellence. The courseware modules are series of executable files that can be used in Windows environment. They also provide links to other useful software packages such as PSPICE and MATLAB. Various examples utilizing these programs are included in the package. The results presented in this paper are based on an on going project that has been partially funded by the Pennsylvania State University and Lenohard Engineering Center of Excellence. A working courseware example will be presented at the conference and also included in the CD-ROM version of the conference proceedings.

Introduction

Clearly the advancement/affordability of computer and communication technologies, during the past decade, have had major effects on our everyday life. Although, computers and their applications have enhanced the quality of many courses but, their impact has been minimal in classroom lectures. Overall the integration of new technologies into classroom instruction has been slow. The general question/problem, that have been raised, is the integration of new technologies into classroom instruction. Are they legitmate teaching tools? If yes, then how do we integrate them into the classroom? How much effort is required for an instructor to adapt these methods? Do they really work? Some educators have started using these new approaches in their classroom instructional methods. However, these efforts have been limited to very few institutions because most instructors are hesitant to convert their lecture notes into an interactive package and make it available to students. Consequently, the effectiveness of these new teaching tools has not been fully realized or studied. The claim is that these new teaching approaches will result in higher learning curves, but there has been no published comprehensive study on this subject. There has been, however, much talk about the use of technology in classroom instruction, but as long as only a few elite universities with relatively small student populations are involved, the full benefits and advantages of these new teaching techniques will not be fully realized anytime soon. This is unfortunate since, as a result of current changes in the economy and work force due to global political and economical changes, we are seeing more and more “non-traditional” students who are dedicated to their studies, but may not have the proper background to be successful at the college level. An interactive tutorial package could be of tremendous benefit to these students. The interactive software package, courseware, could also be used as an effective learning tool for independent/long distance education.

Our Approach

It is our belief that these advancements should be reflected on the classroom and laboratory teaching [1-2]. We believe that the classroom lectures should be conducted in a way that the most students be active participants in the discussions. We strongly believe that the new technologies cannot replace lecturers, but they can enhance them. Therefore, we are proposing a “courseware” approach to the way that we are conducting our classroom lectures. Courseware approach means that the lectures will be produced by the help of a multimedia software. Lectures will be put together by faculty and the results will be portable in a way that they can be accessed by the students at the computer laboratories and used at the state-of-the-art classrooms [3-6].

A typical courseware lecture will include:
This approach will allow us to develop courses that have a richer and more exciting learning environment than before. The outcome should be a user friendly portable multimedia package of lectures enriched with information and excitement. It should be pointed out that a typical courseware package is software independent, meaning that the students need not to have access to a multimedia or a simulation software to use the package. The package will be a series of executable (*.EXE) files that can be run under Microsoft Windows environment.

**General Advantages**

The courseware product, if employed as the lecture source, can make the classroom lectures more informative and, at the same time, more exciting by enhancing student participation in classroom discussions. The intent is to have a more active learning environment rather than a passive one. Such enhanced participation by students should result in higher learning curves. At the same time due to the multimedia nature of the courseware package; short video scenes, scanned pictures or connection to other software packages, it will produce a dynamic learning atmosphere. We have had a very positive response from the students regarding the use of the courseware packages as the lecture source and as a tutorial aid. The effect of the courseware can be enhance if it is used in a technology classroom where every student has access to a computer. It is also worth mentioning that the combination of a courseware package and other tutorial aids can be used to offer a course in an independent study base [7-9]. Moreover, the combination of such communication tools as PictureTel and courseware lecture packages can be used to establish an effective long distance educational system. We are studying the effectiveness of this approach and will report the outcome in near future.

**General Disadvantages**

A great portion of the disadvantages that are associated with a courseware is in the production part. Basically, producing a multimedia courseware is a time consuming and an expensive project. Our experience suggests that the required time for producing a courseware package is about 2-3 semesters, on a part time basis. It also requires appropriate hardware accessories and software packages and obviously a good knowledge of how they work. All of these indicate that to produce a successful courseware package, a long term commitment should be made by the faculty and the administration. Moreover, as it was mentioned before, there are only few published studies regarding the proper use and effectiveness of using courseware packages.

**General Tips For Making a Courseware Package**

Since the courseware product is normally used as a lecture tool and as a tutorial package for the students, several key points need to be considered in the design process. The most important requirements are that the product should be user friendly, and interactive. This means that one needs to give special attention to the design of the information icons in a courseware package so that almost no familiarity with a multimedia software is assumed and at the same time provides an interactive environment. Other requirements are the size of the page and the text, text colors, product resolution, graphics quality, etc. Page size and text fonts are important since the package is going to be used as the lecture source. Therefore, the fonts should be large enough, say times 18, so that the projection of the courseware content, on a screen, can be seen by everybody in a classroom. Obviously, if the course is being conducted in a technology based classroom this requirement becomes less important. Text colors should be picked up so that new and important concepts could be easily distinguished from the rest of the text. The resolution also plays an important role in a courseware development. Although it is true that the resolution has a direct effect on the quality of the presentation but, one must also consider the limitations on the LCD panels, computer laboratories, and student computers.

**Our Experience**

The courseware package that we are developing is for the first electrical engineering circuits course. We have used
the ToolBook [11] multimedia software for putting the courseware package together. In order to provide a user friendly product several different icons and buttons are designed and programmed. Two icons have been designed for navigational purposes. One will take the user to the current module's table of contents and the other one will permit the user to go to the master table of contents that contains the title of all the modules. From the master table of contents one can go to any modules. An information icon has been designed which will explain the general features of the courseware product and how to use them. An area at the bottom of every page has been provided to serve as a note pad for the user. Special icons have been designed so that the worked out problems will only exhibit one, or at most two lines at a time. One need to push these “Hide” buttons to see the next step of the solution. The idea behind this feature is that the product can be used as an effective lecture source, since during the lecture the instructor will write one line at a time and not the whole solution at once. Every example problem includes at least one “Hint” button. An icon has been designed and programmed that will exhibit the related circuit diagram for the example problem. The circuit diagram can be dragged anywhere on the screen. Two other special icons have been designed and programmed so that the user can link to PSPICE and MATLAB, assuming the user have access to those software. Figure 1 illustrates some of these features. Additional figures (Figure 2, and Figure 3 ) included in the CD-ROM version of the proceedings illustrate two sample pages of the courseware modules. Upon completion of the simulation the user will be back in the courseware module. The courseware modules are designed so that the user can save his/her work and next time around start from the point that it was left off. These icons and buttons allow the courseware to be used as a lecture tool and as a tutorial package. In order to make the courseware product software independent, modules are converted to executable files, which can be accessed under Microsoft Windows environment.

Conclusion

In conclusion, we should point out that although some educators have started using courseware in their classroom instructional methods, the efforts by large have been limited to very few institutions. Consequently, the effectiveness of these new teaching tools has not been fully realized or studied. This indicates that the full benefits and advantages of these new teaching techniques will not be fully realized any time soon, as long as only a few elite universities with relatively small student populations are involved.

Our experience has been that the courseware product, if employed as the lecture source, can make the classroom lectures more informative and, at the same time, more exciting by enhancing student participation in classroom discussions. The students’ response to these new approaches has been very positive. Finally, while we are in early stage of using these techniques in our classroom teaching all the parameters are indicating that we are in right track.

References


11. Asymetrix Corp., 110-110th Ave., Bellevue, WA, 98004

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**Figure 2.**

**Figure 3.**

Solution 2.3:
1. At node 1: \(\sum i = 0 \Rightarrow -I_1 + I_2 - 3A - 1A = 0\)
   \[-I_1 + I_2 = 4A\]
2. At node 2: \(3A + 5A + I_1 + 2A = 0\)
   \[10A = -I_1\]
   \[I_1 = -10A\] (meaning \(I_1\) is leaving node 2)

Solution 2.6:
1. KCL at node 3: \(I_2 - I_4 - 6 = 0\)
2. KCL at node 3: \(I_2 - I_4 - 6 = 0\)
3. KCL at node 3: \(I_2 - I_4 - 6 = 0\)
4. KCL at node 3: \(I_2 - I_4 - 6 = 0\)

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**Figure 3.**