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INNOVATIVE SOFTWARE FOR TEACHING PHYSICS TO NURSING STUDENTS

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Abstract - This study is centered on the development of a Physics interactive software package for the Nursing students, using the software tool Flash version 5.0 by Macromedia Company. The software serves as an instructional tool that highlights animated illustrations and simulations, sound effects and interactivity of the presentations, features which cannot be done with a slider or an overhead projector. The software has three main categories: the *Lecture, Problems* and *Laboratory Activities*. Much of the effort in the courseware development is to include motivational aspect to the lecture presentations. Motivation is done by relating Physics concepts to common real-life experiences. These common real-life day-to-day experiences are simulated through visual animations and sound effects then injected with humor by using comical graphics. The lecture coverage includes selected topics in Mechanics, Fluids and Mechanical Waves. The *Problems* category emphasizes the animated illustrations more than the step-by-step solutions. The laboratory experiments given to the Nursing students are simulated in the *Laboratory Activities* to aid the instructor during pre-laboratory discussions. The software works in Windows environment.

INTRODUCTION

The Ateneo de Davao University started the Bachelor of Science in Nursing in 2001. It is therefore inevitable that many academic problems related to Nursing students' and teachers' needs are still waiting to be addressed. The Physics Department has observed that Nursing students have a difficulty in understanding the subject matter. Their negative attitude and pre-conceived notions about the subject, limited mathematical foundation and non-mathematical field of interest, contribute a lot to their weak reception of the topics being discussed. Added to these factors would be a hard time grasping the concepts and the mathematics behind physics by mere "chalk-talk".

The Physics Department thinks of ways to present Physics suited for the fields, abilities and needs of all courses being catered to. Moreover, the focus of the department's research and development is inclined to instrumentation and improvement of teaching tools. In the case of the Nursing students, the department has realized that these are health majors and not math, so the mathematical approach for the Engineering, when applied to them will somehow result to negative attitude and performance in Physics.

It is therefore the department's goal to reach out to these students and teach physics at their level and address their specific needs. A more conceptual approach in presenting Physics is suitable for non-mathematical course like Nursing. This realization spurred the proponent to develop a courseware that emphasizes the conceptual aspect of Physics principles that will be appropriate for the Nursing students.

MATERIALS AND METHODS

Software Tool

The courseware was developed using the software tool *Flash version 5.0* by Macromedia Company. *Flash* has its own language called *ActionScript* which is virtually the same with the syntax of Java Script.

Description of the Software

The finished software has three main parts that are found on the main panel of the main window. These parts are the *Lecture, Problems* and *Laboratory Activities.* Figure 1 shows the main panel containing the buttons for the three major categories (*Lecture, Problems* and *Laboratory Activities),* the exit and hide/show panel buttons.

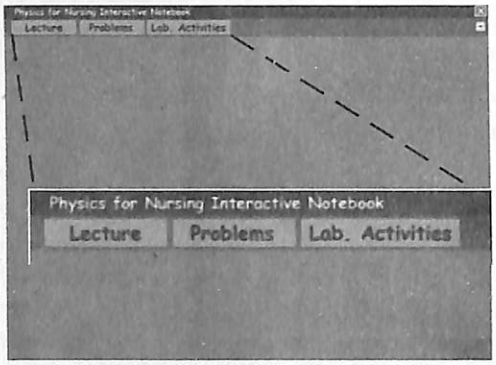

Figure 1. Main window.

These three main buttons in the main window also appear in any presentation/ window so that the user can browse through any topic at any time by simply clicking on them. Since this is intended as an instructional tool for Nursing students, it is made to have a non-intimidating appearance to the students. The mathematics is much less relative to the Physics given to the other courses being serviced by the department. Moreover, font used is *comic sans,* to give the software a less-serious effect. Comical animations and illustrations are used to inject humor in the lesson presentations, without compromising the content.

In some selected presentations, sound effects are also included especially for those topics (sound waves for example) which are better explained with audio effects. Sound effects in other selected lecture and problem presentations are added to give more appeal and humor to the presentation.

The **Lecture button** includes selected concepts, principles and derivations of equations normally presented by the teacher in a lecture session. Figure 2 shows the screenshot of the topics covered by the software.

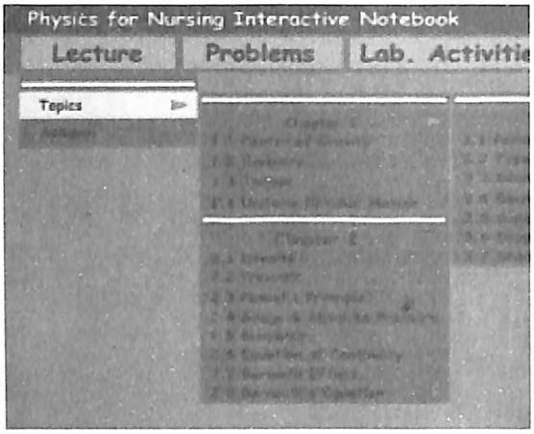

Figure 2. List of topics under the *Lecture* button.

Much emphasis is given on the conceptual aspect of the selected lessons. This is done by relating the concepts to real-life situations or experiences that the students can easily connect with. In other words, the software is not a mere product of transfer of knowledge from the book to the courseware. Furthermore, motivation aspect of the lecture presentations is given prior to the main lecture discussion of the topic. The main way of motivating the students to be interested in the topic is through giving questions about some common experiences and how certain concepts can explain such real-life experiences. These common real-life day-to-day experiences are simulated through visual animations and sound effects, injected with humor by using comical graphics. Figures 3a and 3b show examples of the motivation part of lecture presentations on *Pressure and Principle of Superposition.*

Furthermore, animations can be played and replayed by just clicking on the appropriate buttons, a feature that cannot be given by merely using a visual slider or an overhead projector. Using concrete experiences to introduce concepts is done to emphasize to the students that Physics is not just about solving word problems nor just a subject to pass, but it is actually an explanation that helps people understand and appreciate the physical world they live in and live with.

In addition to this, the **Problems button** includes selected problems with their animated illustrations. Much emphasis is given on the

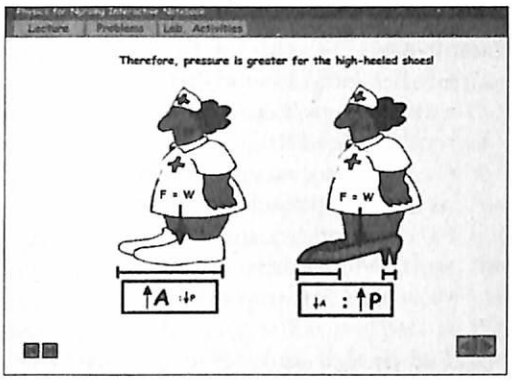

Figure 3a. Concept of pressure related to high-heeled shoes and painful feet.

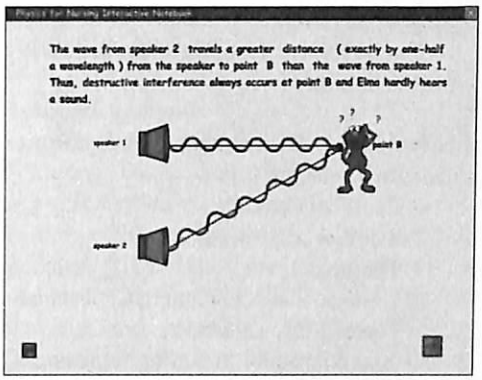

Figure 3b. Concept of Principle of Superposition related to sound perception.

animated illustrations than on the step-by-step solution which can be presented better on a blackboard. A button can be clicked by the instructor to show and hide the answer for a particular problem. Figure 4 shows a problem in *Doppler effect*.

Finally, the **Laboratory Activities button** includes simulations / illustrations of selected laboratory activities / experiments given to the Nursing students. The illustrations are focused on important points given by the teacher during pre-laboratory discussions. These important parts in a pre-lab discussion include identifying the parts and the proper electrical connections of an experimental apparatus or set-up and explaining how to gather the data through an equipment. The actual data gathering and data processing for the experiments is not included in the simulation because the activities are more accurately done with real apparatus and there are already existing computer programs specifically used for the data processing of these particular experiments.

In the experiment shown in Figure 5 for Free Fall, the instructor can show which button to click to turn on the millisecond timer, release the ball, reset the ball and choose the appropriate timer function and range. Moreover, the instructor can also show the proper wire connections. These features are true for the rest of the other laboratory activities in the software.

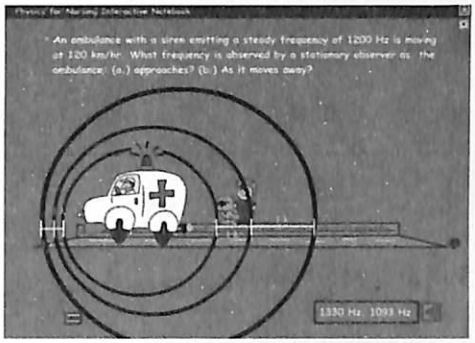

Figure 4. Problem in *Doppler effect*.

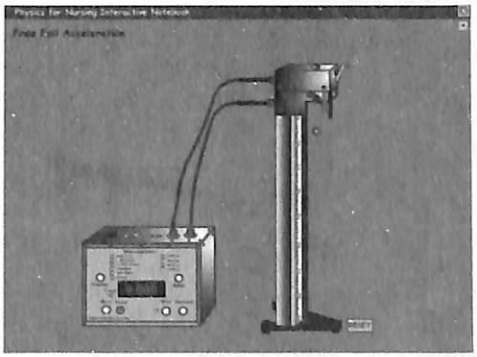

Figure 5. The experiment on Free Fall.

Software Coverage

The software includes the following topics and subtopics:

1. Mechanics: Kinematics and Dynamics including topics on
    1. Center of Gravity
    2. Stability of Systems
    3. Torque defined
    4. Uniform Circular Motion; Centripetal Force and Acceleration
2. Fluids and Pressure including topics on
    1. Density
    2. Pressure defined
    3. Pascal's Principle
    4. Gauge and Absolute Pressures
    5. Buoyancy: Archimedes' Principle
    6. Equation of Continuity
    7. Bernoulli Effect and Equation
3. Elasticity and Waves(Sound) including topics on
    1. Periodic Motion
    2. Types of Waves: Transverse and Longitudinal
    3. Wave Characteristics
    4. Energy in Waves: Sound Intensity
    5. Superposition and Beats
    6. Doppler Effect: Moving Source and Observer
    7. Sonic Booms and Bow Wakes

It took more than one and a half years (mid-2004 until end of 2005) or three semesters to complete the development of the Nursing package. It was first used and introduced to the Nursing students during the second semester of school year 2005-2006.

Software Installation

The Physics for Nursing software can be installed in other computers as stand-alone program. This is done by creating an executable file (.exe) of the presentation that will call the other presentations in the software. A built-in program in Windows XP called *Install Creator,* is then used to create an installer for the software. The installer is saved on a compact disc and is ready for use. Once the software is successfully installed, it can be run even in computers with no Flash movie player.

Minimum Requirement Specifications for the software:

- Pentium 133 or higher
- Windows 95 or later
- 32+Mb of RAM
- 256-color monitor capable of 800 x 600 pixel resolution
- 5 Mb of disk space
- CD-ROM drive
- Other Software

The design and development of the software for Physics for Nursing was greatly influenced by and anchored on a similar local software called **PIN** or *Physics Interactive Notebook* developed by Eng. Lauro N. Casocot, a Physics faculty of the Ateneo de Davao University. The following are the similarities of the two software: the software tool used which is Flash version 5.0 by Macromedia Company; the physical arrangement of the main buttons in the main panel and the inclusion of Lecture and Problems categories. On the other hand, the two greatly differ in the manner of presenting Physics concepts (Physics for Engineering software presents Physics concepts mathematically while the software for Nursing is conceptual.) ; Physics for Engineering software has *Simulations* and *Tools* categories as additional features while Physics for Nursing software has added *Laboratory Activities* category and sound effects. Physics for Engineering software motivates through simulations while Physics for Nursing software motivates through comical animations.

DISCUSSION

The three chapters that are included in the software are chosen because these are the topics which the students find more difficult to grasp. Furthermore, the selected topics have more medical applications which are important for the Nursing students to learn. The software topic coverage takes 70-75% of the topics required by the Physics for Nursing syllabus.

A positive feedback from the students has been received. Students' feedback indicate that the software package through its comical animations and sound effects succeeded in motivating the students to be interested in the

topics. Students' interest in the presented topics was evident through the positive reactions seen while the courseware was shown. Moreover, some Physics faculty who have browsed through the software have commented that the motivation aspect of the lecture presentations is well-presented and the comical animations and sound effects elicit interest. Based on such affirmation, the department intends to expand the coverage to include other chapters that are part of the Nursing Physics course. Modifications of the already produced materials will be introduced based on actual classroom experience.

Having the positive feedback in the reception of the Nursing students of the Physics concepts using the developed software package, the Physics Department plan to work on the remaining 25-30% of the whole syllabus coverage to complete the software package for Nursing. Moreover, the department further intends to make the simulations of laboratory experiments be made able to function like the actual apparatus.

Acknowledgments

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