

In Defense of Lecture: Using Technology Inside and Outside the Classroom

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Introduction

In recent years, the lecture format has been the subject of numerous criticisms and cast aside as an old-style pedagogical method that has no place in the modern college classroom. One reason that lecture has gained such a bad reputation among many in the educational community is the idea of providing a “learning-centered” approach in the classroom. In 1995, Barr and Tagg described a paradigm shift in higher education where institutions should exist to produce learning rather than to provide instruction¹. Since this article, there have been many initiatives that have embraced this learning-centered approach. A few examples include Greater Expectations² and the Pew Grant Program in Course Redesign³. Note that ABET’s Criterion 2000 is an example of this paradigm shift as engineering programs must now assess how well students are learning and not what we as instructors are teaching.

An important question that should be addressed is the role of the lecture format in the learning paradigm. Many individuals in this reform movement have used terms and words such as “sage on the stage” and “passive” in regards to the lecture format. However, we strongly disagree with this classification of lecture and believe that lecture is a vital tool for instruction, including learning-centered instruction, in technical courses including engineering and chemistry. Certainly, the lecture format has its share of problems; and we personally believe that a balance of lecture and inquiry-based approaches (foundation of learning paradigm) has proven the most effective structure for our courses, especially in introductory courses. Some of the more notable problems associated with the lecture format are that students tend to take many more notes at the beginning of lecture than they do toward the end of lecture and that students lack the ability to take accurate notes. We are not convinced that instructors truly appreciate the magnitude of the note-taking problem, especially at regional universities with students that have diverse educational backgrounds.

This paper discusses how we have used a Tablet PC both inside and outside the classroom to improve teaching effectiveness and student learning. While we believe that “low-tech” instruction using chalk on a blackboard can be an effective teaching method, we have both become frustrated with the challenges that this type of lecture format presents. Some specific examples of challenges that we have faced in engineering, physics, and chemistry courses include writing many long derivations with complex equations, struggling to draw complicated three-dimensional geometries, and writing long problem statements for examples to be worked in class.

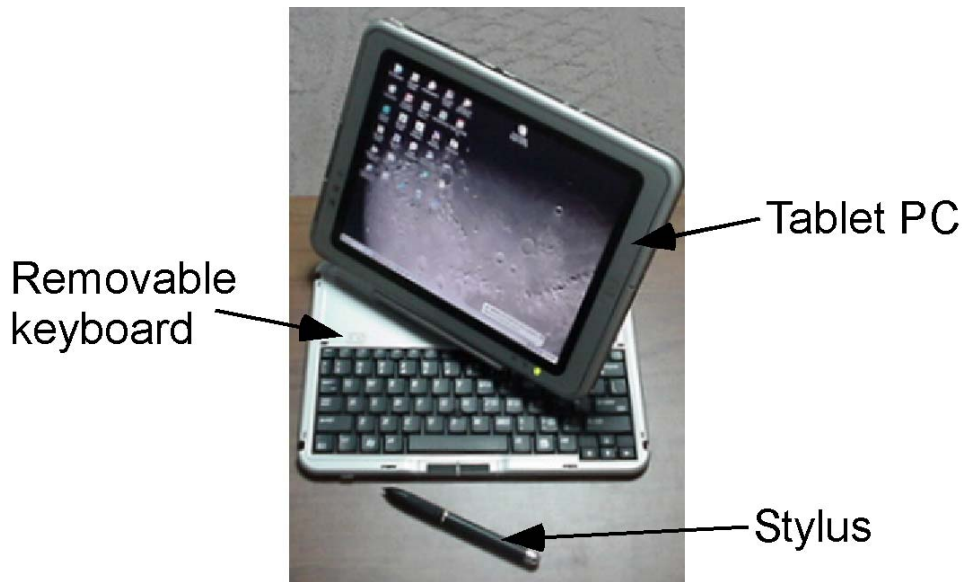


Figure 1: Photograph of the HP Tablet PC. The screen is shown in landscape mode but can easily be switched to portrait mode.

Tablet PC in the Classroom

Figure 1 shows a photograph of the HP Tablet PC that we use during classroom lecture. The tablet PC is a fairly new technology that increases the capabilities of a portable computer by allowing the user to annotate with “electronic” ink using a stylus. The tablet is similar to a PDA but on a larger scale with the full capabilities of a PC. The tablet includes an Intel M 1.0 GHz processor, 512 MB of RAM, 40 GB hard drive, 10.4” screen and integrated wireless networking capabilities yet only measures 10.8 X 8.5 X 0.8 in. and weighs just 3.1 lbs. With the annotation capabilities, the user can ink on PowerPoint slides, web sites, or other programs including Windows Journal, which is software included on most tablet PCs. Using Windows Journal, we can ink on blank pages or inside outlined notes instead of writing on the blackboard. As shown in Fig. 2., Windows Journal provides a full range of colors and highlighting capabilities to construct notes. Another powerful feature of the tablet PC is the ability to capture any part of the computer display (graphs from a spreadsheet, tables, diagrams, web-based renderings or materials, etc.) and place it into the Windows Journal to create a rich set of lecture notes which are both complete and accurate. After lecture, these notes can be archived and placed on the internet (at Murray State, we use Blackboard) where students have continuous access to them. The ability to archive the exact set of notes we present in class is the greatest advantage of using the tablet PC in the classroom as it gives the students the most complete and accurate set of notes possible. Preliminary data has shown that this is the most useful feature in the opinion of the students as it accommodates for many different learning styles and abilities.

An example of a page of notes for a Dynamics class is shown in Fig. 3. As you can see in Fig. 3a., PowerPoint has been used to create an outline of the notes which in this case is an example problem. Note that it would normally take 2-3 minutes to write out this problem statement and draw the picture, so by making these notes available to the students before class via Blackboard,

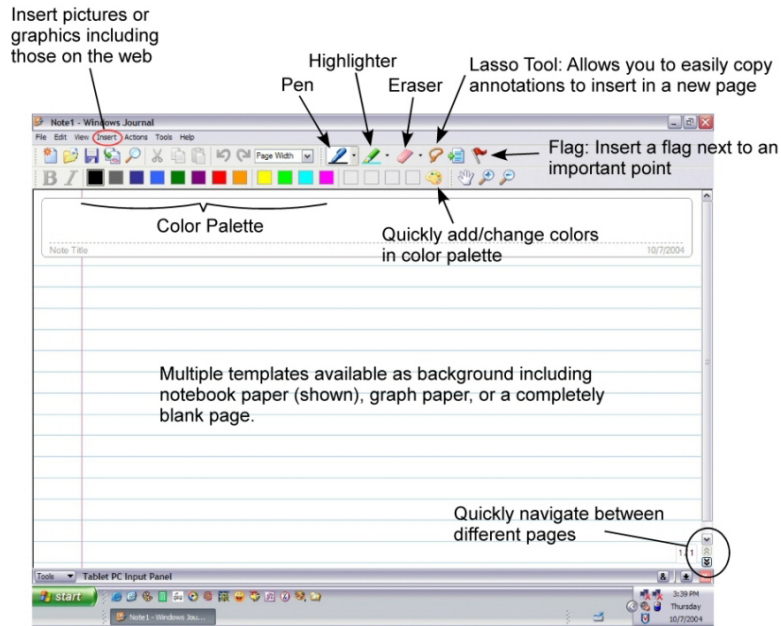


Figure 2: Screenshot of the Windows Journal Software. Note the full color palette for ink and highlighting.

we have just saved time; time that can be spent working more examples or considering contemporary issues which we sometimes have little time for. In Fig. 3b, the example problem has been worked using electronic ink. A situation like this is where the power of this technology is really seen. If you were to stand in this class and watch the students, you would find that 70-80% would be following along with the annotations and writing notes just like if the information was written with chalk onto the blackboard. However, the other 20-30% would be watching and listening and writing only when a point is stressed or a hint is given but not written down. This group of students prefers to avoid being distracted by writing notes as they know they can download the archived notes at a later date.

12-173 If the end of the cable at A is pulled down with a speed of 2 m/s, determine the speed at which block B rises.

a.)

12-173 If the end of the cable at A is pulled down with a speed of 2 m/s, determine the speed at which block B rises.

SINCE THERE ARE 2 CORDS, WE NEED 2 LENGTH EQUATIONS

$$2s_C + s_A = L_1 \quad (1)$$

$$s_B + (s_B - s_C) = L_2 \quad (2)$$

SOLVING FOR s_C IN BOTH EQUATIONS,

$$s_C = \frac{L_1 - s_A}{2} \quad (1)$$

$$s_C = 2s_B - L_2 \quad (2)$$

SETTING (1) = (2) $\rightarrow \frac{L_1 - s_A}{2} = 2s_B - L_2$

$$s_A - 4s_B = L_1 - 2L_2$$

b.)

Figure 3: Example of notes given in a Dynamics course. The outline of the notes (a.) can be downloaded by the students before class while the annotated notes (b.) are archived and are made available after each lecture. Note that having the problem statement written before class saves considerable amounts of time especially in classes where many example problems are worked.

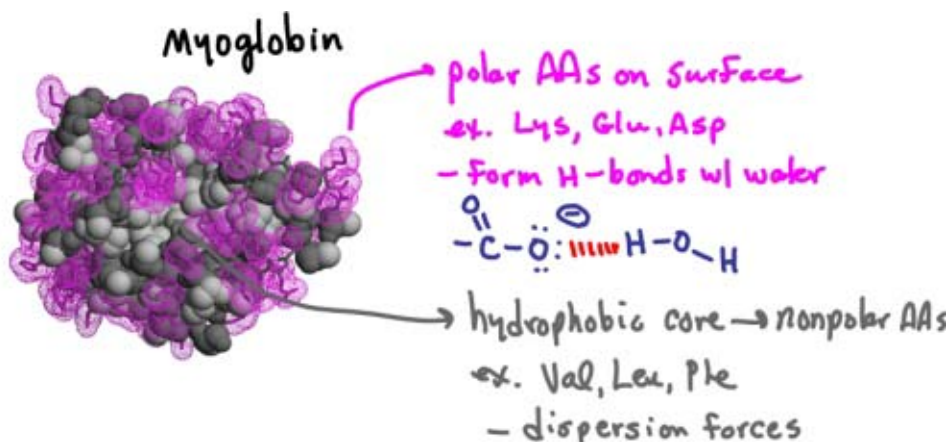


Figure 4: Complicated 3D geometries can be captured from the internet or other media and inserted directly into the notes and then annotated.

To illustrate how the tablet PC can be used to overcome the difficulty of drawing and/or explaining complicated three-dimensional geometries, Fig. 4 shows a computer-generated 3D molecular rendering used in an upper-level biochemistry course. It is virtually impossible to draw such a structure, but using the screen capture feature of the tablet PC, the rendering and its full color can be brought into the notes and then annotated upon.

Some opponents of this technology may argue that if students are given the ability to download a complete set of lecture notes, they are less likely to attend class. However, that is not the case as the students benefit from the verbal communication that accompanies the notes. Further, this same argument is true if students photocopy the notes of other students taken in a standard classroom setting. Anecdotally, attendance has been no different during semesters where lecture notes were archived compared to semesters where they weren't.

Another advantage of using the tablet PC that cannot be understated is the change in classroom dynamics. Specifically, it allows the instructor to never have to turn his/her back to the students and with a wireless projector, even allows him/her to teach among the students. For example, in Dr. Cox's introductory organic chemistry class, he used to be trapped behind a large lecture bench and tethered to the chalkboard with his back turned to the class for a large portion of the class period. Currently, the tablet PC is next to the lecture bench so that he never has to turn his back to the students. It is also very easy for him to move around the lecture hall and teach among the students. This is very important as student participation and interaction is a key ingredient to a good lecture. Using the tablet PC and archiving lecture notes has also allowed us to take a closer look at the lecture notes we write during class. On several occasions, we have found ways to improve the presentation of material through inspection of our notes.

Virtual Office Hours using the Tablet PC

With more departments and programs around the country providing online and distance learning courses, the need for personal instruction outside of class time for these courses has become evident. Dr. Rogers is intimately aware of this need as he teaches a course each semester at the

University of Kentucky's Paducah extended campus which is about an hour away from Murray. While he is able to hold office hours in Paducah for about 30 minutes two days a week, this is not a sufficient amount of time. Therefore, he has tried several different approaches to make himself more available to his students including phone office hours, Interactive TV, and finally Virtual Office Hours. Both Dr. Rogers and the students have been most pleased with the Virtual Office Hours which uses the tablet PC. In the Virtual Office Hours, the students and instructor log on to the Virtual Classroom feature of Blackboard which is shown in Fig. 5. In the virtual classroom, the students can ask questions using text chat, and through the use of the tablet PC, the instructor is able to write directly into the whiteboard, shown in the upper right of the figure, in order to answer those questions. The instructor may also allow one or more students to work on the whiteboard which increases the quality of interaction between the student and instructor. The whiteboard pages from the virtual office hours can also be archived and made available to students on Blackboard.

A weakness of the virtual classroom is that it does not include audio so all communication must be done using text chat or the whiteboard. However, this is easily overcome by using Yahoo!

Instant Messenger (YIM) which includes a voice chat/conference feature. YIM, shown in Fig. 6, is a free download from www.yahoo.com and many of the students are familiar with instant messaging as they use YIM or similar programs such as MSN Instant Messenger or AOL Instant Messenger to communicate via the internet. In order for the students to talk to the instructor, they must acquire a microphone but those can be found for just a few dollars. Therefore, with the use of the virtual classroom feature of Blackboard simultaneous with a voice conference using Yahoo! Instant Messenger, an instructor can have an interactive session with one or more students who have access to a computer with an internet connection including modem connections. Not only has this technology proven effective with the distance learning students but Murray State students have also made use of it during evening hours.

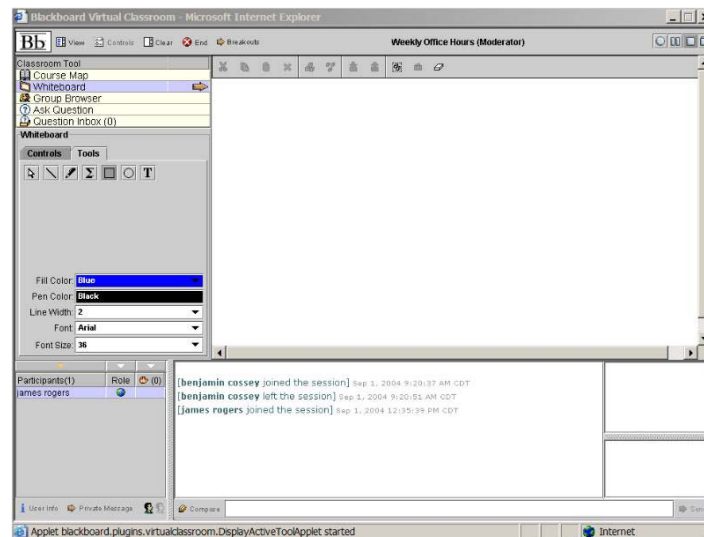


Figure 5: Screenshot of the Virtual Classroom feature of Blackboard. The whiteboard in the top right corner can be drawn on using the tablet PC for all those logged on to see. Each whiteboard page can also be archived.

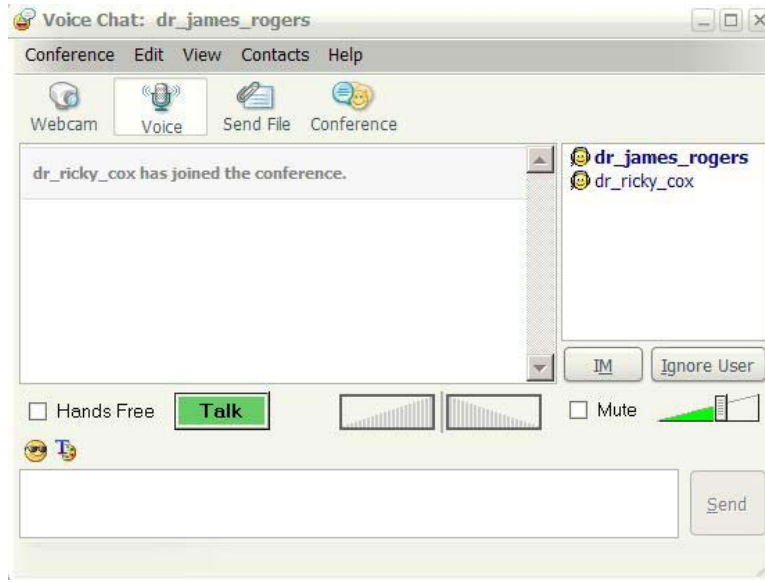


Figure 6: Screenshot of the Voice Chat feature of Yahoo! Instant Messenger. By incorporating voice chat into the virtual office hour sessions, the instructor is able to have a fully interactive office time with any student that has access to a computer with an internet connection.

Conclusion

Overall, we are strong supporters of lecture and believe that technology can play a role in addressing some of the problems typically associated with the lecture format. At this point, we only have preliminary data and anecdotal evidence but we feel that this technology has helped us to increase both teaching effectiveness and student learning. This technology has also allowed us to maintain our enthusiasm and love for teaching.

References

- [1] Barr, R. B. and Tagg, J. *Change* **1995**, 27, 12-25.
- [2] www.greaterexpectations.org
- [3] www.center.rpi.edu/PewGrant.html

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