

*Using Tablet PC's Interactively to Teach Critical Thinking in Real Analysis*  
*Final Report*

**V.S. Prasad, Mathematics Dept, UML**

V. S. Prasad received a Professional Development Grant for \$8250 to purchase 3 Tablet PC's and a course buyout to address student learning issues in Real Analysis (92.305), a math course for juniors and seniors at UML. The course was restructured so that one of the three weekly lectures would be replaced by a lab performed in class in an interactive manner, using the tablet pc. The course buyout was not used so that the PI could purchase 5 Gateway M280 Tablet PC's. The PI purchased another tablet using an internal UML grant from the Council for Teaching and Learning.

**Rationale (pedagogy):**

The purpose of the labs is to introduce the students, through many examples, to the way mathematicians invent new definitions and think of new theorems.

**Implementation (technology):**

The tablet was used by the PI for each lecture for the first half of Real Analysis 92.305 each semester, and for the labs for the remainder of the term whenever there were lab questions.

The year the grant was awarded, Fall 2006, the course was restructured so that one of the three weekly lectures would be replaced by a lab performed in class in an interactive manner, using the tablet pc. This year (Fall 2007) I offered the students, 5 tablet pc's to use for the entire semester – in particular I asked them to use it in my course to take notes and really take advantage of the tablet capability (to have the tablets sit in a closet and be used only once a week is a bad use of resources). Only three students took up the offer and one of them dropped the course after 1 month, another did not like the tablet, but one student did use the tablet everyday for the semester. Over the course of the summer 2006, slides for the class (covering 6 weeks of classes) were prepared using the Beamer (PowerPoint style) presentation package, and are available at:

<http://faculty.uml.edu/vprasad/92.305.032/Chapt%201%20Reals/RealMaster.pdf>.

The PI found that using MS One Note with the transparencies enlivened the static presentation slides, as well as providing an endless white board to answer questions “on the run”.

Use of tablets including, was expanded to include the PI's Engineering Differential Equations class (92.236) at Andover High School, offered to 14 junior and senior high school students, through the university's outreach program; T&L's tablet was used at UML Fall 2007 in 92.236. The PowerPoint presentations in Differential Equations are available at:

<http://faculty.uml.edu/vprasad/92.234.A33/material.htm> .

**Conclusions and Modifications:**

Use of tablets by students, *once a week* did not result in any significant difference in the performance of Real Analysis students compared to previous years: of the 10 students who originally enrolled, only 6 finished the course and of these only 4 passed. This is the steady state over the last twenty years. The attempt to lower the dropout rate in this course by having the students keep the tablets did not change the story either.

What did change is the PI's own lecturing. The PI expanded greatly, his own use of the technology to incorporate tablets in his lectures as well as the labs. The PI has

discovered that he cannot go back to a laptop that does not have the inking capability of tablets:

*Regular use of the tablets has changed the way the PI teaches his classes.*

The ability to solve equations on the fly enabled the PI to teach side issues (such as programming commands for MAPLE or ODEArchitect) on the fly. The Real Analysis students found that the PI's use of prepared presentations in class resulted in the class going too fast – however, the Real Analysis students had the same complaint when the PI returned to the whiteboard presentations in the second half – and all of this in 2 sections which did not cover as much material these past two semesters as in the previous years. Sometimes, the students are just not as capable as other years. Also, this material is definitely difficult.

The PI expanded his use of tablets to other courses, in particular Engineering Differential Equations. In last spring's Differential Equations course at Andover High School, the PI offered 5 tablets to the Andover High School students. This offer to the students was a complete failure as the tablets succeeded only in distracting these very bright kids - the tablets were used for only three weeks. The PI then used the tablets only for his own presentations of lab material and occasional PowerPoint presentations – combined with board work, this resulted in a much more successful presentation of the course than in previous years. The use of the tablet in DE's to introduce a few labs and a few PP presentations was also very successful in 92.236 (Differential Equations) this past Fall at UML – it was not as successful in 92.305 as the PI hoped.

The PI will continue to use and expand his use of the tablet(s) in all of his presentations (teaching *and* research). I am most grateful for receiving this grant to use a tablet in my classes.

**Dissemination:**

The PI gave a poster presentation of these results at the ITC conference in Sturbridge, MA (*Incorporating labs in higher level math courses*) in April 2007. The PI is also preparing an article for publication in the department's alumni newsletter *Tangents*.