



## Mobile Studio Classroom for Minority Students at Howard University

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In March 2005, Howard University received an HP Technology for Teaching grant to encourage the transformation of learning and teaching. Mohamed Chouikha (PI) and Co-PIs are using HP mobile technology to create a mobile learning environment which eliminates the boundary between lecture and lab, theory and application, and of facility limitation in the student learning. The "anywhere anytime" mobile class pedagogy, realized with HP Tablet PCs, wireless routers, and measurement software is currently applied to a few courses and have been enthusiastically accepted by students. (\*Don Millard is with RPI.)

### Rationale

Most core electrical and computer engineering courses are taught along with accompanying laboratories. Lectures and labs are taught sometimes by different instructors at separate times. In other words, theories and applications and simulations and implementations are separately taught. Great are the need of combining two components together and the demand of synergy learning in which introduction of a theory and verification of the theory are possible and instant in a conducive learning environment. In addition to the need and the demand, there is a practical barrier to break in the current laboratory system: facility limitation and time of use restriction. Traditional labs are to be equipped with work benches and expensive instruments, and students have to come to the the physical facility to perform an experiment, where the access is often denied after hours.

Our project, motivated to meet the need and the demand and to lift the barrier of the conventional laboratory limitation, seeks to develop a mobile studio class using wireless enabled Tablet PCs. For the data acquisition software and its interface, which substitute laboratory equipment, our collaborator at RPI was generous enough to provide the laboratory software "scope" and the USB interface between the Tablet PC and students' breadboards.

In Fall 2005, two classes adopted the mobile studio approach. In Electronics I class, students experienced exciting moment of theory, simulation, followed by circuit implementation and testing and measurement, using only a Tablet PC. The "Scope" enabled measuring and display of the result. In Microcomputer course, students had an instant access to the lecturer's material and the writing pad of the Tablet PC supplied much better explanation board for the lecturer, further augmenting students learning.

An initial survey conducted by a collaborator in the Education Department was very encouraging. Overall, the students expressed very positive attitudes regarding the mobile studio approach in their courses. **The students rated the mobile studio class as quite favorable in terms of increasing their ability to apply theory, knowledge of subject matter, and interaction with other students in the course.**

### Implementation (pedagogy)

Mobile studio pedagogy has two essential components: combination of theory and application and extension of classroom to "anywhere anytime." A lecture and lab pair, for example Electronic I and Electronics I Lab, which has been separately taught in a classroom for the lecture part and in a laboratory for the lab, is now taught in any room. Currently, a lab space is used for the mobile studio class, it is not necessary. Any place with tables and wireless access could be turned into a class.

In Microcomputer Fundamentals course for assembly language programming, students are provided on their wireless networked Tablet PCs with multi-stream of lecture materials through lecture note web pages, slides in the screen, additional drawings and explanations written and displayed on the writing board of the lecturer's Tablet PC.

This dramatic change and quick realization of the mobile studio pedagogy was only possible by the help from our collaborators in RPI. Their expertise and experience opened our eyes on the new pedagogy of engineering teaching, and they helped us launch, before applying for a HP Technology for Teaching grant, two demonstration events of mobile studio class. The experience gained from the demonstration propelled us to easier deployment of the wireless environment with the HP grant and to smoother transition to the mobile studio pedagogy.

[Charles Kim's Classnote Page](#)

[Mobile Studio Demonstration Page](#)

### Implementation (technology)

This technology-rich environment can only be available by utilizing and connecting computer, wireless communication, microcontroller-based interfacing, and Windows based data acquisition and graphic display software. The hardware part of the system consists of HP Tablets PCs equipped with wireless communication, a wireless router, and an LCD projector, all provided by the HP grant. Additional hardware component is a USB connected interface board which measures signals in an experiment circuit and sends the measured value to the Tablet PC via USB connection. The current USB interface is installed in a small breadboard, and the rest of the board is large enough for most of the experiments in the course. The measuring and displaying software, which replaces the conventional oscilloscope and digital multimeter, was developed and provided by RPI. This Windows based software can read multi-channel signals with accuracy and real time.

### Impact on Teaching

The purpose of the project is to develop a mobile studio to provide students with a conducive and synergistic learning environment. For a teaching perspective, it also involves the improvement in the betterment of conveyance of knowledge. Lecturers are excited by the enable technology of Tablet PC and its writing table. A simple and fixed slide now can become just a template of a more dynamic teaching material with instant drawings, scribbles, and additions. We envision, with full deployment of the mobile studio in a wider range and a broader exposure, that more lecturers join us in this exciting teaching environment. For an effort to disseminate the benefit of the mobile studio, we held an open house in November 2005 for Howard faculty.

### Impact on Student Learning

The eventual goal of the project is to improve the learning of the students and the betterment in conveyance of knowledge. The deployment of a mobile studio class does not solve every problem the engineering education faces. However, the alienation of application from theory and out of steps in lecture and lab of the traditional learning are slowly receding. Currently students learn knowledge with multi-faceted streams of lecture, circuit design, simulation, experiment, and output visualization. We envision, in the near future, we deploy the mobile studio pedagogy in a wider net with a Tablet PC to every student in our department so that all the lecture-lab classes are benefited by this "any place any time" learning environment.

An initial survey conducted by a Howard collaborator in Education Department for Electronics I and Microcomputer courses showed very encouraging results. The survey showed that the students expressed very positive attitudes regarding the mobile studio classes in their courses. The students rated as quite favorable in terms of increasing their ability to apply the theory, knowledge of the subject matter and interaction with other students in the course. We plan to collect more data for summative assessment of the mobile studio class, and at the end of the project, we will perform formative assessment on the project.

[Survey Form](#)

[Initial Survey Result](#)



Prof. Kim and Francis Sammy test a microcomputer code while Andrew Barnor is waiting for his turn.

**"My teaching philosophy with Mobile Studio is to provide greater flexibility in student learning such that students can learn using mobile technology in any physical environment, no longer restricted by facilities or special equipment. The motto is 'lecture in lab, lab in lecture, anywhere any time'"** -Charles Kim

**"Utilizing design software, in conjunction with the lab station, provides a wider approach to teaching the course"** - Kojo Linder

[Mobile Studio by HP Technology for Teaching grant](#)

### Quick Facts

Dept: [Electrical and Computer Engineering](#)

Courses Impacted: [3 \(Electronics I and Lab, Microcomputer Fundamentals, and Network Analysis II\)](#)

# Students Impacted: [45](#)

# Faculty Involved: [2](#)

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[Department Web Page](#)

### Contact Us

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[Howard University HP Project Web Site](#)



### References & Publications

Charles Kim, "Mobile Studio Lab - Future of Engineering Education," Presentation in the Mobile Studio Open House. November 14, 2005.

Kojo Linder, "Mobile Studio Lab Demonstration." Presentation in the Mobile Studio Open House. November 14, 2005.

[Charles Kim's Presentation Fille \(pdf\)](#)

[Kojo Linder's Presentation File \(pdf\)](#)



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