iPOD/PDA-"casting" in a CS program with Integrated Distance Technology

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ABSTRACT

This paper presents the results of a semester's experiments with producing instruction in "castable" format for iPODs and PDAs. The program involved is a non-traditional graduate computer science program emphasizing "applied computer science" that also includes integrated distance-learning technology. Existing lecture recording and web-streaming technologies were upgraded to also produce "castable" versions of the lectures for downloading and viewing on mobile devices. Observed student use and survey responses were used to evaluate the pedagogical value of these lecture formats.

1. INTRODUCTION

The Master of Science with major in Applied Computer Science (**MS*A*CS)** at Kennesaw State University is a non-traditional program emphasizing applied rather theoretical topics, though a recent restructuring adds a conventional science-oriented track with a thesis [1],[2]. The program integrates the use of distance technology as an optional way to attend lectures, in order to accommodate the working professional with substantial business, travel, and family commitments [3],[4]. The program accommodates part-time and full-time students. All lectures may be viewed on campus in a conventional classroom upgraded with distance technology, and are streamed over the internet live, and are recorded for later review and study.

The program includes a premium tuition rate of $5000 per semester (five semesters), which represents a resource flow that strengthens the **MS*A*CS** program by providing equipment, laboratory facilities, distance technology, and opportunities for student and faculty research, graduate assistantships, and travel. The premium tuition currently supports a number of expensive premium features that students enjoy: Included in the tuition:

- Distance Learning over the internet with a browser
- Archive lectures for later view
- All books and materials
- Travel and certification options.
- Laptop computer
- PDA
- Embedded Systems lab equipment
- Student ACM membership

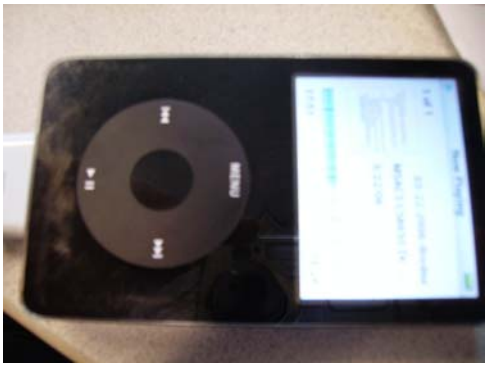
2. iPOD AND PDA EXPERIMENTAL TECHNOLOGIES

A grant provided iPODs for experimental use, which were distributed at no charge to students willing to take part in experimental use in a graduate course titled "AI and Robotics". Students also had PDAs available which are used in another course, so the opportunity to compare the two devices was incorporated into the experimental design. The grant also supports a collaborative effort with faculty experimenting in a variety of courses and in other computing and informatics programs [5].

Apple iPOD:

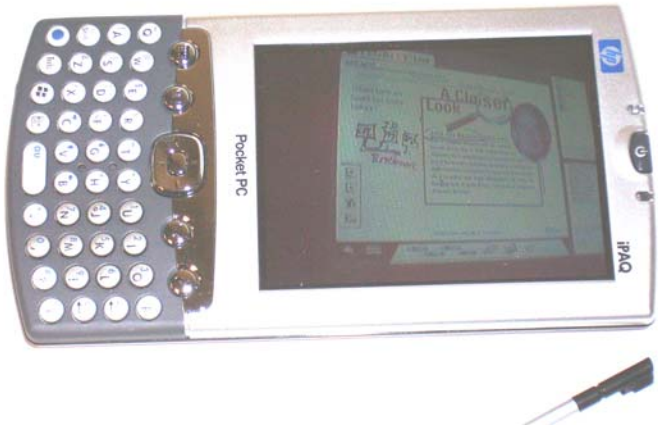
60GB Apple Video iPOD with docking station and iTrip. Each "cast" was between 30 and 50MB in size, so the iPOD has the capability of storing a large number of lectures. The iTrip is used to transmit and play the audio content on the iPOD to a car radio. The iPOD has the capability to automatically detect when new lectures have been recorded on our lecture sever, and download them through the laptop to the iPOD. The smaller size of the video screen

of the iPOD is partially offset by its higher resolution.



HP iPAQ H4350 PDA:

The PDA runs Windows CE. And comes with 256MB of memory, but can be upgraded with an additional 2GB of storage on a memory card. Expanded with the memory cards, the PDA can hold a substantial number of lectures, but far fewer than the 60GB capacity of the iPOD. The larger viewing screen is a plus, as is the multifunction capabilities of a PDA.



3. PROGRAM DISTANCE TECHNOLOGY PHILOSOPHY AND STRATEGY

The philosophy behind the MSACS distance-learning technology is to provide a set of flexible tools to allow instructors to choose the teaching mode that best suites their style and needs, rather than impose a "one-size-fits-all" structure. This flexibility is necessary in order to mitigate some of the overhead of teaching distance classes, by having the technology accommodate the instructor, rather than forcing the instructor to make accommodations in their teaching style and lecture preparations to adapt to the technology. Like many institutions, KSU does not have a faculty teaching model that acknowledges the effort involved in distance/technology teaching. Prior to proceeding with the development of this distance-learning dependent program, the technology was thoroughly tested against a high bar of capability and ease-of-use and minimal instructor overhead. The reality is that teaching in a distance-learning program has great rewards, but also places greater demands on the instructor. Our pedagogical approach was designed to mitigate as much of that burden as possible.

The strategy adopted to deliver effective instruction at a distance, is to provide flexibility for both the instructor in terms of teaching modes, and for the students through a choice of attending class live and in-person in the classroom, live but remote with voice and chat interaction, or by viewing the recorded lecture. The technology supports students connecting in at different speeds and delivers different streams matched to the user's connection bandwidth. Students may connect over high-speed broadband connections, or over slower modems, down to 56Kbps. The processing capability needed at the client/student machine is very low, requiring only a recent version of MS Internet Explorer, and does not require that a client interface program be installed on each student's machine.

Rather than deliver high-bandwidth full-video streaming, which would not be viewable from a modem connection, our choice of technology delivers a small web-cam view of the instructor lecturing, and a large view of the lecture material supporting live annotations and additions. The lecture material (MS PowerPoint and other applications) is updated only when the image is modified, as in a change to the next slide, or when the instructor writes on or annotates the screen. Thus, only the changed material is broadcast. In this way, the overall data stream is low bandwidth and is viewable over a modem, being composed of the low-bandwidth instructor webcam, and periodic and occasional graphic-screen updates. Figure 1.illustrates the student interface, showing

an instructor lecturing at the whiteboard using markers to annotate a prepared PowerPoint ™ lecture, with annotations automatically captured and streamed to the students.

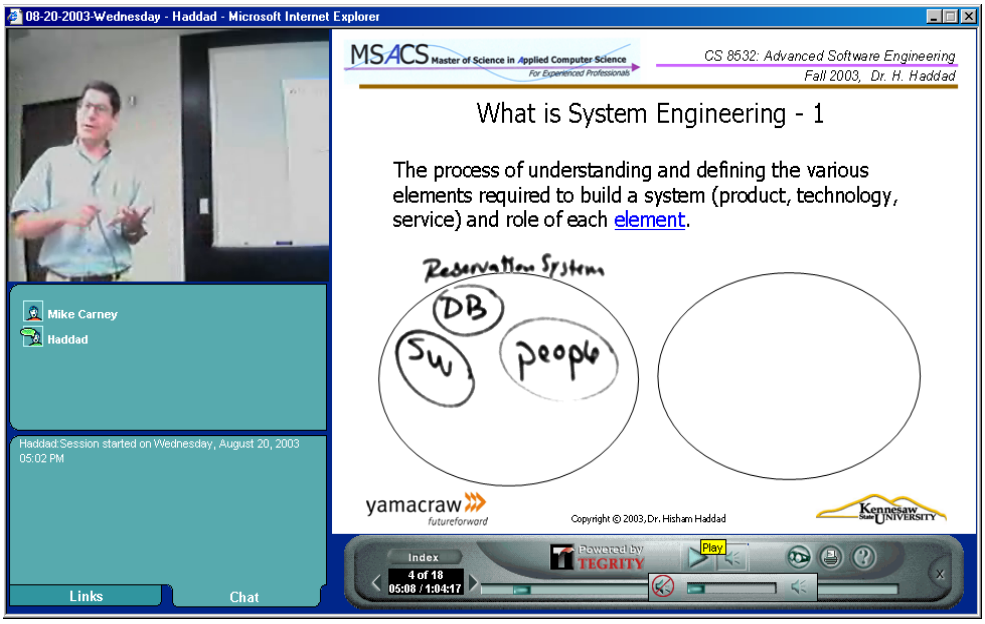


Figure 1. The Student Interface

4. STUDENT PERCEPTIONS OF DISTANCE TECHNOLOGY

The MSACS program is in its fifth year with around 50 concurrent students. Students were surveyed as to how they perceive the program, its strengths and weaknesses, and the attractiveness of the curriculum, premium features, and other aspects of the program (Table 1.). One portion of the survey asks students to rank 9 features of the program in order of their importance to them and how attractive those features are as prospective students.

Analysis of student responses: (96% return rate)

1. **Curriculum Design and Content** of this applied computer science program is evaluated by our students as the most attractive feature. The focus on applied computer science is attractive enough to bring in a sufficient number of students willing to pay premium tuition.
2. **Distance Learning:** After students have had an opportunity to develop experience with the system, their appreciation and comfort level with the technology increased from a 3.6 rating to a 2.8, (low numbers better). Correspondingly, the importance of KSU's location fell from eighth to ninth, reflecting

Table 1. Student Ranking of Program Features (1-10, where 1 is most important)

	Prior to First Semester		After First Semester	
1	Curriculum Design and Content	2.8	Curriculum Design and Content	2.8
2	Distance Learning and Archives	3.6	Distance Learning and Archives	2.8
3	CS Faculty Credentials	3.9	CS Faculty Credentials	4.0
4	Emb Sys Microcontroller and lab	4.2	Emb Sys Microcontroller and lab	4.2
5	Books & Materials Included	5.3	Books & Materials Included	5.1
6	Premium: Emb Sys Conference	5.4	Premium: Emb Sys Conference	5.5
7	Premium: UNIX certification	5.8	Premium: UNIX certification	6.1
8	KSU Location	6.2	Admissions, Integrated Foundations	6.4
9	Admissions, Integrated Foundations	6.5	KSU Location	6.8
10	Other	9.8	Other	9.4

the success of our integration of distance technology, and increased student comfort with our specific technology. This corresponds with an observed decrease in the number of students attending on-campus, as their comfort level with the technology increased. Clearly, the technology adopted and pedagogical model utilized for distance-learning in the MSACS program meets the criteria needed for student success.

3. **The most Expensive Premiums**: Attending professional conferences and obtaining professional certifications are ranked only 6th and 7th in order of importance.

4. Faculty Credentials ranked third in importance to students, both before and after their first semester

5. **Overall Student Satisfaction with Program:** On a scale of 1-5, where 1 being the best and 5 the worst, student satisfaction with the program was rated an excellent 1.4 overall. On a scale of 1-5, where 1 being the best and 5 the worst, student willingness to recommend our MSACS program to others was ranked an excellent 1.4 overall. Many students indicated in the narrative portion of the survey, that the program exceeds their initial expectations.

5. iPOD/PDA –CASTING RESULTS

Students were surveyed at the end of the semester as to their perceptions of the iPOD and PDA as lecture viewing technologies. Table 2 is a ranking by students of the usefulness of seven different distance lecture delivery mechanisms. This data was obtained from students in a single class over the course of one semester's experience.

The primary lecture delivery mechanism for most students is the web-based technology delivered over the internet. The survey results yield a number of observations about alternative instruction delivery mechanisms:

1. The ability to download and view lectures "off-net" was important to some, but not all students.
2. The traditional in-class lecture experience was rated as best by students.
3. The live and in-class experience (2.8) is closely followed in the student evaluations by the live Tegrity experience (2.8), validating our approach with Tegrity in our program.
4. Viewing the "castable" recordings on either the iPOD or PDA was rated higher by students than viewing the same recordings on the laptop, even though the view on the laptop is much larger and higher resolution. The portable convenience of having lectures on the PDAs or iPODS were reported as a factor in this preference.

Table 2. Average Student Ranking of Delivery Mechanisms Ranked 1-5, with 1 being best.

1.	In-class conventional	2.6
2.	Live streamed l (Tegrity)	2.8
3.	Recorded & Downloaded (Tegrity)	3.8
4.	Recorded and streamed (Tegrity)	3.8
5.	iPOD "cast"	4.2
6.	PDA "cast"	4.6
7.	Viewing the "cast" on a laptop	4.8

Table 3. explores the direct comparison between the iPOD and PDA for viewing lectures.

Table 3. Direct Comparison between iPOD, PDA, and Tegrity

1	Viewability of lectures on the iPOD and the PDA.Average rating by students, rated from 1-5, where 5 means good or very likely.	
	iPOD	2.6
	PDA	2.75
2	Likelyhood of viewing "casts"as the primary lecture delivery mechanism. (1-5, with 5 being "very likely")	
	iPOD or PDA	2.6
3	Direct comparsison of iPOD and PDA against our primary lecture delivery system (Tegrity)	
	iPOD	2.4
	PDA	2.0

The survey data in Table 3. reveals the following observations:

1. Neither the iPOD or PDA was rated by students as being a particularly good mechanism to view lectures (2.6 and 2.75 out of 5), but were rated as acceptable. Student comments suggested that lighting improvements and camera angles might improve the casts. [This semester was our first experiment with this particular technology]
2. Students were unlikely to select the iPOD or PDA as their primary instruction delivery system.
3. Students made direct comparisons between the iPOD and PDA directly against the primary distance lecture system (Tegrity). Neither mobile device compared well against the more robust system that supports a high level of interactivity and greater communication bandwidth. Students perceived the iPOD as slightly superior to the PDA for viewing lectures (2.4 vs 2.0).

Student comments in comparing the iPOD/PDA casts against the Tegrity recorded lectures indicate that an important feature that the mobile devices lack is the ability to index the slides in a lecture. Students use this feature to more around in a lecture to review specific portions. The Tegrity system provides an index screen with a thumbnail shot of the slides that allows students to choose which slide to move to. This feature is very useful to students for studying and reviewing previously viewed content.

Our experience with our distance graduate program, backed up by student input, has revealed a number of important observations:

1. The instructor video is critical for non-verbal cues and student interaction, and maintaining student interest in a live-distance or recorded lecture.
2. Some method of capturing content created on-the-fly like drawing, annotation and writing, must be supported by the technology or the lecture tends to devolve to just reading prepared slides.
3. The LCD touch-sensitive monitor that can be written on has been shown to be comparably effective with the white-board annotation capture using markers. Most but not all faculty are gravitating toward this lecture method, but both methods will continue to be available in the future.
4. The document camera can be utilized for showing textbook pages, notes, objects, demonstrating live experiments, etc. This feature is used occasionally, but is a crucial capability when needed.
5. Our remote students interact far less frequently than in-class students, with the two methods available: the typed "chat" interface, and voice-over-IP. Subsequently, capturing in class student questions and discussion is very important to capturing the overall experience for the remote students and students viewing the recorded lecture..

The Tegrity ™ technology used is feature-rich and actually provides more capabilities and options that are absolutely required to deliver successful distance-lectures, based on our experience. Table 4. identifies which options in our experience are critical for student-learning at-a-distance, and which are useful additions, and which are not necessary. As an aside, our primary system (Tegrity) provides a mechanism to automatically produce iPOD "casts" for each lecture, which turned out to be problematic. Consequently, we investigated and successfully worked-out an independent mechanism to produce the iPOD and PDA recordings.

Table 4. Required and Optional Distance Learning Features (Based on faculty & student observations & feedback in the MSACS program)

S – Supported for the MSACS program at KSU

P – Planned for future in the MSACS program at KSU

Must Have	Useful Option	Little Value	Distance Technology Feature
	X		In-class students during lecture ***S***
X			Recorded lectures for review ***S***
	X		Synchronous live lectures ***S***
X			Instructor Web Cam ***S***
X			Instructor Audio ***S***
X			Capturing Annotation ***S***
	X		Whiteboard annotations ***S***
	X		TouchPanel annotations ***S***
X			Document Camera for occasional use ***S***
X			Remote Live Student Interaction ***S***
X			"Chat" captured and recorded ***S***
	X		Voice over IP live student interaction ***S***
		X	Student Web Cam ***S***
X			Capture in-class student audio ***S***
		X	Capture in-class student video
		X	Live student sharing of applications during lecture
	X		iPOD capability ***S, P***
	X		PDA capability ***S, P***
	X		Student collaboration at a distance tool ***P***
	X		Remote Student video conferencing capability ***P***

6. CONCLUSION

This research project has explored and compared a wide variety of distance instruction technology features, including the investigation of the use of iPODs and PDAs for viewing "casts" (downloaded recordings viewable on mobile devices). The use of the iPOD and PDA was shown to be of value to students, but are not satisfactory as the primary instruction delivery technology.

Our unique program already provides a variety of technology to our students, including laptops and PDAs. Rather than purchase and provide iPODs to students, we have decided to provide a 2GB memory card for the student PDAs, allowing the storage of a larger number of lectures. The PDA is capable of much more than an iPOD, and is used in other regular curriculum courses in the program. The 2GB SD memory cards can be easily used to transfer files between the PDA, laptop, and other devices like cameras. The PDAs will also include upgraded video capabilities with a larger and higher resolution display.

The success of the project and student feedback from this first experience has convinced us to commit to providing recordings in formats for both the iPOD and PDA for all future lectures, as a supplement to our primary instruction delivery mechanism.

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[2] MSACS web site: http://msacs.kennesaw.edu

[3] Tegrity web site: http://tegrity.com

[4] Distance Learning Page on MSACS web: http://msacs.kennesaw.edu/distance-tech

[5] Collaborative iPOD investigation project: http://science.kennesaw.edu/~khoganso/I-POD-Project/I-POD-Project.htm