CASE STUDIES

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**The Educational Applications of Streaming Audio:
Accessible, Do-It-Yourself Multimedia**
by **Grover C. Furr III**

The term "multimedia on the Web" evokes expectations of Web-based presentations with sound and video. Although significant barriers exist today for the professor or teacher who wishes to create his or her own audio/video course content, streaming audio alone—sound without video—is a Web-based technology that is available *today*. It is easy to learn, inexpensive to produce, and available to off-campus students with only a 28.8 Kb connection to the Internet.

INTE with this article!

During the summer of 1999, I learned how to produce Web-based multimedia presentations for my classes. I had seen such presentations on corporate sites in the form of "streaming media." They looked and sounded very good when I viewed them over my university's T1 Internet connection.

After spending a week making some very simple files, however, I decided not to proceed further with streaming audio/video (A/V) for two reasons. First, producing all but the simplest streaming video requires considerable technical skill. Though it's easy to "capture" (convert from VHS videotape format to digitized file format) a straightforward video clip, the editing skills (cutting, splicing, fade-in and fade-out, adding titles and captions, synchronizing with sound, and so on) needed for all but the simplest videos require considerable practice and time to learn.

Second, A/V files are too large to stream fluently over a modem connection to the Internet, whether the modem is 28.8 or 56 Kb. There are many pauses in the streaming process, and the video motion is jerky, making presentations unusable in a course for students who prefer to work off-campus and who have only a modem connection to the Internet. Though these problems are eliminated when the A/V file is viewed in an on-campus computer lab, I felt I could not justify forcing my students to

use already overcrowded labs rather than their own home computers. (See **Exhibit 1** for more information about producing streaming video.)

However, I discovered that while A/V presentations did not stream to a 28.8 Kb modem connection fluently enough to be usable, audio presentations *did* stream very well when viewed at all but the busiest Internet times. Furthermore, the software required to create the digitized streaming audio files is free, as is the software required to listen to them. Finally, the software is very easy to use; a teacher can make a streaming audio file after only 10 minutes of practice.

What Is Streaming Audio?

"Streaming audio" refers to a file format and software that permits a long audio (or A/V) file to be played without the listener's having to first download the entire file, a process that could take an hour or more and occupy several megabytes of drive space in the case of a long lecture. A quarter- or half-minute of the file is preloaded into a "buffer," which the player software uses while more of the file is streamed in advance. This buffer permits a very long file to be played continuously after only a few seconds' delay.

There are several formats for streaming audio. I use the **RealAudio** [.rm] format, the current industry standard.

Why Stream Rather Than Download the Audio Files?

Sound files can be made in many formats other than RealAudio's Streaming RM format, but I prefer streaming for several reasons:

- RealAudio files can be played almost immediately, without being downloaded in their entirety first.
- In the event that Web use is heavy and even an RM file does not stream fluently enough, the student can simply download the file to his/her hard drive and play it with complete fluency thereafter. The professor need only provide students with a direct hyperlink to the file.
- RM files are up to 40 times smaller than sound files in other formats. They can be downloaded more quickly, and they take up less space, with little or no perceptible loss of sound quality.
- Many college computer labs, such as those at my institution, do not permit students to download anything onto them.
- RealPlayer now comes bundled as a plug-in with the free Netscape Navigator and is easy to download and install by itself. Users of older versions of Netscape Navigator and of Microsoft's Internet Explorer can download it from the Real.com site. (See **my streaming audio tutorial** for details.)

Using Streaming Audio in the Classroom

At present, I use streaming audio in three ways:

- *Sound samples.* For example, in my Middle English Literature class, I can demonstrate various modern experts' oral interpretations of Middle English texts, such as the opening of **Sir Gawain and the Green Knight**, read by a scholar from the University of Georgia.

- *Lectures.* Some lectures are already freely available in streaming audio format on the Web, such as a **discussion of Ebonics** featuring Professor Richard Wright of Howard University's Linguistics Department.

- *Supplementary material.* Some of my own lectures are available, such as "**The Medieval World-View**."

I have found that making my own lectures available to students for remote listening and study has been most beneficial to my classes. Years ago, I basically abandoned formal lecturing because it allowed students to be too passive, and I changed my teaching style to emphasize small-group work. During class, students work in groups of four to six, beginning with assignments I have already given to them over the Web. I act as a mentor, going from group to group to ask questions, refocusing discussion when needed, and listening a lot. Most classes end with the whole class in one large circle, engaging in a group discussion, during which students share the results of their small-group discussions.

But while streaming audio has transformed my classroom, there is still some material I feel I must present in lecture format. I could just write out the material, make it available on a Web page as yet another reading assignment, and do without lectures altogether. However, lectures allow students to hear a real voice behind the material, listen to its intonations, and learn to make notes from a talk rather than from a text. Presenting material in a variety of formats such as this can lead to better learning, or at least to a different way of learning.

Streaming audio helps enhance the benefits of traditional lectures while eliminating some of their drawbacks. For example, I dislike the passivity of students as they listen to an extended in-class presentation and resent spending precious classroom hours in this way. Streaming audio makes it possible to present a lecture without taking up classroom time with a lecture. Furthermore, streaming audio challenges the inherent authoritarian nature of the traditional lecture format, which typically allows little time for interactive question-and-answer or discussion in a large group.

I have made streaming audio files of each of the lectures I used in the fall of 1999. I assign the lectures as homework so that my students can listen to them whenever they want. All lectures are available as links on the course Web page. Students can pause, back up, and replay the lectures, or parts of them, as many times as they wish so that they can make notes, answer the telephone, make a cup of coffee, and so on. With more time to assimilate the lecture material, they can also think more critically about it—an activity that should be encouraged.

Using Virtual Handouts

I compose Web pages for use in conjunction with each lecture, much as I used to make up handouts. It's easy to make simple diagrams with a basic graphics program like Windows Paint and include them in the Web handouts. Students can either look at these pages online while listening to the lecture or print the handouts and write their lecture notes directly on them. For example, see the assignment (**Exhibit 2**) for my first lecture on "The Medieval World View," which contains links to the lecture in streaming audio and the Web page handouts.

I assign each lecture with its accompanying Web page handout as homework, along with a writing assignment based on the lecture. My students listen to the lecture, making notes and studying the handout. They then complete the writing assignment, which they e-mail to the other members of their discussion group and to me. I keep it for grading purposes. Each student has to read at least one or two of their groupmates' assignments.

At the next class, students are well prepared to discuss the lecture's contents, raising questions and criticisms with each other. They spend class time discussing and interacting with each other and with me rather than sitting back passively listening or making notes without discussing or interacting. I also use threaded Web discussion forums provided in Microsoft FrontPage 98 on a FrontPage server, real-time IRC Chat on our MSU IRC server, and e-mail distribution groups (like small mailing lists) to encourage further critical discussion.

Conclusion

I was surprised that student responses to my full integration of streaming audio into my Fall 1999 courses were so positive. Most students appreciated the fact that they could pause the lectures or even listen to them more than once. I am continuing to use streaming audio and have begun to collect some guest lectures for use in future classes, always making sure to get permission from my guest lecturer to put the talk on the Web. (See **Exhibit 5** for more detail on student responses.)

OPTIONS
print
email
discuss
read related
browse section
view issue

search

Using the Internet can make teaching more interactive; more focused on critical thinking, discussion, and problem-solving; and less concerned with assimilation and retention of information. With this simple and cheap streaming audio technology, I can use all of my class time to enhance student-centered, interactive education. I recommend the technology to anyone who wants to enhance his/her teaching.

VISION	**ASSESSMENT**	**FACULTY AND STAFF DEVELOPMENT**	**TOOLS**
CORPORATE U	**COMMENTARY**	**CASE STUDIES**	**VIRTUAL U**
VIRTUAL HIGH SCHOOL		**SPOTLIGHT SITE**	
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Exhibit 1. Note on Streaming Video

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Two MSU staff members skilled in media video—Mike Heller, director of the language labs in the College of Humanities and Social Sciences, and Shunfa Li, computer consultant in the Department of Academic Technology—gave me the basic training. I used Adobe Premier, a powerful video editing tool, to create Streaming A/V files in RealMedia (.rm) format from a VHS VCR.

I needed only a few hours to learn how to digitize the contents of a VHS cassette, using a VCR and Adobe Premier, with a suitably configured computer (at least a Pentium II, at least 64 and preferably 128 Mb of video RAM, a video capture card, and the free RealPlayer, use of which is discussed in the article).

Learning sophisticated editing techniques, including splicing different tape segments together and adding background music, title, fade-in and fade-out, and so on, is much more complex. The **Adobe Premier webpage** has information on several **books** specific to teaching that product.

For anyone who wants to learn more about creating Streaming Video for instructional use, I can recommend these two resources:

Digital Video For Dummies® by Martin Doucette (IDG Books Worldwide, October 1999; ISBN: 0764500236 for the paperback edition).

Here is a good, though basic, tutorial on the Web: **http://webdeveloper.com/ multimedia/multimedia_guide_realaudio**.

Adobe Premier can produce compressed output in a variety of formats, including RealMedia (.rm), AVI (Windows video), MOV (Apple QuickTime), and others. There are several other widely used video creation and editing tools; Adobe Premier is the one my institution made available to me.

[CLOSE WINDOW]

Exhibit 2. First Assignment on "The Medieval World View"

Exhibit 2. First Assignment on "The Medieval World View"

Listen to, and study, **the first lecture on The Medieval World-View**

While listening to, and making notes on, this lecture, make sure you are looking at the handouts, or Web Pages that accompany this lecture (and the next two lectures as well):

The Social Hierarchy;

The Universal Hierarchy; and

The Ptolemaic Theory of the Universe.

Please print these out and use them as "handouts." Also, bring them to class as well.

You will need to complete **the set-up for Streaming Audio**.

Or, you may use either of the computer labs DI-277 (when it is free -- there are classes in it, too) or DI-281.

THIS IS A REQUIRED ASSIGNMENT. The fact that it is over the Internet doesn't mean it is "optional" or "extra."

Exhibit 3. How To Make A Streaming Audio File

Exhibit 3. How To Make A Streaming Audio File

(These instructions are for PC users. Colleagues have assured me that the Mac versions work the same way).

What You'll Find Here:

System and Program Requirements
Digitizing the Lecture
Putting Your Streaming Audio File On the Web
Creating A Link to Your Streaming Audio RM File
Finding Streaming Audio Sites on the Web
Online Tutorials

System and Program Requirements

1. Download the **free RealProducer** and **free RealPlayer** from RealAudio.

Note that both of these products have free and commercial versions. The free versions are completely adequate. You may have to hunt around on the RealAudio pages for links to the free versions. But hunt around; they are there.

2. In addition to these, you will need the following:

* Pentium-based PC with 10 Mb of hard drive space;

* a sound card that is installed – that is, that can take sound *in* as well as sound *out.* All sound cards come with installation disks or CD, but usually it isn't necessary to install them simply to listen to sound through the speakers.

* a good quality cassette tape recorder – the best quality you can get – both for making a high-quality audio cassette of your lecture and for "inputting" the audio into your sound card. Therefore, it should have a "sound out" jack (often called AUX) or an earphone jack.

* a cable – usually with 1/8 or "mini" jacks on either end – for transferring the

Exhibit 3. How To Make A Streaming Audio File

audio from your cassette recorder (analog) to the computer through its sound card (digital).

3. When recording the sound on the cassette, be sure to get the highest quality sound you possibly can get. There is some loss of sound quality in converting from the cassette tape (analog) to the .RM format (digital). A lecture that is audible in cassette format may not be audible when digitized unless it is a high-quality recording to begin with.

Digitizing the Lecture

1. Connect the "sound out" of the cassette recorder to the "sound in" (often labelled MIC for "microphone) jack in your sound card, with your cable.

2. After installing RealProducer, open it. Press "cancel" when the New Session screen comes up, and go to the main screen.

3. Choose File – Recording Wizards – Record from Media Device (your tape recorder is the "media device").

4. Check the "Capture Audio" box only. Press "Next".

5. Fill in Title, Author, Copyright, Description, and Key Words appropriately for your lecture. Press "Next."

6. For "File Type" press "Single Rate for Web Servers". This is the smallest size file you can create. This is important, as the smaller the file, the less information must be passed over the Internet connection, and so the more fluently the file streams.

With decent audio, this and the rest of the settings create a file that is fine for lectures. Press "Next".

7. For "Target Audience" check the box marked 28.8 Kb modem. Again, this creates the smallest size file, and it is adequate with decent audio input. Many students access the Internet only through a 28.8 Kb modem from home. Press "Next".

8. For "Audio Format", check the box for "Voice Only." Again, this is adequate for

Exhibit 3. How To Make A Streaming Audio File

lectures, and creates the smallest possible file. Press "Next".

9. For "Output File" and "File Name", browse to the directory on your hard drive where you want the .RM file to be created. The Default is to your desktop; it's best to create it to a directory. Press "Next".

10. "Prepare To Record" summarizes all your settings and gives you a chance to back up and change any which are incorrect. If all is OK, press "Finish".

11. When you are ready, set your tape recorder to "Play" and press "Start" on RealProducer. After about a second, you will begin to digitize the file.

If you do not see any movement (yellow and red bars) in the "Audio Level" meter, your audio is not being received by the computer. I have found this occurs when the jack is loose, the tape recorder defective, or – usually – when the computer's sound card has not bee properly installed to receive Sound In.

12. If all goes well, press "Stop" on RealProducer when your lecture has finished. RealProducer will take a few seconds to produce your .rm file.

Putting Your Streaming Audio File on the Web

1. Upload your RealMedia (.rm) file to a web server using FTP.

2. If more than one student at a time will have to listen to the file, ask your server administrator to install the RealMedia extensions on your server. This will make your server a "RealServer". Now it will be able to stream your file to many listeners at once, and each of them can be at a different point in the file.

Creating A Link To Your Streaming Audio .RM File

The older versions of RealMedia files had the RA extension.. It was possible to create a link to these files simply by putting the name of the file as **filename.ra** at the end of a normal HTTP link. .RA files could also be easily copied, just like HTML, GIF or JPG files.

Current RealMedia files are .RM files. To link to them, you must create a "pointer" file. This makes it impossible to copy the file without special software, and so is more secure.

Exhibit 3. How To Make A Streaming Audio File

Here is how to link to an .RM file, the kind you will be making:

1. Create a pnm link to a file with a RAM extension (.ram).

For example, I have a short .rm file called "Achebeanalysis.rm". It is a recording of me analyzing a paragraph from Chinua Achebe's novel *Things Fall Apart.* I have uploaded this RealMedia file to a RealMedia server named *edtech1.montclair.edu,* and put it in my subdirectory, */furrg* The full path to the file, therefore, is:

edtech1.montclair.edu/furrg/Achebeanalysis.rm

The "pointer" file looks like this:

pnm://edtech3.montclair.edu/furrg/Achebeanalysis.rm

Save this and call it ***Achebeanalysis.ram***

2. Upload this to any web server. I have put it on my regular web space, at

chss.montclair.edu/english/furr/media

So the full path to this .ram file is
chss.montclair.edu/english/furr/Achebeanalysis.ram

3. Create a link on any regular web page – say, on the Homework page for my "World Literature" course – just as you would a regular HTML file, like this

http://chss.montclair.edu/english/furr/Achebeanalysis.ram

Now, when a student clicks on the link to the .ram file, that student's browser will:

a. access the .ram file;

b. read it;

c. be directed to the .rm file, on another server;

Exhibit 3. How To Make A Streaming Audio File

d. automatically call up RealPlayer, which the student must have previously installed; and

e. download the "buffer", or first few seconds of the file, and automatically begin to play the file over RealPlayer.

Audio Level may be adjusted three ways:

1. RealPlayer itself has a slide audio control.

2. If played through the computer's speakers, the speakers themselves will have a volume control;

3. Windows 95/98 have a volume control, in the form of a small yellow "speaker" icon on the working tray (right side of the Windows taskbar).

(If this icon is not visible, go to Start-Settings-Control Panel-Multimedia-Settings-Multimedia Properties-Audio-Playback, and check the box marked "Show volume control on the taskbar").

Finding Streaming Audio Sites on the Web

There are many Streaming Audio lectures and other recordings already freely available for linking to or even for downloading, on the web, and more all the time. The best way to locate them is to use one of a number of specialized Search Engines. Here are some of them:

1. "Snap.com". You can use this right from RealPlayer. Go to the "View" pulldown menu and make sure "Search" is checked. A text form window is displayed into which you can type keywords for the kinds of files you want. This will connect your web browser to the search facility at http://real.snap.com. You can also just go directly to real.snap.com in the first place.

2. RealAudio has a guide to Streaming Audio and Video files at **http://realguide.real.com**

3. The Altavista search engine has an Audio and Video Search facility. Click on the "Images, Audio/Video" tab on the home page, **http://www.altavista.com.**

Exhibit 3. How To Make A Streaming Audio File

Other search engines also have facilities for searching for Streaming Audio. These are the ones I have found most helpful

Online Tutorials

1. There is a good one at "hotwired", the web page for *Wired* magazine, at:

http://hotwired.lycos.com/webmonkey/templates/print_template.htmlt?meta=/webmonkey/98/17/index0a_meta.html

2. Jonathan Angel, *Realmedia Complete : Streaming Audio and Video over the Web*, has been announced but not published by McGraw-Hill. The author has made chapters of the work available on-line, in PDF format (Adobe Acrobat Reader needed) at http://www.angel.org/. It's for further reading – more than you need to know.

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Exhibit 5. Student Reaction

Exhibit 5. Student Reaction

I required students in all three of my Fall 1999 classes to listen to Streaming Audio presentations, to most of which I provided "handouts" keyed to the lectures, in the form of web pages.

Every semester I ask students to write what I call an "Anonymous Constructive Course Criticism" during the final class. I don't use a form, suggesting instead that the students comment on both the form and the content of the class, and offering some examples of aspects of the course they might choose to critique. In addition, I stress that I would prefer if they confined their remarks to those aspects of the course which they think should be improved – those which did not work as well as they should. I specifically ask them not to spend their limited time, about 30 minutes, on those aspects of the course they were satisfied with. I emphasize that I am not looking for a "balanced" critique, but one which focuses on whatever failings they find in the course. I ask them not to put their names on the evaluations, even if they are willing to do so, because I want their responses to be as frank as possible. I hand out lined paper so that each criticism will have a uniform appearance. Finally, in order to further stress that I am really interested in their frank and critical opinions, I remind the students that I have no idea what their handwriting looks like, since I have never seen it (all assignments are emailed to me or put on threaded web discussion forums).

I have reproduced below every comment concerning Streaming Audio from the Anonymous Constructive Course Criticisms done by my students in two of my three Fall 1999 classes. The **first set are from Middle English Literature**. The fifteen students were English Majors, mainly juniors and seniors. The **second set is from World Literature**, a course which satisfied a General Education requirement, and which therefore draws upon the whole student body, mainly freshmen and sophomores, with few literature majors. (Although I specifically encouraged all the students to comment on the use of Streaming Audio, some chose not to do so.)

The criticisms are basically four. First, that setting up the free RealPlayer caused some students problems. Second, that the audio did not stream fluently during peak Internet usage times. Third, that some of the audio files were unclear, difficult to understand, in places. Fourth, that to listen to, make notes on, and

Exhibit 5. Student Reaction

then write an assignment (to be emailed to me and to the student's small in-class discussion group) was <u>too onerous a task for a single homework assignment.</u>

How have I changed my creation and use of Streaming Audio in response to these student criticisms? To be honest, I had anticipated them all.

RealPlayer setup is the most problematic. It caused no problem for computer-savvy students, but some problems for most of the rest. No student criticized **my detailed directions**, however.

In future I am planning to provide an additional link to the RM file itself, so that students may, if they wish, download the file onto their own computers and save it there. Then it will be no problem to "stream", or listen to, it, since it will not have to "stream" over the Internet, but only from their own computer's hard drive. Naturally, students will be able to delete it at the end of the course, as they will probably want to do.Audio clarity is a major issue. The sound file to be digitized must be as clear as possible. I have had the best results if the speaker uses a hand-held microphone connected directly to the tape recorder. With this method, even a very basic, inexpensive Radio Shack tape recorder yields tapes of excellent quality. When I used a small, expensive Aiwa pocket tape recorder with a lapel mike for one speaker, I unexpectedly picked up a lot of noise from his heartbeat! As for the issue that listening to a lecture and reading the web-based handouts, making notes, and then writing and emailing a 300-word assignment was "too much", it should be kept in mind that these classes met only twice a week, for 75 minutes each. I am not now persuaded that this is too much work.

Responses from Students in World Literature, Fall 1999

The streaming audio was a great idea but I think we over-emphasized it in the beginning, and then didn't use it enough. I also think that if we did have to listen to it, I don't think we should have to write about it, because that adds to the workload. Rather, come to class w/ notes to [be] ready for a discussion.

The Streaming audio is a waste of time and always caused problems.

The streaming audio is an interesting lecture method but it puts students without a computer at a disadvantage.

Exhibit 5. Student Reaction

Streaming audio was a good tool. It was easy to do and informative – but I am biased because I already had it installed. It was probably harder for other students, so keep that in mind.

Streaming Audio– add more it was good (less reading)

Use of the streaming audio was also interesting– should be used more.

I did not really like the streaming audio, the reason being was because I had trouble operating it, especially since I did not use it before. It got to be confusing at times.

Spend more time on streaming audio – fine tuning it.

I liked the streaming audio & I wished we used it more because I could listen to it more than once and get a really clear understanding of the main points.

The streaming audio was a little absurd at first, but once I got the hang of it, it wasn't so bad. I think it was okay.

The streaming audio is a good idea, but there are many problems with the quality of the tapes. Otherwise, it is a good idea as long as the tapes are not too long.

The Streaming Audio never worked right. Maybe, it will improve with time.

Streaming audio is good. It has advantages because you can hear the professor, pause him/her, & repeat it just in case you missed something.

Responses from student in Middle English Literature, Fall 1999

Streaming Audio is great. It was very stimulating.

I liked Streaming audio once I got used to it because I could listen to it on any time, late at night after work, etc. It was also useful because I could always go back to it.

Exhibit 5. Student Reaction

Sometiems when there was a lot of internet traffic it broke up.

MORE STREAMING AUDIO– LECTURES ARE MORE THAN HELPFUL ONE ON ONE W/ THE COMPUTER.

I think the streaming audio was a good idea, but we didn't use it too much, & a lot of us went through major stress trying to set it up. Also, I think if we have to listen to a lecture, I don't think there should be an assignment. It was too much.

3. Streaming Audio– keep, yet try to concentrate material more an hour listening to a lecture on tape off a computer is agonizing.

As for the Streaming Audio, yes their can be improvements but I felt that the audio was helpful for it allowed the students to go back and listen to the lecture. Maybe you can put your lectures on the Streaming Audio as well, I think that would be very helpful.

The Streaming Audio help when some kind of information or handout come with it; other than that its pretty helpful.

Streaming audio was easy to use although it was time consuming. It was time consuming b/c I constantly had to rewind due to poor sound. Lectures were difficult to hear. Other than problems w/sound, streaming audio is a useful tool to use to help teach students.

The Streaming Audio I found to be helpful but make sure we use it in the class.

- Streaming Audio. This was the bane of my existence for the first few weeks of the class. I understand you refuse to abandon this diabolical "source of information., " but perhaps the contents of the tapes could be posted on the web in text for those students who are less computer savvy or lack immediate access to this tool of enlightenment.

[CLOSE WINDOW]

Accessible Audio Files. If you use audio only, like a podcast or audio lecture, we must provide a text transcript of the spoken word. And that text transcript should be a document that's accessible, preferably HTML, but it can be an accessible document of another format, such as .TXT. Accessible Video Files. If you provide video without audio, you need to provide a video description. We must provide an option to turn off all multimedia on a website or in an online course. This means that the Pause and Stop buttons must be keyboard accessible, and the controls need to be screen reader accessible. Imagine a blind user navigating your page and getting bombarded with an auto-playing video that they can't stop. The most accessible multimedia means it is necessary to recognize so-called electronic textbook and various training programs-simulators. According to the type of organization and method of delivery to the learner, multimedia textbooks come in three forms: 1) on a CD-ROM with or without a printed application; 2) on the Internet sites were printed without application; 3) on a CD-ROM, but linked to some Internet sites, with or without a printed application. Multimedia presentations can be held anywhere where there is a computer and a projector or another local playback device. It is worth noting that multimedia can either be downloaded to the user's computer and reproduced in some way, or reproduced directly from the Internet using streaming technology.