Analog to Digital:
Technology Shift with Classroom Implications

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Prosperous regions of East Asia have been at the forefront of technological advances. In the past few years, we have been witnessing a massive shift from analog to digital technologies. In the classroom this shift is seen in the form of tape recorders being replaced by CD players for audio, and videotape players being replaced by DVD players for video. A primary difference with these digital technologies is their interface with computers.

This shift to digital is having profound effects on the lives of both students and teachers. Students are already leading the way in adapting the new toys to their own needs, whether sharing music files or sharing photos taken on their cell phones. Schools are adopting e-learning and distance education. Teachers, too, need to keep up as digital technology permits the editing, repackaging, and wider dissemination of our previous teaching material, in particular audio and visual media, by means of the computer.

In this talk I will first look at just what the advantages and disadvantages of both analog and digital media are, covering both audio and video capture and playback, and also present some of their practical applications in the ELT classroom. Then I will address the implications of using these new tools on current and future classrooms.

In November 2003, about halfway through an 18-week semester, I gave my tertiary level Advanced Listening class their outside term project assignment. As in past years, I gave each of 21 students a videotape containing either a 50-minute lecture or a documentary, the topic area chosen to roughly match each student's major. Students were required to write an outline, a one-page summary, a critique, and a word-by-word transcription of a five-minute portion of the video to be checked individually with the teacher before final submission. Students seemed to understand what was required of them, and they knew they could watch their videotapes in either of two self-access labs on the campus. But then about two weeks later a few students came requesting that I give them their videos in VCD or DVD format instead. One said, "I took the videotape home on the weekend, but my parents threw out the video player and only have a DVD player now." At that point I was not equipped to convert their videotapes, but I welcomed them to convert their own if they could—and several did. In the end each student was able to complete the assignment, but I was troubled. I had thought I was a tech-savvy teacher, but once again the students were ahead of me. When I teach the course again beginning in September 2004, I will have nearly all materials available in a digital format.

Meanwhile, I started thinking more about just what was happening. It seems to be the case that in Taiwan analog entertainment technologies are nearly obsolete. A few months ago I tried to buy a new videotape player. Several shops I visited had none at all, and those that had one had only one—and it had no counter. It is the same case with tape players/recorders. What does that mean for teachers and classrooms, both of which seem to be located now somewhere between analog and digital? What are we losing as we abandon analog; what are we gaining when we adopt digital? As we stand in this border region, it seems to be an appropriate time to analyze these two different types of technologies in terms of their usefulness

for preparing teaching materials and for classroom teaching. We look first at audio, moving then to visual images, still and moving (video). In the final portion, we look at the classroom implications of this shift.

Audio Technologies--Analog

These days, when we are bombarded by the music of radios and MP3 players and the musical ringing of cell phones in public places everywhere, it is difficult to imagine how language teaching proceeded before the invention of the audiotape player (see Winston, 1998, for the historical development of recording devices), yet somehow people still managed to learn foreign languages successfully. Tape recorders and players facilitated the invention of the language laboratory, which was essentially a wired combination of playback and recording devices combined with headphones to keep each student's learning private and isolated. A language lab—or just one reel-to-reel tape player—went hand in hand with the audio-lingual method. Listen and repeat, often quite mechanically. This was the expected teaching method when I was doing my student teaching back in the 1970s.

Teaching methods evolved, but the tape recorder remained because it was still able to bring native speakers into the classroom. Meanwhile, the cassette recorder was invented, making tape players ever more lightweight and, hence, far more portable and affordable. Young people carried their music with them in large boom boxes, much to the distress of their elders. And teachers carried their language lessons around to their classrooms as course books soon came with audio cassettes.

The past decade has introduced another revolution in sound devices for us—digital audio. Digital promises to be better and it is for the most part, but like many teachers, I am used to the older technologies, and sometimes what I want to do as a teacher is not what the manufacturer of a device had in mind.

Have you ever met an EFL teacher in recent years who was afraid of using a tape recorder? Probably not. Even the teacher who has technophobia can usually handle this device, can go into a class and play the cassette that goes with the lesson. S/he may not always find the right starting place but s/he somehow manages. The functions are straightforward and playback is easy. You can preset the place where you want to start ahead of going to class, then just turn it on and play it. If you are fortunate enough to have a machine with a counter, you can find the right places on the tape on that machine, but counters are not consistent across machines, so you can still have trouble finding your material on different machine. However, if we are using material on different parts of the tape, it does take time to run forward and backward in class to locate the starting points. For language teaching, we may want to repeat small portions, such as an individual sentence, a number of times, and this is fairly easy to do even without a counter, though the ideal starting point may not be exact.

Few if any audiotapes have copyright protection devices, so students as well as teachers copied tapes freely. Especially when preparing tests, it was often easier to put all the stimulus questions on one tape in the proper order than to key up several tapes ahead of time. The double-deck tape player and recorder was useful for copying and editing. How many of us indeed patched together our own listening tests, and we may even have used the built-in microphone to add the directions and question numbers in our own voice. The result, however, was not at all professional. The volume may have differed between our own vocal output to that of the questions copied from other tapes. In editing, the starting and stopping points were not always exact. Moreover, with analog, each time we copy from one tape to another, we tend to lose about 10% of clarity with each successive recording. Thus if your starting point is a copy from someone else's original, and then you make a copy from your copy, the result is at best perhaps 80% as good as the original. In most cases if we were start-

ing from a clear audio tape made for ELT, then a second or even third copy would probably be fine for classroom use.

There was one more sneaky little problem that came with recordings you copied and edited as well as with legitimate recordings you may have made, such as language data you recorded: the tape played perfectly well on the machine it was recorded on, but when you played it back on the school's tape player, it was too soft or you could not hear it at all. The place it was most likely not to play was in the language lab! Why? First of all, individual tape players differ as to their settings for record and for playback; this inconsistency causes problems with playback volume. Notice that when you used commercially produced tapes you did not encounter this problem. The second problem may occur between portable players and is definitely a consideration when using language lab playback: the difference in the channel of recording and the channel of playback. Language labs typically allow students to both listen to a tape and to record their own voice on it; in order to do this, one track is used for play and the other for record. Thus, for example, if your tape recorder uses only the left track to record, but the language lab uses the right track for playback, then when you play your tape in the lab, you and the students will hear nothing. Portable tape players generally do not separate the tracks by function (note that any recording erases the previous) so you will usually get either full sound or at least partial sound from your self-made recording played on any other portable player. To sum up, it was easy to copy and edit on analog tape recorders, but the result was rough and playback on different equipment could be problematic.

Audio Technologies--Digital

In the 1980s, a new way to listen to music began to spread—the compact disc. Ordinary people started buying the new software—the CDs, and hardware—the CD player, replacing initially the earlier vinyl records and turntables. The tape recorder was not threatened at that time because it could record and hence manipulate music, while records and CDs had to be played as they came. Meanwhile, back in the language lab, the downfall of the audio cassette was imminent. Some tapes might be 15 – 20 years old and had deteriorated. A combination of old hardware and software meant that tapes more often got stuck in tape players or tore. Suddenly CDs looked like a more permanent storage option. Moreover, they seemed less likely to suffer damage in a faulty machine, although they could still be scratched.

Producers of ELT materials saw the potential. Tapes that came with textbooks did not provide any interactivity; students just listened to them as they came. Therefore, there was no pedagogical reason preventing a CD option. At first textbook companies offered both tapes and CDs because not all customers had CD players. Now in Taiwan, for example, it is nearly impossible to find accompanying tapes for newly-produced textbooks, just CDs.

CD players quickly became portable; at first they often came with tape player in one portable unit. Teachers could take these to class and use either older or newer technology on one machine, and they could copy parts of the CD on to a tape for testing purposes. CDs were comparable to the audio cassette in size and ease of storage, but the sound quality was much better and clearer. One disadvantage was that you could not set the exact starting point ahead of time but, on the other hand, there was no need to run through the whole CD on fast forward to find your lesson. However, it was a bit more difficult to find the exact spot within a lesson and to repeat short sections; ease of location depends also to some extent on the controls on each machine, whether you can go back and forth to a particular place following the counter.

The big advantage of the tape recorder was that it could copy music, but toward the end of the 1990s CD copying in one's own computer became widespread. CD editing was more exact, and there was no loss of quality when copying digital to digital. Now we also

have MP3 players; MP3 files are more compressed, hence smaller, than the files on the usual music CD, meaning we can put more material on one CD, upload them to the Internet, or send them by e-mail attachment. In addition to copying existing materials digitally, we can make our own using a digital voice recorder. Moreover, with just a cheap microphone we can record our voices directly into the computer; newer computers have built-in sound cards for recording and software for editing. The various recording hardware comes with any necessary physical connections and software to upload to your computer; more sophisticated software is also available for audio editing.

How can these digital recorders and playback with a computer interface affect the teacher's life? An initial possibility would be to digitize any audio tapes that are one-of-a-kind and essential for any special lessons. This is done by running a wire from the tape player's LINE OUT or headphone jack into the computer's LINE IN or microphone jack and recording (for example, Windows comes with a sound recorder). After saving the file on your computer, you can later turn it into a CD if you have a CD writer. Note that if you want the separate units/segments of the tape to be separate on the CD (the way you can locate separate songs on music CDs), you will have to edit your sound file into separate files for each unit/segment. Then you can re-organize them when you make your CD. I would recommend that teachers save in the WAV format that is the default for copying most music CDs because you will be using the disc on different equipment in different classrooms, and even the oldest CD players can handle WAV files, but they may not play MP3 and other formats. Even so, some high quality DVD players have a copyright protect mechanism and will not play homemade CDs, VCDs, and DVDs even if they are your original material. Thus it is wise to test your CD on the machine you will use it on ahead of time. Computers generally play more formats, but if you will use someone else's computer, use a more common format and try to check it on that machine earlier. For example, your lesson stimulus is on a disc in MP3, but you get to the language lab computer and find someone has deleted the free software to play it; you try to download it again quickly while the students are walking into class, but the Internet connection is too slow. Lesson diverted.

Another important application is making your own listening tests. With editing software, you can take specific questions from the CD that comes with your course book combined with directions that you yourself give by recording your own voice into the computer. You can even add in timed pauses. Editing is far more exact than it was with an analog tape player and recorder. You can still re-record your listening test back to an audiotape or CD or play it through a classroom computer.

In addition to storage on disc or in your computer, you can share speech files by uploading them to the Internet. Students can click on oral instructions, perhaps in the teacher's own voice; they can see and read a text on screen and hear someone read it at the same time. Teachers can design while-listening activities, such as comprehension questions or fill-in-the-blank. For linguistics classes, we can illustrate examples of World Englishes or how Old and Middle English was probably pronounced, for example. When using the Internet, smaller is better, so choose MP3 now until an even more compressed format comes along. Roughly speaking, one minute of an MP3 sound files take about one megabyte (1MB). Insert your sound files into your HTML files as a hyperlink and remember to upload the sound files separately.

If you like to use Power point in class, why not add relevant sound files to click on at appropriate times? If you are talking about language, these could be linguistic examples or other speech samples. Or perhaps you would like to insert a sound effect or a few seconds of music to keep the students awake; some basic sound effects should already be installed on your computer, and CDs with sound effects can also be purchased. Unlike pictures and Clip Art, however, sound files are not actually embedded in the Power Point file and will not

travel with your file to a floppy disc or external hard drive to be used in another computer. You therefore need to save your sound files separately to the medium you will use (disc or portable hard drive). Embedded sound files will also not play when you upload your Power Point presentation to the web unless you upload the files separately and re-establish the hyperlink.

With digital technologies, too, necessity of the mother of invention, or should I say, application. In speaking classes I sometimes ask students to make an audiotape recording. This not only saves class time but I can more carefully analyze pronunciation problems from a selected reading on an audiotape. In October 2003 two members of my public speaking class missed the due date and then asked if they could send me an MP3 file by e-mail attachment. Fortunately, I agreed and found this a great technique, as easy to use as the telephone without the intrusiveness; immediately I sent back my reply—also in MP3 format. Not long after, a good friend on the other side of the world celebrated a birthday: I got my singing friends together, recorded a greeting on my digital voice recorder, turned it to MP3 and sent it as a singing e-mail attachment birthday greeting, much to the recipient's delight. Thus for teachers and students alike, the boundaries between digital applications for work and play are blurred; we can certainly think about whether the toys we use for entertainment might have some very practical and useful application in our teaching.

Pictures and Photography

When I was studying to become a teacher, we were encouraged to collect colorful pictures from magazines so that we might have appropriate examples for teaching vocabulary or for use as the stimulus for some writing or speaking activity. I wonder how many new teachers today even bother going through magazines for teaching material now that illustrations are just a mouse click away. Suppose you are teaching a beginning class and you want to illustrate vocabulary. There is wonderful Clip Art probably already on your computer. If you teach in a tech-friendly room, present your material on a large screen with Power Point (Simmons, 2004), or make colorful vocabulary cards with Clip Art and your color printer, and then laminate the cards. And a bit of Clip Art on a handout full of dense text makes that text seem a bit less formidable.

Not that long ago, if we wanted to use a picture or photo in class, our options were limited. We could pass the photo around, but that wasted time. Provided we still had the negative, we could go to the photography shop and have several large copies made, and these could be used for group discussion, one copy to each group. However, that took preparation time and some money. If we wanted to project a photo or picture on to a screen, we needed a large and heavy special opaque projector. There was no possibility of a color copy, and making an acceptable black and white copy was a matter of trial and error and wasted paper with the copy machine. If we wanted to change the size of the original, again we could only experiment with the enlarge and reduce functions of the copy machine.

Now, however, those pictures from magazines and old photos can be put to wider use with a scanner. Once you scan the original, you can work with the resulting digital image the same way you work with images from a digital camera. All newer computers have some sort of picture editor installed, and scanners and digital cameras also come with compatible editing software. The basic functions a teacher needs are cropping, brightness, and resizing. With cropping you actually cut off parts of the picture that you do not want. In a family photo of several people, for example, you could select front face views of each individual and present them separately on a handout and have students fill in descriptions of each family member.

Often color photos do not look bright enough on the computer screen, but the software allows you to increase the brightness. If your desired end-product is a black and white handout, you need to make the image even brighter so the detail stands out or, better still, turn the image into something called grey scale (black and white and all shades of grey), where it will appear in grey shades on your computer and you can brighten to the desired level. If your original image is large and your desired output is smaller, you may want to change its size at the picture editing stage. The format to save in is also important. Two common formats are Joint Photographic Experts Group (JPG/JPEG) and Bitmap (BMP). Bitmap files are larger than JPEG files, so for the Internet, saving in JPEG is better; however, if you have simple black and white images, such as line drawings to be used on the Internet, it is better to save in Graphics Interchange Format (GIF). For other applications, if size matters (e.g., you are taking materials to class on a floppy disc), then choose JPEG. (a useful site is http://www.widearea.co.uk/designer/index.html).

If you are using Windows and Microsoft Office, then the programs you probably use for creating teaching materials are Word, Power Point, and Front Page (for creating HTML files for the Internet). All of these allow you to insert pictures from either Clip Art or from your own files. Both Word and Power Point also have Picture Toolbars that allow you to crop, adjust brightness, and resize or adjust the size to fit your layout; Front Page allows some editing for size, but it is best to do other editing first in your picture editor before inserting a picture into a Front Page file..

With digital cameras we can take our own shots. With a scanner we can digitize any hard copy photo. Thousands of Clip Art images are available in our software or over the Internet. The computer lets us modify these images to suit our needs. We can make our own color hard copies or color transparencies with the help of a color printer. Now teachers have no excuse not to create their own materials, from worksheets to websites, that look just as professional as those found in textbooks.

Analog Video—The Video Cassette Recorder

What a revolution it was when we could record tonight's TV news and show it in class tomorrow. The need for a complex projector was gone and we could easily show commercially produced movies on videotape (Winston, 1998, provides a detailed history of the development of the VCR). Moreover, we could record anything off the television. This paralleled the shift from reel-to-reel tape recorders to audio cassette with ease of recording and playback. Smaller and smaller video cameras followed; we could record not only our children's antics but our students' role plays and other performances, view them with students, give them advice for improvement of various aspects of presentation skills and later let them evaluate themselves as we are often our own toughest critics (Katchen, 1992). Copying from VCR to VCR was easy although the editing might not always be exact, and we could just as easily copy from the video camera to a videotape in the VCR. However, as with audio, successive copies had reduced quality. Soon commercially available videos came with copyright protect mechanisms to prevent all that copying, but the cost of purchasing originals was not prohibitive.

Most VCRs had real-time counters, a feature convenient for locating particular clips during class and, critically, for knowing how far to rewind to repeat a clip since we almost never play a clip just once. Pedagogically, it is better to exploit a 3 – 5 minute clip in a one-hour class by watching for different purposes than to play a longer clip just once (Stempleski & Tomalin, 1990; Katchen, 1996). As with audio players, we could also prepare the tape ahead of class by winding forward to the starting place. Another useful teaching function is the pause or freeze frame, but on many video payers the pause function is not too stable. The

image may wiggle or become fuzzy so that we cannot see on the screen the details we paused to examine more closely. Furthermore, use of pause and frequent starting, stopping, and rewinding could damage the tape and equipment. As with audiotapes, frequent starting and stopping would loosen the tape so that playback sounded slow and garbled; the solution to both is running fast forward and then fast rewind for the entire tape to tighten it up.

There was, however, one annoying little problem that travelers abroad encountered: videotapes bought in one country might not play in another due to a difference in standards of speed and resolution adopted in different parts of the world. Basically, Western Europe and its associates in other parts of the world used PAL, while the USA, Japan, and their associates used NTSC. France used SECAM and the former Soviet Union and its allies favored it, but after 1989, much of Eastern Europe switched to the European standard PAL. Clever hardware makers developed multi-system video players with compatible projectors/televisions, and experts appeared to convert tapes from one system to another. This difference is still with us and continues into the area of digital video.

The videotape player is a useful device and we still have many in our classrooms. However, in Taiwan it is now harder and harder to find shops selling new videotape players, and fewer videotapes are sold. The videotapes we have are deteriorating. Sooner rather than later, we will have to master digital video for the classroom.

Digital Video

A DVD (digital versatile disc or digital video disc, more technical details are available at http://dvddemystified.com/dvdfaq.html) takes up less space than a videotape, and DVD players can be hardly bigger than the size of the DVD playing on it. Moreover, the hardware usually also plays the older VCD and audio CD formats. DVD quality is much higher than that of videotape and, as with audio CDs and other digital media, that quality is not decreased with successive copying. One big advantage over analog video is the clarity of freeze frame (pause); you can stop the image on the screen and it remains clear, and there is no possibility of damage to the disc.

Another feature language teachers adore is the multi-language captions/subtitles (Lin, 2000; Markham, Peter, & McCarthy, 2001). Whereas lower-level students might first use L1 subtitles to get the gist then L2 captions to really concentrate on the linguistic input, higher level students may prefer L2 captions and then test themselves by turning off the captions.

Some DVDs contain more than one audio track. For children's movies, this may include an L1 track for a movie produced in another language. Other films may include tracks with on-going comments by the director or actors, commentary on setting or costumes (e.g., *Shakespeare in Love*), or other relevant material. DVDs may contain extra material that could be useful in class—interviews with the actors, insights into how the film was made (e.g., *Shrek*), even games and quizzes (Katchen et al., 2001). For example, when we used the film *Castaway* in a speaking and listening class, we showed a 20-minute segment on how the idea for the volleyball named Wilson was developed (Luo, 2004).

However, DVDs are still not as flexible as videotapes. DVDs are divided into sections called chapters, which usually contain a few scenes. Locating the start of chapters is done easily through the menu and remote, but ease of locating exact spots within chapters depends on just which functions are provided by your remote. It is useful to be able to move forward or back at a low or faster pace using the counter. Different brands and models have functions organized in different ways, and it may take the teacher some time to learn to operate the equipment.

Recording a television programme digitally is possible, but a digital video recorder to connect to your television is still rather expensive and there are more complications with

compatible standards compared to analog VHS (http://dvddemystified.com/dvdfaq.html explains these issues). There are copyright protect mechanisms on commercially-produced DVDs, though software writers are always finding ways around this restriction.

Another method to counteract piracy was the establishment of six different world DVD regions. Thus a DVD bought in the USA (region 1) would not play in Asia (mostly region 3) even if both were using NTSC. Asian hardware makers, however, soon began selling DVD players that would play multi-region (but still you need to be aware of the NTSC/PAL distinction for playback on your television). Note that if you play a DVD on your computer, you can set the region code and the NTSC/PAL distinction is also adjusted. Computer makers tell us you can only change the setting up to five times, but others have found ways around this.

If you use DVDs and VCDs in class, you may encounter the same problem you do with audio CDs: some discs will not play on certain machines. Sometimes the problem is one of region, but other times the cause may be copyright protection built into the hardware so that your own made or copied discs will not play. This is an important issue with video editing as DVDs you make yourself, whether or not copyright issues are involved, may not play on DVD players. Most often the problem has to do with whether the hardware plays DVD-R, DVD-RW, DVD+R, DVD+RW (see http://dvddemystified.com/dvdfaq.html), sometimes also with the format you save in. Think first of how the finished product will be used, on which hardware you will most likely play it. Although your movie is more likely to play on a computer, you still need to check the individual computer as the computer may not have the proper software installed to play a DVD or your kind of DVD or it may not have the proper codecs (decoders to interpret and play from the format your movie is compressed in).

If you use digital video a lot and have different classrooms and equipment, you may find it useful to purchase a small, portable DVD player that plays more regions and formats—although it may not play the discs you made yourself. Then if you have access to only a television, if you can locate the input jacks, just plug in your portable DVD player and you have instant classroom access to DVD, VCD, and audio CD. Or take your own notebook to class (provided there is a compatible projector) on which you are sure your DVD works; you may have to take a set of speakers, too, but they are small and cheap.

We now have digital camcorders; most use a mini-DV tape which still has to be run forward and rewound, but some newer models use a disc for recording. Nearly all these cameras allow some editing within them. However, for more sophisticated editing, connect your video camera to a computer via a fire wire (IE1394). To play video into your computer, you will need to have a video card either pre-installed or installed after purchase. To copy to VCD or DVD, you need to have a DVD writer (which will usually also write audio CDs).

So what else can a teacher do with digital video technology besides show a film clip in class as one did with videotape? Certainly in class you will want to take advantage of the ease of varying L1 and L2 captions with no captions, and the material supplemental to the film For materials creation, some of the software that permits you to view DVDs on your computer has a capture function. Thus if you pause the scene, you can capture and save the still image (Katchen, 2003). Suppose you watch the opening scene of a film where the main characters are introduced and then you would like the students to spend some time describing the characters for both language practice and to help them remember who the characters are and what their names are. You could play the scene again and pause when each character appears, but you could also provide a handout or put up a transparency or Power Point slide with a still image of the character next to his name to help students remember which character you are talking about. Or you may arrange five or six relevant still shots to stimulate students to retell the story.

Students, too, can use this technique in their own presentations in the same way they would use digital photos. It is also possible to insert video clips within a presentation. One does have to limit one's use of these useful techniques because of copyright issues. Nevertheless, it is far easier to have a few still shots prepared for review than to waste time trying to locate them on a running DVD player in front of a large class of restless students.

If you record your students' presentation activities or would like to create your own videos to use as teaching materials, digital gives you more editing and storage options. With your fire wire and video capture care, you can play tapes from your digital camera into your computer and, with one of the many brands of movie making software available (Windows Movie Maker comes installed with Windows on new computers and is relatively easy to use), you can edit. With editing you can make a more professional-looking product. You cut out those few seconds before starting and after ending, add titles such as the students' names and title of performance, perhaps add music, put in scene change breaks, and so on. However, when you work with video on the computer, you need a lot of temporary storage space on your hard drive. One way to get more space is to purchase an external hard drive (they can be 40 giga and even larger) and set that drive as your temporary storage drive for that program.

What can you do with your finished movie? You can record back to tape or burn a DVD (but as mentioned before, the finished product will probably play on your computer but not on your DVD player at home or the one in the classroom). While it is possible to upload video to the Internet, it still takes a lot up space even with compression (about 10 MB per minute for reasonable clarity), but this will get better in the near future. AVI (Audio Video Interleave, for PC, details at http://www.jmcgowan.com/avi.html#Definition) format is better quality; however, MPEG (Moving Picture Experts Group, for both PC and MAC, details at http://www.mpeg.org/MPEG/index.html) provides more compression possibilities for Internet use.

If you have collected teaching material on videotape in the past, now it the time to convert those deteriorating videotapes to a more permanent medium. Some video capture cards permit analog input; the other option is a small device that works as a bridge, converting analog to digital or digital to analog, with input and output for VCR jacks, S-video, and fire wires. Once you play the video into your computer (from a VCR connected to your video card via a bridge if necessary), you follow the same process as editing from a digital video camera. Of course, the final result will not be digital quality, but you have more flexibility in editing out unwanted portions, adding titles, even inserting questions in text or audio or video format between segments.

Playing clips from a commercially-produced DVD in class is not particularly difficult once you master the remote, nor is using a digital camcorder as the controls are much the same as the older analog. However, video editing is somewhat more complex than audio editing alone. The most frustrating aspect is the various standards, so self-made DVDs do not usually play on DVD players and only play back on computers that have compatible software installed. At this time, the ordinary classroom teacher may not want to tackle such complexities, but after a few years, the software will become more user-friendly, the compression rate will increase, making it more feasible to store video on the Internet, and the problem with standards should get sorted out somewhat.

Implications for Teachers and Students

Schofield and Davidson (2003), in a study on a large urban secondary school in the US, point out that Internet use resulted in increased student autonomy, more personalized student-teacher relations, and the bringing out of special student skills, among other effects.

Teachers also changed their role and became learners at times. While I am not aware of any specific studies looking at teacher DVD use, for example, I would expect that here, too, teachers become students at least for a time as they learn how to operate new equipment. This role reversal may be very difficult for adults to manage when their students are much younger than themselves, and it may be more difficult in East Asian societies, where the teacher is respected as the all-knowing one.

Teachers who are good at technology are admired by some colleagues, disliked by others. One teacher illustrates her lectures with colorful Power Point slides and uploads the materials to the Internet for student access. Another lectures by indicating the page number in the textbook and writing important points on the board. When it is time for oral reports, some students want to use Power Point, but the teacher does not know how to use it. As Lin and Hatano (2003, p. 4) state, "These power shifts in classrooms may be related to the fact that modern technology often deprives experts of their privileged status by redefining the expertise needed to accomplish academic or occupational tasks." Thus, some teachers save face by maintaining the high status professor role: professors do not stoop so low as to make contact with wires and switches. They assign the students to take care of the equipment.

In terms of classroom dynamics, the shift to digital creates a difference not in kind but in degree. The difference is a question of whether the teacher incorporates technological options in his/her teaching, and the question was the same with analog. In this sense ELT teachers are no different from teachers of other subjects. On the other hand, language classes are usually not large lecture classes. Teachers try to maximize student exposure to and use of the target language. Here we are more unique. Our older technologies aided the teaching of listening with recordings of native speakers and the teaching of speaking with recordings of the students. Now the computer is involved and we simply do not know what kinds of innovative combinations will arise. It is not up to the hardware makers to create teaching devices but it is up to the end user—the teacher in the classroom—to combine the possibilities of the hardware with useful software applications, to create the teaching techniques and materials. To me this is the most exciting aspect of digital technology—the exciting possibilities.

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