



The Benefits of Using a Course Disk to Aid in the Instruction of Statistics Courses

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Abstract

A course disk in either CD or DVD format can be very beneficial to online, hybrid, or distance courses in statistics as well as traditional on-campus courses, augmenting existing technologies like course management systems. A typical course disk may include the syllabus and course outline, calendar, instructions, lecture notes and lecture outlines, handouts, assignments, interactive content such as quizzes and surveys, software, statistical tables, example program files, program code, data files, video lectures and tutorials, and pertinent website links. In most cases, a course disk would be used *in addition to* traditional methods like course management systems rather than *in place of* these traditional methods. Most of the benefits of a course disk are shared with course management systems like Blackboard or Moodle; however, a course disk has the distinct advantages that it need not rely on internet access and it provides access to course materials after a course has ended.

One course disk was developed and used in teaching a graduate-level introductory statistical methods course in three different settings: distance learning off-campus condensed course, online course, and traditional on-campus course. The course disk provided a variety of benefits across delivery formats as well as benefits unique to each delivery format.

This article will (1) review relevant literature, (2) describe the course disk and compare its use to other content delivery methods, (3) discuss the experiences and evaluation of using the course disk in three different settings and how the students in each setting benefited from using the course disk, and (4) discuss the necessary hardware and software and the process of making a course disk.

1. Introduction and Review of Relevant Literature

This article discusses the use of a course disk to supplement other tools and methods used in statistics education. The use itself of a course disk is an implementation of technology in statistics education. Additionally, the digital content contained on a course disk can be used to enrich statistics education using technology. The [GAISE College report \(2005\)](#) specifically recommended the use of technology to aid in conceptual understanding and data analysis in undergraduate statistics education. The use of technology can enhance student learning ([Garfield, Chance, & Snell, 2000](#)), facilitate student accessibility and interaction ([Chance, Ben-Zvi, Garfield, & Medina, 2007](#)), and provide students with opportunities to become familiar with the technology that they may encounter in their future jobs ([Chance et al., 2007](#)).

[Chance et al. \(2007\)](#) warn that technology is not meant to replace the teacher, but that it can provide a learning environment that is supportive and rich in resources. They also warn that technology can only have a positive impact on education if it is used appropriately. Consequently, a course disk would not replace a teacher but provide both teacher and student with additional tools for learning.

An effective course disk can contain multimedia applications including computer-assisted instruction activities. Computer-assisted instruction (CAI), which often refers to drill-and-practice, tutorial, or simulation activities, has been shown to have positive effects in statistics education, including an enhanced rate of learning, better retention, and higher final examination achievement ([Cotton, 2001](#)). Computers can improve scores in reasoning, visualization, and problem solving ([McCoy, 1996](#)). Computers can increase student motivation and student self-confidence and facilitate a better attitude toward learning ([Rochowicz, 1996](#)).

Creating and incorporating a course disk for statistics courses encompasses the positive aspects of technology in education to facilitate learning in any environment: on-campus, online, or hybrid. On-campus courses can benefit from multimedia tutorials contained on a course disk. [Aberson et al. \(2002\)](#) found that the use of multimedia tutorials helped students outperform their counterparts without the tutorials, and multimedia tutorials on optical media (CD-ROM), such as a course disk, have been described as “ideal” in supporting a traditional classroom ([Ragasa, 2008](#)). Online courses, which inherently involve a lot of digital material and presentation, and hybrid courses, which involve both in-person instructor contact time and instruction through computer resources, can benefit from a course disk because of the delivery format. [Ward \(2004\)](#) cites advantages of the hybrid format as student access to digital content such as digital libraries, web pages, and databases; a need for students to spend more time learning independently; and instruction characterized by better premeditated presentation of ideas—digitally recorded as opposed to in-person stammering.

Implementing a course disk may seem a daunting task to an instructor and is susceptible to similar obstacles as other technology adoptions. Obstacles in using technology include a lack of awareness and comfort by teachers in using new technologies they might not be familiar with

([Chance et al., 2007](#)), a lack of administrative support ([Ritchie, 1996](#)), and a significant investment in time and thought ([Huffman, Goldberg, & Michlin, 2003](#); [Chance et al., 2007](#)).

2. Course Disk and Comparison of Its Use to Other Content Delivery Methods

2.1 Course Disk

A course disk may contain any materials that would otherwise have been used as printed materials, including syllabus and course outline, calendar, instructions, lecture notes and lecture outlines, handouts, assignments, interactive content such as quizzes and surveys, software, statistical tables, example program files, program code, and data files. More importantly, it can contain video, including video of lectures, examples, assignment explanations, demonstrations and tutorials, interviews, and practical applications. [Jaki \(2009\)](#) found video recordings of lectures to be very helpful in an introductory statistics course for biology students. [Gunderson \(2009\)](#) found video recordings helpful for pre-lab tutorials on the use of SPSS for her statistics course. [Derr \(2000\)](#) used video to model good and bad examples of statistical consulting sessions, which allowed students to see the interaction between consultant and client as if they were in attendance. Video could also be used to clearly demonstrate the lesson objectives rather than simply stating them.

The following three video clips provide examples of the video content of the course disk used in this study. They are all in Windows Media Video (.wmv) format. The first video, Video clip 1, is a clip of the lecture on inference. The clip shows instruction on confidence intervals for the difference between two means. Notice how clear the formula is because it is typed rather than hand-written. Also notice that during the clip the software allows the instructor to write on the screen, enabling circling and highlighting the portion of the formula being described. Students can benefit from the typed formula, the handwritten notes, and the instructor's voiceover describing the content, all at the same time.

Video clip 1. Lecture on confidence interval for the difference between two means (requires the wmv3 codec). <http://www.amstat.org/publications/jse/v18n3/CI.wmv>

The second video, Video clip 2, is a clip from the tutorial video on using MS Excel to compute table probabilities. By viewing this clip, students can see a step-by-step demonstration of how to compute distribution table probabilities. Video demonstration is far superior to a printed list of instructions because students can actually watch the instructions being carried out as they are described in detail. In this clip, the instructor also refers to a graph to show the area of a distribution represented by the computed probability, helping students to make the connection between the graph and the computed probability.

Video clip 2. An MS Excel tutorial for computing distribution table probabilities (requires the wmv3 codec). http://www.amstat.org/publications/jse/v18n3/Excel_Prob.wmv

The third video, Video clip 3, is a clip from the answer key for one of the assignments. This clip allows the answer to be fully explained along with common mistakes and greater insight into the intent of the exercise. Further examples and elaboration on the answer key are given, and students can see what the instructor is looking for in an answer to an exercise. Students with disabilities may find this especially useful since the video provides more than just reading off a page. (Note: The answer key is given because these exercises are intended to provide students with practice. Students are encouraged to complete the exercises prior to looking at the answer key. These exercises are graded for completion rather than being assessed for accuracy.)

Video clip 3. Answer key video for one of the assignments (requires the wmv3 codec).
<http://www.amstat.org/publications/jse/v18n3/key.wmv>

A course disk can also contain pertinent website links that can be accessed when a student has an internet connection. Such links may include online data sets, journal articles, software downloads (i.e., pdf creator/reader, graphics viewer), the course management system, the university final exam schedule, and the department website. A course disk may be the principle source of information for a course or it may supplement printed material, online material, and/or a course management system.

Because a course disk does not require an internet connection, the course materials are available to students wherever and whenever they have access to a computer with the appropriate disk drive. This is advantageous for non-traditional students who may spend time travelling and not have ready access to an internet connection. But perhaps more important is that once a student uses a course disk for a class, they have that course disk for future reference after the class has ended. This is not true of course management systems, which are typically unavailable to students once the course has ended.

Content delivery methods other than a course disk include printed course materials, video CDs (VCDs), digital files of both limited and comprehensive course materials, course websites, and course management systems.

2.2 Printed Course Materials

Many classes print syllabi, handouts, worksheets, assignments, exams, and course packets for students. Printed course materials can be a financial burden to a department. Additionally, students may potentially lose printed material. When the instructor has the original, the student must request and then wait on the instructor to produce additional copies—again at the department's expense. Printed material also limits the ability to use large data sets. All of these are non-issues when a course disk is used.

2.3 VCDs

For many years departments have recorded live lectures onto VCDs for students to watch at a later time through a distance learning, at-your-own-pace, or directed studies course. VCDs are typically direct transfers from video camcorders so they are limited to what is seen and heard by the camcorder during the recorded class period. In the most rudimentary case an individual

stands at the back of the classroom with a video camera and records the instructor writing on a whiteboard or chalkboard. This can be problematic if the instructor stands in front of the writing or writes too small or illegibly. In contrast, material on a course disk may include video screen captures with the video representing what is seen on the instructor's computer screen narrated by the instructor. Unlike a course disk, a VCD does not contain additional multimedia content such as lecture outlines and data sets.

Each VCD typically holds two to four lectures and is then made available to the students. The department must then act as a library for on-campus students or as a video rental store for online and out-of-town students, sending out each week's media and awaiting the return of the previous week's media. For a large class, this may require numerous copies and expensive postage. [Stephenson \(2001\)](#) noted that using media for individual lectures and then mailing the media to the individuals, or company media libraries in some cases, requires a one week delay in the material for off-campus students. In stark contrast, a course disk recorded on a DVD can hold all the video lectures for an entire semester's course in multiple formats and is made available to students prior to the start of the semester. This is possible because lectures are prerecorded, either live from a previous semester or recorded in a studio such as the teacher's office.

2.4 Digital Files

Providing limited course material in a digital format requires that students print the content at their own cost yet it gives them the option of choosing what and how many copies they print. Students are then responsible for any lost printed materials.

Current methods of disseminating comprehensive digital course content include email, podcasting, course websites, and course management systems such as [Blackboard](#) and [Moodle](#). To put digital content on the internet, the instructor digitally creates one copy of the content, which is then available to all the students in the class via download from a website or an email attachment. This enables students to download program code and data files rather than copy them from a printed course handout, which saves time, minimizes data entry errors, and allows for the use of large real-data examples. However, files should not be so large as to hinder or even prevent download by students with slower internet connections.

Podcasting involves a series of online media files released episodically. For educational purposes, podcasting is a method teachers can use to post video files related to daily lectures, seminars, or tutorials. As opposed to posting lecture videos for manual download, podcasting is characterized by client software that automatically checks the online course video repository for updates (new video episodes) and downloads the new videos.

Issues with online digital content include potentially slow internet connection for students who have access to the internet only via dial-up modem (especially among older non-traditional students) and a lack of internet connection for students who wish to work on their course materials while away from home. In contrast, a course disk requires no internet connection and makes course materials available to students wherever and whenever they have access to a computer with the appropriate disk drive.

2.5 Course Websites

Course websites tend to be a repository for digital content. Compared to a course disk, a course website requires the students to have an internet connection to access course materials and it cannot contain large files that prohibit downloading.

2.6 Course Management Systems

Course management systems are becoming more common in college courses, providing resources for communication, collaboration, and assessment ([Chance et al., 2007](#)). Course management systems are an improvement over course websites because they can include discussion boards and tools for tracking scores and grades. In most cases, a course disk will not replace a course management system but can enhance it by providing course content without requiring an internet connection. One student commented that she used the disk as a passenger in a car and would not have had access to the materials had they only been available on the course management system. A course disk also enhances a course management system by providing large video files that do not need to be downloaded.

The biggest benefit of a course disk remedies the biggest drawback of a course management system: availability of course material after the course has ended. Once a course has ended, students will lose access to any course material that was available on the course management system. Videos can no longer be reviewed and tutorials can no longer provide guidance. This is not the case with a course disk, which provides students with a resource that they can review throughout their academic and professional careers. This is especially beneficial for non-majors who will continue to use statistics throughout their lives and who will benefit from continued access to review material.

Similar to digital movie downloads versus physical movie media (i.e., DVD or Blu-ray), it is noted that some people just prefer a physical copy that they own and to which they will always have access versus downloadable media (in this case movies) that may not always be available. [Schlaffer \(2008\)](#) writes, “There’s no substitute for holding an actual physical disc in your hand, it won’t go anywhere and it won’t get corrupted.” (See also [Kon & Teitell, 2008](#); [Keegan, 2008](#); and [Greenfield & Smaldon, 2006](#))

Course management systems and course websites may be updated at any time during the semester. Because the course disk is produced before the semester begins, any corrections, updates, or additions to the course disk must be delivered to the students over the internet using a course management system, a course website, or as an email attachment if the files are not too large. Consequently, the teacher can deviate from the material presented on the disk and augment the course disk with that additional information. In fact, the course disk for a current semester can incorporate the best of the course management materials, updated and polished from previous semesters, leaving the course management system to focus on recordings and content made during the current semester.

3. Experiences and Evaluation of Using the Course Disk to Teach a Graduate-Level Introductory Statistical Methods Course

The course described in this study is a graduate level introductory course in statistical methods. Service courses of this nature are notoriously viewed as challenging by students because of the wide array of statistics topics covered and students' fears of mathematics and statistics as they are not themselves statistics majors ([Jaki, 2009](#)). These service courses can also be seen as a challenge by teachers because of the lack of motivation by these students ([Symanzik and Vukasinovic, 2006](#)).

The course disk in this study was used to aid in teaching a graduate-level introductory statistical methods course in three different settings: distance learning off-campus condensed course, online course, and traditional on-campus course. Students in each type of setting benefitted in different ways from the addition of a course disk.

3.1 Distance Learning Off-Campus Condensed Course

The original impetus for the course disk was to improve student learning in distance learning off-campus condensed courses. At one Midwestern university, introductory statistics courses are offered to cohorts of students who live geographically close together but geographically far from the university's main campus. These classes are taught at a satellite campus or local area business office. The instructor condenses into six days the traditional 45 contact hours typically spread over 15 weeks in an on-campus course. This is accomplished in the following manner: the instructor teaches three consecutive days, eight hours per day, for the first half of the course. After two weeks, the instructor administers the mid-term exam, teaches three more consecutive days, and without another break administers the final exam. This format is not as conducive to learning compared with other formats but accommodates the students' schedules and geographic location. Nonetheless students are still expected to perform above the same minimum level on assignments and exams as students who take the traditional on-campus 15-week course.

In many ways the course disk helped to reverse the students' disadvantage of receiving so much material in very short periods of time and greatly facilitated their efforts to retain the information they were taught. The first six benefits in this list could also be gained through the use of course management software, but the seventh benefit is unique to course disks.

1. Students went two weeks without seeing the instructor. The course disk provided a connection to the instructor during that time period.
2. Students were able to review the video lectures throughout the two weeks, spreading out the lectures over a longer time period than the original three contact days. This assisted with comprehension of complex topics.
3. Lecture outlines were included on the disk for students to print out and fill in while reviewing the lecture videos.
4. Complete lecture notes were also included but [Adobe Acrobat](#) software was used to set restrictions preventing students from printing the complete lecture notes. Consequently, students could view the complete lecture notes to fill in their printed

- lecture outlines, but could not skip filling out the lecture outline by printing the completed lecture notes.
5. Assignments and all materials needed to complete the assignments were included on the disk.
 6. Tutorials were included to assist students with using equation editors and using the statistical software chosen for the course to compute basic statistics and statistical analyses.
 7. Students have access to course materials included in the course disk after the course has ended to assist them with their future classes as well as for after they graduate.

3.2 Online

The type of online course in this study was a course in which students never needed to physically visit the campus because the instructor and students communicated by telephone and the internet. A course management system was developed to coordinate the course and provided many advantages for both instructor and students. The system allowed the instructor to upload files for students to download including the course syllabus and any assignments, data files, or other files that may have been updated after the course disk was produced. The students in turn could upload a document file containing their completed assignments. A testing feature allowed the instructor to provide computerized tests that were timed and automatically graded upon completion, providing students with instantaneous feedback. Most importantly, the system included a discussion board on which most of the communication took place. The instructor and the students posted items for class discussion and then the instructor and other students contributed to the items by clarifying instructions, providing ideas, explaining concepts, and answering questions.

For the online course, the main purpose of the course disk was to provide clearer audio and video files of the lectures. This was accomplished by using less compression than what would have been used for files required to be smaller to be downloadable from the internet. This availability removed the potential burden of using a dial-up connection or being away from an internet connection. Another benefit included access to course materials after the course had ended.

3.3 Traditional On-Campus

The disk was not initially intended for the traditional on-campus course. However, once on-campus students found out about the disk being used for online and distance learning off-campus condensed courses, they requested access to the course disk for their course as well. In the traditional on-campus course students received their primary instruction in the classroom but found the course disk very useful because it enabled them to review recorded lectures for better comprehension, complete handwritten class notes, and view lectures they might have missed. This was especially helpful for non-traditional students who traveled great distances to attend class and had to miss classes on occasion due to adverse weather and poor driving conditions. Additionally, students who missed class due to family illness and other reasons were able to view the recorded version of the class they had missed to stay caught up with the rest of the class. This reduced the need for extensive office hours to review material covered during their absence.

An issue that concerns university administrators is what to do if the university needs to be closed. Issues like pandemics and snowstorms have the potential of closing universities for several days, which can disrupt students' continuity of learning. The [Department of Education \(2009\)](#) states that all education shareholders have a responsibility to establish plans for maintaining a continuity of learning in the case of extended absences of students due to reasons such as flu. Further, the [Department of Education \(2009\)](#) specifically includes recorded audio-video materials and recorded class meetings on DVD as options for getting materials to students unable to come to school. A course disk can be a valuable resource to instructors, enabling courses to continue even when a campus is closed. A closed campus can also lead to a disruption in school online resources; however, materials on a course disk would still be accessible.

Even if a major event such as a school closure does not occur, course management systems and school servers go down for repairs, upgrades, and maintenance; systems get overloaded; internet cafés fill up; signals get lost; a few individuals still use a dial-up connection to the internet; and high-speed internet services have their hiccups and sometimes slow down during peak use to near dial-up speeds.

Teaching with technology requires a backup plan ([Chance et al., 2007](#); [Cardenas, 1998](#)). [Chance et al. \(2007\)](#) bring up the issue of implementation and question the accessibility of the technology resources for a class outside of the classroom. A course disk is available to students wherever they go and can be immune to server and internet problems, providing course content when network systems are not available.

3.4 Evaluation

Former students in this study were contacted and asked to answer a questionnaire and provide feedback regarding the course disk. Thirty four students responded, representing a response rate of about 30% (30 online, 4 on-campus). Students were contacted using their university-issued email accounts. Because many of the students contacted had graduated, it is likely that many no longer check their university-issued email accounts. This may account for a significant proportion of the non-response.

Table 1. Evaluation questions and proportion of “Yes” responses.

Question	Yes
1. Do you still own the course disk?	33/34(97%)
2. Did you ever access any information or materials on the course disk after the course had ended?	18/34(53%)
3. Did you ever access any of the videos on the course disk after the course had ended?	13/34(38%)
4. Did you ever use the course disk in a situation in which a high-speed connection was not readily available to you?	17/34(50%)
5. On-campus students: Did having the disk provide enough incentive that you skipped class knowing you could just watch a video of the lecture?	0/4(0%)

6. Do you think I should continue offering a course disk to students who take my classes, or should I just put all the course disk materials on Blackboard? 29/34(85%)
-

Consider the results of the questionnaire listed in [Table 1](#). Nearly all respondents (97%) indicated they still own the disk, which means they still have access to the video recordings, tutorials, notes, and all other resources contained on the course disk. More than half (53%) indicated they accessed the disk after the course had ended, and 38% of the respondents specifically utilized the videos after the course had ended. One respondent, a teacher herself, indicated that she still uses the course disk videos to prepare for one of the courses she teaches and will also use these videos as a refresher while she works on her Ph.D. dissertation. Fully half of the respondents indicated they used the course disk material when a course management system would not have been accessible, including one individual who said that he worked on the course while at his cabin in the mountains with no access to the internet.

One concern in offering a course disk to on-campus students is that it provides incentive for students to not attend class. Of the 4 respondents who were in an on-campus class, none of them indicated that to be true. Comments indicated that they felt it was important to attend all classes, despite having videos of the lectures. One of the respondents indicated that she was unable to attend one class due to a test she was required to take and appreciated being able to watch the lecture she had missed. [Jaki \(2009\)](#) documents no noticeable reduction in attendance for students who had access to recorded lectures. Likewise, in the campus and distance courses illustrated in this study, attendance remained near 90% throughout the semester, except during adverse weather/driving conditions.

When asked if the course disk should continue to be offered, only one respondent said no (4 abstained). Even that respondent said she might need to refer back to the lectures because she will take another statistics course in an upcoming semester.

Other comments by students regarding the course disk included the following:

1. "The nice thing about the disk is that you do still have the information after the course ends. I teach online now and my students do complain that they can no longer access course materials after IT closes the course."
2. "Please offer the disk. There have been times when I have needed to refer to an example from your disk to clarify my work. I think it is especially valuable to folks like me who are not statisticians and need to refresh the information as we get down to data analysis."
3. "I have used the course disk to help explain information to other students."
4. "I loved having the DVD lectures/notes to refer to and the explanations for each assignment were great."
5. "It was extremely valuable to be able to listen to the lectures as many times as necessary."
6. "I am listening to the lectures over and over, and they finally make sense!"
7. "I found the DVD to be incredibly valuable in teaching me the course and it is an incredible resource."

8. “Your format was perfect for distance learning.”
9. “I really liked the DVD format to facilitate the class, rather than waiting for assignments and postings each week.”
10. “This is the best online course I have taken (and my entire Master’s program was online).”

These remarks give insight into how the course disk benefitted individual students.

4. Necessary Hardware and Software and the Process of Making a Course Disk

Developing a course disk may seem daunting, especially to an instructor with limited resources and support. However, a course disk can be very basic and easy to produce or as complex as desired. Necessary hardware and software will vary greatly depending on the sophistication of the course disk and the instructor’s knowledge and ability.

4.1 Hardware

CDs or DVDs: Depending on the amount of material to be stored, a CD or DVD can be used. A CD stores about 800 megabytes (MB) of data and a single-layer DVD stores about 4.7 gigabytes (GB) of data.

CD or DVD writer drive: A CD or DVD writer drive is required to record information to a recordable CD or DVD disk. Most new computers come with drives that will write to recordable CDs and DVDs.

Writing tablet: Creating slides to show during a lecture can be very helpful in a statistics course because many formulas can be misread if they are drawn freehand rather than typed with an equation editor. A writing tablet or tablet PC enables the instructor to draw on slides during a lecture, point to items on a slide, or highlight text or portions of a distribution table. A writing tablet, as shown in [Figure 1](#), is attached to the computer using a USB connection and comes with a stylus (a pen designed for writing on the tablet). As the instructor writes on the tablet with the stylus, the writing appears on the computer screen. The same principle applies to a tablet PC except the stylus can draw directly on the tablet PC’s screen. Actively pointing and writing on the presentation helps students follow along just as an instructor might draw on and point to a white board during instruction. [Wacom](#) is a company that produces writing tablets of different dimensions and different levels of sophistication. Several PC manufacturers produce tablet PCs that cost slightly more than a non-tablet laptop.



Figure 1. A writing tablet and basic headset with an attached microphone.

Microphone: A microphone is essential for recording audio onto the computer. A headset with an attached microphone or a clip-on microphone is advantageous because it frees the instructor's hands for other tasks like writing. Headsets with microphones are very inexpensive and can be purchased for less than \$20.

Video or web camera: A video camera can be used for a high-quality introduction by the instructor and for active demonstrations, interviews, and activities. Video cameras with Firewire connections, also referred to as 1394 connections, can be plugged directly into a Firewire-capable computer, and the video can be copied directly onto the computer. Some newer video cameras record video directly onto a flash memory drive that can be removed from the video camera and plugged into the computer for retrieval of the video file. Older video cameras that record video onto tape and do not have a Firewire connection may require additional hardware and software to transfer the video to the computer.

Web cameras are designed for live internet video. They typically have a much lower picture quality than traditional video cameras but are less expensive and easy to use. They are adequate when recording the instructor's head for short video messages but are not the best choice for interviews, active demonstrations, or other activities. Because they produce low-quality images, writing recorded by a web camera may not be legible to viewers.

Still camera: Still camera photographs of class items might include resources needed by students; tools used for an experiment or an activity; a photograph of the instructor and teaching assistants or graders; a photograph of the university, the department, or other facilities; conferences; and topics of discussion. Digital still cameras prevent the instructor from having to scan photographs produced from film cameras to transfer them to the computer.

Document camera or scanner: Document cameras are like video cameras suspended above a table to record printed information. Document cameras are more useful in live classes than in recorded classes. In a live class, a document camera can be used to project a page of the textbook, a newspaper or magazine article, or some other type of printed document to the students in the classroom. A scanner can serve the same purpose in recording information for a course disk because these items can be scanned and included with the lecture materials on the disk with permission of copyright owners.

4.2 Software

Screen capture software: Screen capture software allows the instructor to capture video and still images from the computer screen. These captures can be tutorials in which the instructor demonstrates an example on the computer that students can play back. An instructor may also use screen capture software to record a live lecture where, instead of writing on a white board, the instructor uses a stylus to write on a tablet and that writing appears on the computer screen. Screen capture software is available from a variety of companies (www.techsmith.com, www.camstudio.org, www.centra.com, www.webct.com, www.jingproject.com). The screen capture software used to make the course disk in this study is [Camtasia Studio](http://www.techsmith.com) produced by [TechSmith](http://www.techsmith.com) Corporation. [TechSmith](http://www.techsmith.com) also makes a free screen capture software named [Jing](http://www.techsmith.com). [Jing](http://www.techsmith.com) can be used to capture short videos including audio but has restriction on video length and format. [Camtasia Studio](http://www.techsmith.com) provides additional features such as basic video and audio editing and various production options including format, video length, and quality. [Figure 2](#) is a screen capture of a video lecture on the course disk. A stylus and tablet were used to draw on the screen, which in this case is a PowerPoint slide, just as one might draw on a white board.

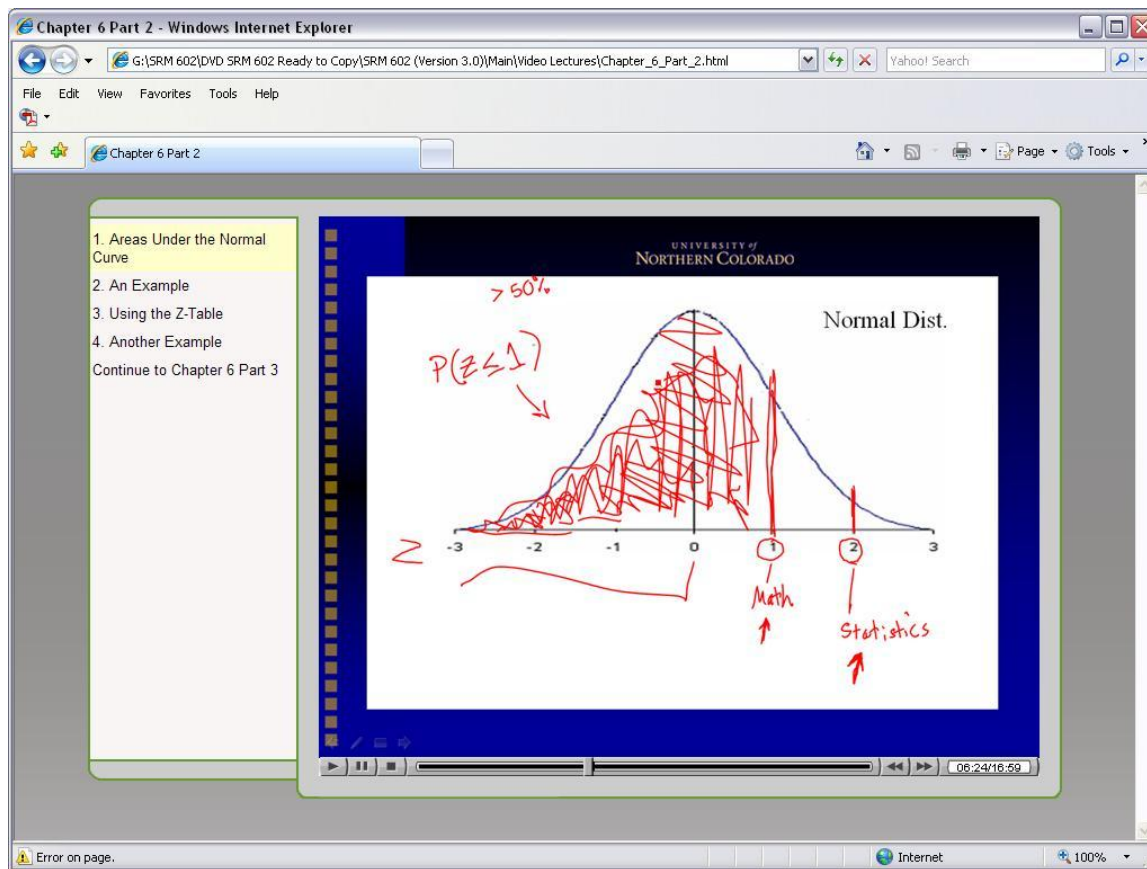


Figure 2. A screen capture of a video lecture recorded using Camtasia Studio.

Video-editing software: If live video is recorded of a lecture or activity, editing the video before including it on the course disk is beneficial. A product called [Movie Maker](#) accompanies some versions of Microsoft Windows and can be used for basic editing. [Adobe Premiere](#) is advanced video-editing software with greater flexibility but added expense.

PDF-creation software: Converting all course documents to PDF format is advantageous because all students may then download and view PDF documents using a free PDF document viewer. If documents are not converted, students must have the appropriate software to download and view documents. For example, if the syllabus is created in a WordPerfect format, students may have a hard time opening that file if they don't own WordPerfect. However, if the document is converted to a PDF format, all students can open it with the free viewer. Although Adobe Acrobat Reader is a free PDF viewer, it cannot convert documents to PDF format. Therefore, [Adobe Acrobat](#), an at-cost product that can convert documents to PDF format, or one of several free products must be used to convert documents to PDF format. One free method is for the software to create a virtual printer on your computer. When you attempt to print the document on that "PDF printer" rather than printing the document, it converts the document to PDF format. Newer versions of word processing packages such as MS Word have a "save as" option to save documents in the PDF format automatically.

GUI-creation software: A graphic user interface (GUI) can be constructed in HTML format, similar to a webpage. For a course disk, the webpage is saved to the disk and enables students to

point-and-click their way to course materials contained on the disk. It can also link students to internet content related to the course.

Many software programs are designed to aid in the construction of a webpage. However, all that is really needed to create an HTML file is a basic text editor like [Notepad](#) or [Wordpad](#). Perhaps one of the easiest ways to learn how to create an HTML file is to learn by example. Teachers who would like to use a text editor to create a GUI for their course disk can look at the HTML code that was used to create any of a number of internet websites. The HTML code for a website can be accessed by right-clicking on the website and selecting the option “view source” from the menu. Another basic way to make an HTML file is to create a document on a program like [MS Word](#) or [MS PowerPoint](#) and then to “save as” an HTML-format file. [Autorun](#) files act much like the HTML-format file would except that the autorun file does not require a web browser for viewing.

[Figure 3](#) is a screen capture of the main menu screen that appears when the course disk in this study is entered into the computer. The main menu screen is saved on the disk and is viewed through a web browser like Internet Explorer, but does not require an internet connection. The main menu screen was created using html code and a webpage template that was modified to suit the purposes of the course disk. This was accomplished without any formal training in HTML programming. From the main menu, students can navigate to the instructions, video lectures, lecture notes, distribution tables, assignments, answer keys, and examples, as well as connect to locations on the internet (if an internet connection is present).



Figure 3. A screen capture of the main menu for the course disk in this study.

4.3 Process of Making a Course Disk

Developing a course disk can take a lot of time initially. The course disk described in this paper was completely prepared by the author with no assistance. Consequently, the process took approximately three to four hours each weekday during one semester. A second course disk, which followed the pattern established in the first disk, was prepared for the second course in a two-course introductory series and was prepared in about half the time. Other subsequently developed disks contained tutorials but no video lectures and were prepared in substantially less time than either of the first two. It is likely that the assistance of an aide would reduce the amount of time involved in preparing a course disk.

Another option for greatly reducing the amount of time needed to produce an initial course disk is to copy the digital content from the course management system used during a current semester to a disk and provide it to students in the following semester. Revisions can be made each semester, adding additional content and updating and correcting existing content, thus improving the course disk for future students.

Preparing digital content for a course disk can be very similar to preparing digital content for an online course. Necessary software is basic and typically includes tutorials associated with using the software.

Printed material should be scanned if no original digital file exists. All documents should be converted to PDF format to accommodate students who may not have the same software used by the instructor to create the documents.

Videos should be separated by topic so that each topic that might be covered in a 50- to 90-minute class lecture is made into one or more videos. Videos should not be longer than 90 minutes each and preferably less than 50 minutes. Students can always watch multiple videos if needed, but may find it difficult to watch part of a video and then try to remember where they left off when they wish to continue.

Videos may incorporate demonstrations. In that case, the video would be a recording of the instructor or another individual, recorded with a camcorder. Video that includes written and drawn instruction should make use of a writing tablet, presentation software such as PowerPoint, and screen-capture software such as Camtasia Studio. Use the writing tablet to draw anything that might be drawn on a whiteboard in a traditional on-campus class. Formulas should be clearly typed on presentation software so they are easily read. Graphs can be made using statistical software and then annotated, or doodled, using the tablet. Throughout the instruction and any demonstration, the instructor's voice could be recorded to explain everything seen in the video.

Videos need to be compressed and/or converted to a format that is viewable with common free software. Flash videos can be viewed with a Flash player that is downloaded free from the internet. Additionally, students appreciate when videos appear in a format like M4V that can be viewed on handheld devices like the iPod to listen to as they commute. This would be in addition to the videos being saved in a larger, easier-to-view format.

Each semester all internet links included on the course disk should be checked to make sure they are active and up to date.

For more information regarding preparing the digital content, which is the bulk of the work associated with a course disk, refer to [Tudor \(2006\)](#), [Stephenson \(2001\)](#), and other articles that describe the production of digital content for an online or distance course. Additionally, resident instructional designers, IT and education specialists, and techno-savvy co-workers may provide useful assistance.

The course disk in this study had been used for five years in seven different sections. At the end of each semester, students' emails, course evaluations, and discussion board posts were culled for potential course disk corrections and improvements. The material on the course disk was easily updated, improved, or corrected. For example, typos were corrected and documents re-published in pdf format, corrected files were copied to the folder that stores all the course disk content, and portions of lectures were re-recorded.

Although creating a course disk may initially require a large investment of time, the course disk saves time throughout the semester. FAQ sections reduce the number of emails the teacher might receive. Lecture notes provide students with missing information. Video lectures reduce and potentially eliminate the need to re-teach material. All assignments and materials needed for

the assignments are accessed from the disk. Software tutorials address students' needs that might otherwise be addressed outside of class. And students may refer back to any material covered throughout the semester by reviewing the disk at any time. Ultimately, the initial investment of creating a course disk pays huge dividends throughout the semester and for many semesters to come. Similarly, creating and setting up content for a course management system may initially require a large investment of time, but it saves time throughout the semester and provides all of the benefits listed above.

Once a "master" course disk has been created it can be submitted to the university bookstore, just as an instructor might submit a printed course packet for copies to be made, duplicated, and sold to students. The cost for each disk should be about \$5; however, as with printed course packets, additional royalty fees may be required for including content owned by a copyright holder.

5. Conclusion

Adding a course disk to a course provides students with course material that does not rely on a high-speed internet connection. The disk can contain polished course materials garnered over past semesters to supplement current-semester content. Perhaps the greatest benefit of a course disk is the fact that it provides students with course content long after their statistics course has ended. It is recommended that a course disk be considered to supplement courses of any format.

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