Eleven Tips to Find Course Materials When Time is Limited

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New faculty and others have limited time to develop new courses and course lectures. Using a short course on human factors and nuclear power as a case study, the author identified tips for finding course-related online resources, which can accelerate the development of course materials. The 11 resources include (1 and 2) course syllabi in the education resources sections of society web sites or otherwise posted on the web, (3) lecture material linked to those syllabi, (4) lectures on the web found using the topic name and “.ppt” extension, (5) graphics found using the Google image tool, (6) books on Amazon.com sorted by relevance, (7) key articles found using Google Scholar, (8) key articles found using databases such as Web of Knowledge and Scopus, (9) reports on industry specific web sites (e.g., Electric Power Research Institute), (10) standards on the International Standards Organization web site listed under technical committee work programs, and (11) videos on YouTube.

WHAT LED TO THIS PAPER?

Recently, the author created and taught a new short course on human factors and nuclear power for the Palo Verde Nuclear Generating Station. That new course was derived from the University of Michigan Human Factors Engineering Short Course (Green, 2012; http://www.youtube.com/watch?v=IGOLPLyHkOw), an intensive course for industry that has been taught for 54 years. The new course was one week long instead of two, involved only the author instead of 10 lecturers, and focused on nuclear power applications. The project contract required the course to cover vision and visual performance, the design of controls and displays, perception and cognition, anthropometry, warnings, situation awareness, human error, the design of experiments, human factors methods, time and motion analysis, usability testing, speech interfaces, and risk assessment.

For a new course that does not follow a textbook, about 10 to 20 preparation hours are required for each contact hour (University of California, 2006). Preparation time is often limited, especially for new faculty members. What can faculty members (and others) do to develop quality courses in less time?

Following are 11 timesaving tips based on the author’s experience of creating the nuclear power human factors course. Each tip is associated with one of the six steps of creating a course -- determining the lecture topics, the topic sequence of topics, and what each lecture should cover (steps 1, 2, and 3), finding key references (step 4), creating slides for each lecture (step 5), and unifying the lectures (step 6).

Step 1 of course planning is to determine the topics and associated objectives (Bain, 2004; Nilson, 2010; Svinicki and McKeachie, 2011). Traditionally, the course objectives are stated using words from Bloom’s learning hierarchy (Bloom and Krathwohl, 1956; University of Florida, 2011) such as create, evaluate, analyze, apply, or know. Now, one begins by listing the expected learning objectives and measureable outcomes, what students should be able to do after the course is completed (Anderson and Krathwohl, 2001). Outcomes are described using active verbs—memorize, recite, name, identify, or understand.

Those learning outcomes should reflect the educator’s own ideas and experience, as well as considerations of prerequisites and subsequent courses. In addition, the course plan may be informed by what others are teaching in similar courses. How does one find that out what others are teaching?

TIP 1: SEARCH SOCIETY WEB SITES FOR COURSE SYLLABI.

Course plans (syllabi) and related materials are often found in the educational resource section of relevant professional societies, though they may be dated. For human factors/ergonomics, they include (1) the Human Factors and Ergonomics Society, (2) the Association for Computing Machinery Special Interest Group in Computer-Human Interaction, and (3) the Society for Technical Communication. At the present time, open courseware sites contain very little material relevant to human factors/ergonomics. If you use any of these materials, get permission if they are copyrighted.
TIP 2: USE "SYLLABUS" AS A SEARCH TERM TO FIND SYLLABI ON THE WEB.

Additional syllabi can be found by entering the course topic and the word "syllabus" into a search engine. For example, typing "human factors" and "syllabus" into Google.com led to syllabi for more than 20 university courses. "Ergonomics" and "syllabus" led to results that were similar to the "human factors" and "syllabus" search, though some of the entries were different. Sometimes, the search phrases "course material(s) repository" or "teaching material(s) repository" or "course description" are helpful. Keep in mind that there is no quality control of the material that appears online, though all syllabi found in this instance seemed reasonable.

Be sure to record the source of materials, especially images, as you may want to later reuse those materials in a publication requiring a copyright release. Given current search tools, finding the source of a particular image without its URL is very difficult.

In deciding the sequence of topics and allocating time to them, step 2, new faculty members sometimes allocate too much time to introductory topics, which should be covered in about an hour for a typical course. Further, covering applications-oriented material early in the course before theory is often recommended, especially for engineering courses. For example, it would be advisable to discuss legibility requirements before covering human visual anatomy and visual acuity. Without context, engineering students often describe those foundational lectures as "just stuff," reflecting their inability to relate to them.

TIP 3: USE SYLLABI URLS TO FIND COURSE LECTURES.

To determine what each lecture should cover, step 3, begin with the courses for which syllabi have already been identified in steps 1 and 2. Sometimes the syllabus will identify a course home page that has hyperlinks to PowerPoint lecture presentations that may contain useful content. If the home page cannot be found in that manner, then enter variations of the syllabus URL that could be used for lectures. For example, if the syllabus is at .../ie778/syllabus, then try .../ie778 or .../ie778/lec1. Approximately one-third to one-half of the time, a few guesses will lead to other files. When the URL includes the lecture topic (e.g., displays) instead of "lec" or "lecture," refer to the syllabus lecture title for hints about the URL. There may be more elegant ways to complete this and other searches using advanced search features.

TIP 4: USE ".PPT" AS A SEARCH TERM TO FIND LECTURES.

The author assumes that PowerPoint or an application resembling PowerPoint (e.g., Apple Keynote) will be used to support lectures. PowerPoint, is not without its critics (Tufte, 2003, 2006; Doumont, 2005; Bumiller, 2010; Garber, 2011; Norman, 2011; Tammes, 2011). Relevant PowerPoint files can also be found by searching the web using combinations of names for a particular lecture topic (e.g., “occupational ergonomics,” “occupational biomechanics,” “human biomechanics”), a PowerPoint identifier, and “course.” Typically three to four phrases will identify the overwhelming majority of the relevant material. For PowerPoint files, “.ppt” often leads to more useful hits than “PowerPoint,” but “PowerPoint” and “ppt” (without the period) generally lead to additional material, particularly where ppt files have been saved in pdf format.

TIP 5: USE THE GOOGLE IMAGE TOOL TO FIND EXAMPLES OF DEVICES AND WORK ENVIRONMENTS.

To illustrate applications in lectures, graphics are desired. As an example, to engage students in the topic of control room design, the author began with a sequence of images entitled “Where is this control room?” To find those images, the search terms “nuclear control room” and “control room” were used in conjunction with Google’s image search feature (usually in the upper left corner of the browser window). Adding in a country name (e.g., Spain), did not always lead to control rooms in that country (verified by examining the source file for each image). In the nuclear power human factors course, this approach was also used to find examples of specific controls (J-handle switches, mice, joysticks, etc.).

TIP 6: USE AMAZON TO FIND THE MOST RELEVANT BOOKS.

Step 4 is to find key references. Often, the fastest way to find those references is to ask an expert. However, one may not know who the experts are, or they may be inaccessible, so search tools may be used to find key references.

Books are desired for their comprehensive coverage of a topic. If one does not have the key books in their personal library, their titles can be identified using the book tab on Amazon.com. Following the example used earlier, the search terms could be “occupational ergonomics,” “occupational
biomechanics,” and “human biomechanics.” Usually, sorting Amazon.com book search results by relevance provides the most useful citations, though sometimes the first page of “sort by best selling” may be useful. There are exceptions. In one search for books on “human factors” and “ergonomics,” the most relevant book identified was Canine Ergonomics, which probably is not true most of the time.

**TIP 7: USE GOOGLE SCHOLAR, NOT GOOGLE TO FIND JOURNAL ARTICLES.**

Invariably, the most recent high-quality material on many topics in science and engineering can be found in journals. Start with Scholar.google.com (not Google.com) to find them, as Google Scholar emphasizes vetted sources—articles, books, theses, and so forth. Undergraduate students and those in industry are often unaware of Google Scholar. To improve searches, (1) use the pull-down tabs to exclude patents, and (2) alter the date range of the search to the last few years, and (3) add “review” as a search term to find current literature reviews.

Useful articles can also be found in the reference lists of articles identified in searches, especially of the most prolific and/or highly regarded authors. A list of what they have done can be found by searching using their name and “resume” or “cv.” If they are faculty, their resumes can be found in the faculty section of the university department for whom they work.

**TIP 8: ALSO USE ISI AND SCOPUS TO FIND JOURNAL ARTICLES.**

Relevant publications can also be identified using various for-fee databases for which universities and others may have licenses. The two major databases are the Thomson Reuters (formerly ISI) Web of Knowledge and Scopus (Zillman, 2006).

Using the advanced search feature substantially reduces the number of useless hits. For example, for ISI, setting the topic to human factors and nuclear power (without quotes) retrieves citations concerning prostate cancer, ocular biometry, and other undesired topics (1,011 total). Changing the search terms to “human factors” and “nuclear power” (in quotes) reduces the number of returns to 160, most of which are of use (though not the citations relating to wind farms). Selecting subject areas (nuclear science and technology, psychology, behavioral sciences) reduces the set further to 67 items, many of which are useful. Furthermore, ISI has a feature to sort retrieved lists by relevance and number of times cited, both of which are recommended. Because these tools focus on books, journal articles, and proceedings papers, they do not find any .ppt files, as .ppt files are found only on the web.

By way of comparison, searching Scopus for “human factors” and “nuclear power” led to 642 hits in Scopus (searching the author, title, and keywords fields) and 320 hits using Scopus keywords only. Scopus also provides a feature to sort items found by citation frequency.

**TIP 9: SEARCH INDUSTRY AND GOVERNMENT WEB SITES TO IDENTIFY APPLICATION-ORIENTED DOCUMENTS.**

Application-oriented materials, such as Society of Automotive Engineers (SAE) technical papers and U.S. Department of Transportation (U.S. DOT) technical reports, are sometimes not cataloged by both the Web of Knowledge and Scopus. In the case of nuclear power, the key sources for technical reports are EPRI (Electric Power Research Institute) and INPO (Institute of Nuclear Power Operations). INPO and EPRI publications are on their web sites.

Reviewing industry and government technical reports often reveals key contributors. For human factors and nuclear power, these contributors are at the Brookhaven National Laboratory of the U.S. Department of Energy (www.bnl.gov/humanfactors/Publications.asp), with John O’Hara of that organization being particularly prolific. Follow-up searches of primary authors frequently identify additional useful documents.

**TIP 10: SEARCH THE ISO WEB SITE FOR KEY STANDARDS.**

Identifying relevant standards is important for engineering courses, and they are most quickly found by searching the web site of the issuing organization. For global standards, the primary organization is the International Standards Organization (ISO, www.ISO.org), though for some topics, other organizations may be relevant (International Telecommunications Union (ITU), International Electrotechnical Commission (IEC), etc.). To find relevant ISO standards, scan the list of technical committees to find the relevant ones. The work program for that committee (or subcommittee or working group) will list the standards they have issued.

For nuclear power, the relevant ISO technical committee is generally TC 85 (Nuclear energy, nuclear technologies, and radiological protection). However, a review of the TC 85 subcommittees shows that other than radiological protection, this TC is not concerned with human factors issues.
Human factors activities are the purview of ISO TC 159 (Ergonomics). One way to determine this would be to type “control room” into the ISO site search box, which identifies ISO 11064, a standard produced by Technical Committee 159, Subcommittee 4.

In the case of the class on human factors and nuclear power, the relevant U.S. government agency was the Nuclear Regulatory Commission (NRC). A Google search readily identified the NRC site (www.nrc.gov) and the primary document on human factors and nuclear power, NUREG 0700 (U.S. Nuclear Regulatory Commission, 2011).

When creating slides for each lecture (step 5), an accepted rule of thumb is that one should present no more than one slide per minute on average unless the slides are illustrations or there is only one bullet point per slide. If there are questions or discussion, the number will be less than one. Junior educators are often afraid of running out of materials to present, so they tend to have too much material, rushing at the end of their presentation to complete it.

The author’s personal experience is that text that is 24-point or larger will be legible in reasonable worst-case viewing conditions (such as the back corner of a room). Exceptions to this rule are URLs for figures and tables that need to be changed from year to year (for example, data on annual crash statistics). The URL should appear on the slide so the educator can retrieve data the next year. That text can be small.

When pasting in figures as images, make them as large as possible so the scale information is legible. If something is too small for the viewer to see, then do not show it. When pasting in material from another PowerPoint presentation, there are invariably font and background color inconsistencies that take time to eliminate.

To aid recall of a presentation, a recent recommendation is that figure and table titles, should be assertions (e.g., “Older Drivers Take Two Times Longer to Respond”) rather than descriptions (e.g., “Response Time by Condition vs. Age”) (Alley and Neeley, 2005; Penn State University, 2011).

Another recommendation is to use fewer words and more images, as do some of the great presenters such as Steve Jobs (Gallo, 2009). Having images reduces the tendency to read the slides.

TIP 11: SEARCH YOUTUBE FOR INTERESTING VIDEOS.

Videos can provide interesting examples of applications and demonstrations of ideas, and their entertainment value can be a positive element in a course evaluation. For automotive human factors courses that the author teaches, there are video clips of crashes, usability tests, examples of test methods, traffic in other countries, and so forth. The widespread use of YouTube (with its feature to search for clips on particular topics) has made finding course-relevant videos much easier. The video search feature on Google can be used for the same purpose. There are many good engineering videos on Mythbusters (Discovery TV) and for ergonomics, Dirty Jobs (Discovery TV).

After a video is found, download and save it in a low-loss format that is likely to persist, so it can be used in the future. Do not count on having a live and high-speed Internet connection when ready to present. Make sure a player for that format is on the computer used for downloading and the computer used for the presentation.

Finally, in some courses, there may be value in showing inspirational or motivational videos (such as Randy Paush’s last lecture (Carnegie Mellon University, 2007). Unfortunately, one usually learns of these videos by word of mouth.

The final step (6) in developing a course is to unify the lectures. Developing a course does not proceed in a strictly sequential manner, completing one lecture after another. Searching for material on one topic invariably leads to discovering new material for lectures previously deemed done. Further, as material is gathered, there is often a mismatch with what was planned; the instructor finds that he or she is short on some topics and has a surplus of others, and adjustments are needed.

Finally, as part of this last step, make sure that all of the course topics and expected learning objectives have been accomplished. Quite often, one becomes enmeshed in the course details and loses sight of the objectives.

CONCLUSIONS

This paper describes 11 tips to aid in finding existing course syllabi, PowerPoint lectures, images, books, journal articles, standards, video recordings, and other materials that can be incorporated into lectures. The intent is not to use those materials as is, but to adapt them, with proper attribution, for academic purposes. Those materials should complement what the educator already knows so the resulting course contains substantial original material, not a reformulation of what others have done. The materials described need to be supplemented with activities that engage students and provide opportunities to apply the material presented, changing what is presented from a dry set of facts to interesting and useful material that is remembered.

Three decades of experience in creating course materials have given the author the insight to realize
that, had these methods not been used, the human factors and nuclear power course could not have been created in the time available. Comparing preparation time now with the past is not as straightforward as it might seem, as over time, the amount of technical material available to consider has grown substantially. Further, the most noteworthy difference with previously created courses was the quality of the initial course material, which greatly benefited from the focused and extensive searches to identify relevant content.

REFERENCES


UPDATE

After this article was basically completed, the author learned of another useful resource that should be Tip 12: Search Slideshare.net for relevant material. Slideshare is a free web site where presentations are posted. As an example, there is a good summary of Fitts Law (http://www.slideshare.net/lrizoli/fitts-law-basics?from_search=10, retrieved June 16, 2013) on Slideshare.