A good usability assessment test report would identify many usability problems, and for each, the possible causes and solutions would be explained.

- **“Errors: The system should have a low error rate … if they do make errors they can easily recover from them. Further, catastrophic errors must not occur.**
- **“Satisfaction: The system should be pleasant to use….“** (p. 26)

Carol Barnum (2002) provides a list of “What usability is not: quality assurances; zero defects; utility of design features; intrinsic in products.” She insists that these terms relate to the product rather than its user interface, noting, “The presence of these qualities may validate a product from the standpoint of utility, while saying little about its usability” (p. 6). In technology education, the past emphases on product design and product function have to be broadened if usability is to become a criterion; a new emphasis would be on the design, function, and harmony of the product-user system.

**Usability**

As consumers, students typically notice when one product is more user-friendly than another. Many factors can contribute to user-friendliness or “usability.” Jakob Nielsen (1993) lists the following five attributes of usability:

- **“Learnability:** The system should be easy to learn so that the user can rapidly start getting some work done with the system.
- **“Efficiency:** The system should be efficient to use, so that once the user has learned the system, a high level of productivity is possible.
- **“Memorability:** The system should be easy to remember…

Characterizing the user, however, may be difficult without gaining information from actual users, which is where usability testing can be of assistance.

**Usability Engineering and Usability Testing**

Usability engineering (Remington, 2000) extends to product design, development of instruction manuals, and even packaging, in an attempt to engineer a product with improved usability. Sometimes, the emphasis on the user is so strong that the design process is termed, “user-centered design.” One critical subset of usability engineering is usability assessment, where information is gained about the usability of a product/system. Common usability assessment techniques include focus groups, surveys, expert evaluations, usability audits, and usability tests (Nielsen & Mack, 1994).

Usability tests involve collecting data from actual users as they use a product. Rubin (1994) identifies four common types of usability tests:

- **Exploratory tests** typically occur during a product’s early design development, possibly looking at the “the user’s conceptual or mental model of the product” (Rubin, 1994, p. 31).
- **Usability assessment tests** typically occur after a working
solution has been developed. The richness of information makes this a great choice for technology education students.

- **Validation tests** are attempts to see whether a product/system meets established standards.
- **Comparison tests** are performed to compare alternative product designs.

### Planning and Conducting a Usability Assessment Test

Usability assessment testing can be a great way for technology students to develop a more critical eye toward technology. Usability tests may be performed on existing products/systems, or on prototypes designed by students, including physical objects, software, or Web sites (Kaufman & Flowers, 2000). The goal for students to keep in mind is to uncover a wealth of information regarding many usability problems.

#### Developing Tasks for Users

The researcher should have a good knowledge of the product/system to be tested, establishing appropriate tasks for users to perform during a usability assessment test; performing his/her own task analysis may improve the researcher’s ability to design a usability test. The directions given to test subjects should not be too specific, such as “Press the ON button,” but should reflect actual users’ goals, such as “Set up and use this wireless remote to play that X-Box® game.”

#### Using a Script or Checklist

It is good practice to develop a checklist (Dumas & Redish, 1993; Nielsen, 1993) or script (Rubin, 1994) to orient test subjects. This might contain items such as:

- Greeting the subject.
- Stating that this is a test to uncover usability problems, not a test of the subject’s abilities.
- Discussing the subject’s rights and asking the subject to sign an informed consent form.
- Encouraging the subject to think out loud so that the researcher can better understand the reasoning behind his/her decisions.
- Asking if there are any questions.

#### Planning the Environment

The usability test environment should closely model the actual environment of users, but allow the researcher to gather data through unobtrusive observation. Professional usability test laboratories, such as those used by Microsoft Corporation (2000), typically employ one-way mirrors and video cameras, but usability testing can be accomplished without these.

#### Recruiting Subjects

Nielsen (2000) suggests that professional usability tests can be adequate with a small sample of only five varied users, though others disagree (Caulton, 2001). A screening questionnaire can be used to determine the subjects’ characteristics that would determine their inclusion in the usability test (Barnum, 2002).

Small, in-class usability tests performed as a part of a technology class might not be subject to the guidelines for the protection of human subjects in research that larger-scale tests would require. If there is any doubt, the teacher/researcher should consult his/her local administration. Teachers who ask students to perform human subject research are in an excellent position to provide a lesson on the importance of safeguarding the rights of these subjects.

#### Conducting the Test

With the environment, script, and plan ready to go, the researcher typically performs the tests with each subject, one at a time, beginning by reading an introductory script where the test participant is asked to think out loud, etc. The subjects are then asked to actually perform selected tasks using the technology under study. “Testers can influence the way participants act and what participants say by biasing them” (Dumas & Redish, 1993, p. 297), so it is important for the researcher to record observations and to avoid interfering, only helping where the subject has reached an impasse.

After the test, it could be helpful to have subjects complete a post-test questionnaire, and then to have a debriefing session where the researcher can ask probing questions to make sure his/her observations are accurate and to uncover the reasons behind the subject’s decisions and comments (Rubin, 1994).

#### Analyzing and Reporting on a Usability Test

It is recommended that technology students who perform a usability test compose a report of the findings. Both secondary and post-secondary students should be encouraged to do some related reading and to include discussions and citations of relevant literature. The report could either follow the teacher’s specifications, or a proposed “common industry format” from the National Institute of Standards and Technology (1999), and may be even be published online.

The study’s clients could be seen as those charged with product redesign for improved usability. During the analysis of results, the student should make connections between observed usability problems and the design features of the interface, noting what was found to be unintuitive or troublesome and why. A good usability assessment test report would identify many usability problems, and for each, the possible causes and solutions would be explained. In some instances, one solution may create larger problems than it solves, so caution is recommended.

#### Examples

Professional examples of usability test reports can be seen at the following locations:

- **Case Study of Sun Cobalt**
- **The Usability of Good Documents**
  - [www.gooddocuments.com/usabilitytest/ut1_home.htm](http://www.gooddocuments.com/usabilitytest/ut1_home.htm)
- **The Usability of Scribble Matching**
  - [www.acm.org/sigs/sigchi/chi96/proceedings/shortpap/Frohlich/fd_txt.html](http://www.acm.org/sigs/sigchi/chi96/proceedings/shortpap/Frohlich/fd_txt.html)
Examples of over 130 online usability research reports published by undergraduate and graduate students in technology education classes at Ball State University can be seen at http://web.bsu.edu/jcflowers1/rlo/usabilityreports.htm (at the time of writing). These are based on instructional materials at http://web.bsu.edu/jcflowers1/rlo/modusability.htm.

Suggestions for Working with Technology Education Students

Years of experience with technology education college students as they design and conduct usability tests, and as they teach secondary students to do the same, has revealed some pitfalls. Students may:

- Think they can be their own test subject.
- Confuse usability testing with product performance testing.
- Look at usability testing as only validating the usability of a product, rather than of uncovering usability issues that could inform redesign.
- Ask yes/no or ratings questions, rather than probing questions.
- Forget to carefully observe.
- Prompt users, wanting them to succeed.
- Select a pool of subjects that is not varied regarding experience with the technology.
- Fail to read relevant information.

Fortunately, these are easy to overcome when the teacher is aware of them.

Conclusion

Usability testing can be a wonderful addition to secondary school and higher education technology education classes. It can shift the emphasis from product design to the design and analysis of product-user systems. Students can be asked to design and perform their own usability assessment tests on professional or student-designed product-user systems. But care should be given to developing tasks for test participants, writing a script, recruiting participants, conducting the test, analyzing data, and preparing a meaningful report.

Usability testing, however, is rather narrow. It does not give adequate attention to the social and environmental impacts of the system. Technology assessment tools, such as life cycle analysis, may be used to help technology students gain a fuller understanding of the assessment of technological decisions (Hoepfl, 2001). Yet, usability testing of a product-user system can be one step on the road to providing technology students with a more critical eye toward the technological world.

References


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