

Constructing a Web-Based Delphi

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A recent study (Colton, 2002) used the Delphi research method to develop the Online Adult Learning Inventory, an instrument to apply the principles of adult learning to Web-based instruction and training. A pioneering feature of this study was the construction of a website and conducting the Delphi process on the Web rather than employing the traditional paper and pencil Delphi techniques. The researcher constructed a Web site with a threaded discussion forum for discussions related to developing content and validity, Web forms for voting purposes to determine the level of expert consensus, a calendar to keep the panel on task, and as an archive to hold draft versions of the instrument and the text of previous discussions available for review at any time by the expert Delphi panel. The experts were assigned pennames for anonymity. Ample time was allotted for expert panel members to reflect on the content of the draft instrument and to add additional commentary to the discussion forum any time and from any place. This paper provides an overview of the process in detail for constructing the Web-based Delphi site used for this study.

Overview of the methods

The Delphi research method is a procedure for structuring a communication process among a group of experts to effectively deal with a complex question or problem (Linstone & Turoff 1975). The problem posed to the expert panel was to construct and validate an instrument to apply principles of adult learning to web-based instruction or training. The review of the literature encompasses and impacts the other research methods of the study.

The list below is an outline of the overall research process. A detailed discussion of each item follows.

1. Literature review: Preliminary content was collected for the instrument using established quality filters, criteria for selecting the expert panel was established, and appropriate and established research methods were selected. The principles of adult learning were reviewed as were web-based instructional methods.
2. Selection of the expert panel: Selection criteria for panel members was based on a review of the literature, potential panel members were selected based on the criteria, and approval of the potential expert panel members was obtained

from the Dissertation Committee. All approvals from the University Human Studies Committees were obtained.

3. Set-up of the discussion forum: The discussion forum was set up on a Web site with the latest revision of the instrument and other data attached to the site. Pen names for anonymity and passwords were selected for the participants.
4. Round one of the Delphi: Establishment of adult learning principles by discussion and vote for possible consensus. The experts were given a draft instrument with adult learning principles, as derived from the literature, as the structure of the instrument. The main points of consideration were: Is the principle relevant to web-based course development, and, if so, is it worded correctly? They were asked to keep in mind that this list of principles in its final form will serve as the structure of the instrument. They had three weeks to discuss items on this list, suggest changes to the list, collapse any two principles into one, separate one complex principle into two separate principles, alter wording and phrasing, and make additional comments that come to mind. They then had another few weeks to vote on the list. Prior to voting, the list of adult learning principles was revised based on suggestions by the expert panel. Voting ended the round. Results of round one were displayed on the discussion forum. Mean, median, mode, standard deviation, and interquartile range were calculated. Based on the suggestions and a statistical analysis of the vote, the instrument and its structure of adult learning principles were revised again.
5. Round two of the Delphi: The establishing and sorting of an item pool completed by a vote. Consensus was not expected. Expert panel members were asked to list one or more instructional methods that apply an agreed-upon adult learning principle to Web instruction or training for adults. Because of the opportunity for discussion and debate that a threaded discussion forum affords, there was expected to be some negotiation toward consensus during the dialogue. Results of the listing of instructional methods were displayed on the discussion forum. One week was given to the expert panel for reflection on the draft instrument as again revised with the list of instructional methods included. Then, a vote was conducted on the large item pool or list of instructional methods, which apply the various adult learning principles to Web courses, using a Likert scale of 1 to 4. (1 - does not apply, 2 - moderately applies but not strongly enough to use in the instrument, 3 - applies enough to be included in the instrument, and 4 - outstanding application and definitely to include in the instrument). The following descriptive statistics were calculated: mean, median, mode, standard deviation, skewness index, interquartile range, and rank to indicate consensus. Edits were made by the researcher to the list of instructional methods based on the results of the vote, comments on the voting ballot, correspondence, and references from the literature where necessary. Items receiving weak consensus (mean of 3.0 or higher and an interquartile range of 2 or greater) were retained for a re-vote for the third round to allow panel members to consider changing their vote.

6. Round three of the Delphi: Follow up discussion was available and a second vote was performed on the revised list of instructional items either to include in the instrument or consider for elimination. Statistics were calculated as before. Items not having reached consensus to be included in the instrument were considered for elimination from the final instrument. Edits were made to the list of instructional methods based on the results of the vote, comments on the voting ballot, correspondence, and references from the literature where necessary.
7. Field test for indication of reliability:

Potential panel members were selected from the literature based on the number and quality of their publications or experience in the field, particularly during the past nine years, a time when Web-based distance learning became feasible. The researcher rated each potential panel member as to their perceived usefulness to the study based on their specific area of expertise. Usefulness for this study included contributions to the scholarly discussion of adult learning principles, expertise in courseware development, or familiarity with instructional methods appropriate for delivery by the Web. Table I. outlines the procedure used to select the Delphi expert panel members.

Also, the number of secondary citations, from the *ISI Social Sciences Citation Index* and journal articles, were used for the selection process to some extent. A greater number of citations can reasonably be assumed to mean greater expertise in a general sense. Keith (1999) found that 34 citations per faculty was the average for universities deemed prestigious. A system of marks or quantity of citations constituted the preliminary rating system. This researcher and the dissertation committee made the final selection of Delphi panel members based on their suitability for the study and their expertise in the field.

Based on previous Delphi research and the review of literature, fifteen potential panel members were invited to participate. Of that, twelve agreed to participate. Turoff (1995) suggests ten participants to be the minimum.

The time requirement for the Delphi process was significant. The process can last for 30 to 45 days (Barnes, 1987) but in this Web-based study, it took several months. The participants were offered the opportunity to participate in the discussion with other panel members of equal merit, to participate in producing and validating an evaluative knowledge-based tool for others, and to experience a Delphi process. Scheele (1975) states that attractive and stimulating peers provide the most powerful incentive to participate. It is also necessary for the panelists to be assured that the facilitator (researcher) has an understanding of the content. Participants who responded slowly or not at all to calls for participation were contacted by telephone or sent additional e-mail reminders in order to gain a higher level of participation.

The researcher is inherently part of the Delphi process, as facilitator, interpreter, editor, and as a data-gathering instrument, thus is integral to the research (Linstone & Turoff, 1975). A point was made by Miles and Huberman (1994) that the researcher must be “self-aware as much as possible about personal assumptions, values and biases” and to

be “explicit” on how they may come into play during the study (p. 278). Patton (1990) noted that the researcher’s bias is always present and cautioned that the “investigator does not set out to prove a particular perspective” (p. 55). Guba and Lincoln (1981) suggested a member check to look for bias. The discussion forum provided a venue for member checks. The researcher declared to the expert panel her bias as a teacher, and that it was important for the final instrument to serve as a teaching tool. This declaration by the researcher was important to the study in deciding to retain the adult learning principles as section headings.

Web-based discussion forum

Computer-based Delphi procedures have been used since the 1970s (Turoff & Hiltz, 1995). Today, however, the technology is available to conduct an anonymous asynchronous threaded discussion easily on the Web “...where the merger of the Delphi process and the computer presents a unique opportunity for dealing with situations of unusual complexity” (Turoff & Hiltz, 1995 p.9). Research indicates this combination opens the possibility for greater performance from the Delphi panel of experts than could be achieved from any individual, something that rarely happens in face-to-face groups (Turoff & Hiltz, 1995, p.8, p.11).

For this study, the threaded discussion forum from the company Eduprise was used. The site consisted of a homepage that is referred to as the “Welcome” page (Figure 2: Home page of the website), assignments (Figure 5: Assignments screen), calendar (Figure 6: Calendar screen), and discussion forum with attached documents (Figures 7,8,9,10,11,12,13). In addition, the researcher had access to a user analysis of the discussion on the Web site (see Chapter IV, Figures 21 and 22). The attached documents in the discussion forum included draft instruments, text of previous discussions, and voting forms.

The home page or welcome page included the following internal links: the dissertation topic (Figure 3: Dissertation topic screen), a short explanation of the Delphi method (Figure 4: Delphi method screen), and short biographies of the researcher and dissertation chair, including photos (not shown).

→ [Welcome](#)
[Calendar](#)
[Assignments](#)

[Sharon Colton](#) and [Dr. Tim Hatcher](#) welcome you to the Delphi Research Site.

Be sure to check Assignments (see link on left). Sharon will send e-mail to each of the expert panel members as tasks are assigned as a prompt. There are two parts to this Web site: "home" which is where you are now and the "forum" where our discussion will take place. Note the navigation bar above.

The [dissertation](#) research which Sharon Colton is conducting uses the [Delphi](#) method, originally used by the Rand Corporation during the 1950s. Integral to this method is to assemble a panel of experts in the field to be researched, in this case, adult learning and Web course development.

As members of the expert panel, your role in this research is in content development and validation, resulting in the construction of an instrument.

Results of the Round 1 Vote are posted [here](#)

Figure 2. Home page of the web site.

The home page or "welcome" page of the web site contains general information, navigation menus, short biographies of the researchers, and information on the study.

The following two figures are screen captures of the dissertation title link and the dissertation method link.

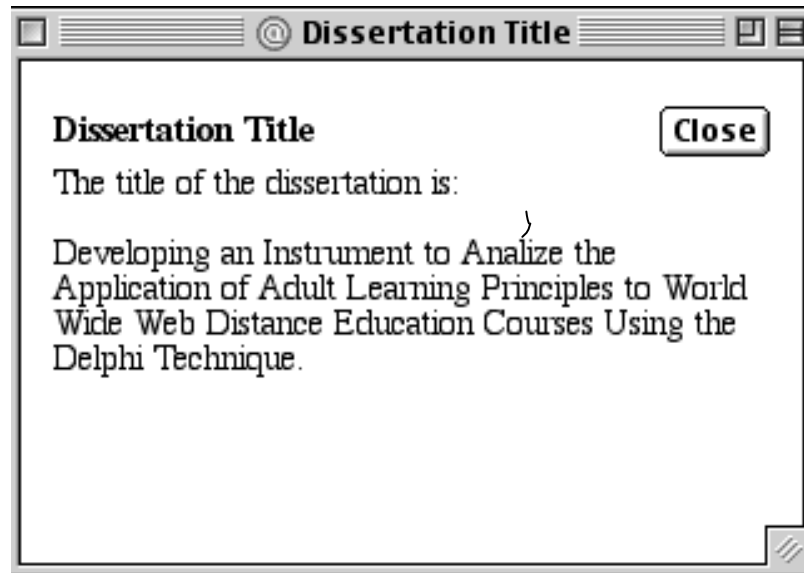


Figure 3. Dissertation topic screen.

The dissertation topic screen is embedded in the home page.

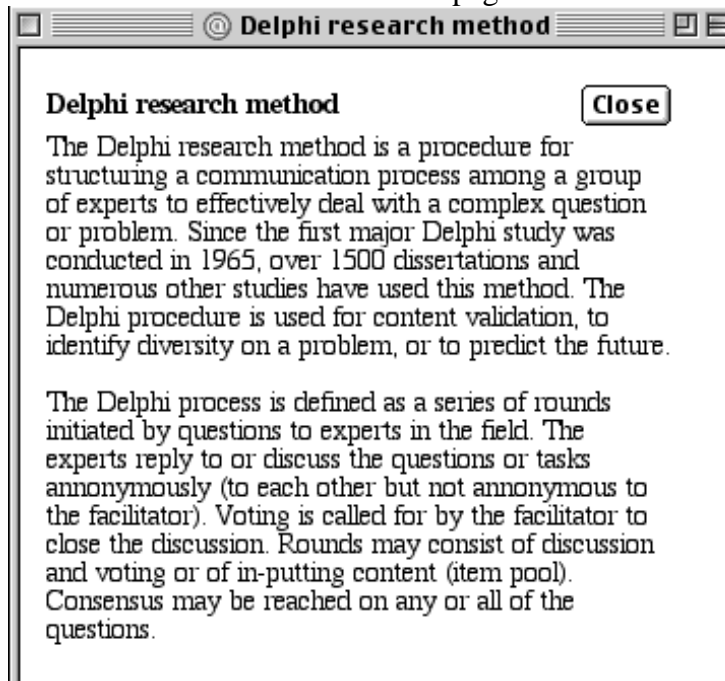


Figure 4. Delphi method screen.

The Delphi research method screen is also embedded in the home page.

The assignments internal link listed the tasks or assignments for the expert panel members and, also, a calendar was generated based on the due dates of assignments or tasks. Both the assignments and calendar were linked from the welcome (or home) page (see Figure 2: Home page of the website). Each time a task was assigned an e-mail note was sent from the researcher to each expert panel member separately so as to keep the panel member's anonymity. One note to all would have listed the expert panel member's e-mail addresses which would compromise anonymity.

The following is a screen capture of the assignments page.

[Welcome](#)

[Calendar](#)

→ [Assignments](#)

[Previous](#) | [Next](#) | [Expand](#) | [Collapse](#)

- [01/25/2001 Task #1: Discuss adult learning principles](#)
- [02/09/2001 Task #3: Vote on Adult Learning Principles](#)
- [02/22/2001 Task #4: Identify instructional methods](#)
- [02/28/2001 Task #5: Continued discussion of the adult learning principles structure to the instrument](#)
- [03/06/2001 Task #2: Instrument Draft \(most recent\)](#)
- [12/05/2001 Task #6: Vote on instructional methods \(measurables\)](#)
- [12/12/2001 Task#7: Final vote on instructional methods](#)

[Previous](#) | [Next](#) | [Expand](#) | [Collapse](#)

Figure 5. Assignments screen.

The assignments page can be accessed from the home page of the web site and lists the various tasks as they are assigned.



The following screen capture shows a view of one month of the online calendar.

[Jan](#) | [Feb](#) | [Mar](#) | [Dec](#)

View by: [Week](#) | [2-Week](#) | [Month](#)

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December 2001

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
26	27	28	29	30	1	2
3	4	 Task #6: Vote on instructional methods...	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	 Task#7: Final vote on instructional...	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

[Jan](#) | [Feb](#) | [Mar](#) | [Dec](#)

Figure 6. Calendar screen

The calendar is generated automatically by the web software whenever a new assignment is listed.

For each round of the discussion, threads, or sub-heads, of each discussion topic were developed. The discussion topics were the various adult learning principles (from the literature) for round one, continuing through round three, with additional threads for rounds two for creating and sorting instructional methods and a catch-all thread, “general comments about the instrument” for the remaining rounds. All of the discussion could be viewed by all of the participants at any time and they could respond to any part of the discussion at any time and in any place with a computer and an Internet connection.

There were three general discussion areas as shown in Figure 7: Discussion areas. The threads or sub-heads are shown in Figure 8: Threaded discussion topics, and will be discussed more fully in Chapter IV, Results. Figure 9 shows typical discussion thread headings. Within each heading is the discussion content that is fully detailed in Appendix D: Delphi discussion, comments, and correspondence.

The following two figures display two views for accessing the discussion forum. The first view (Figure 7) is by category and lists the three overall discussion topics. The second view (Figure 8) displays topics by thread.

The screenshot shows the header of the 'UofL Online Courses' forum. On the left, the logo 'UofL Online Courses' is displayed. On the right, the text 'Delphi Research Forum' is shown, with navigation links 'Home | Forum | Help' below it. A horizontal line separates the header from the main content. Below the line, there is a 'Create: Thread' link. A list of navigation options is provided: 'Introduction', 'By Thread', 'By Author', 'By Category' (highlighted with a red arrow), and 'Roster'. To the right of this list, three discussion areas are listed with blue arrowheads: 'Adult Learning Principles', 'General Topics', and 'Web Instructional Methods'. At the top right of the content area, there are links for 'Previous', 'Next', 'Expand', and 'Collapse'. At the bottom right, there are similar links for 'Previous', 'Next', 'Expand', and 'Collapse'. A horizontal line is at the bottom of the content area.

Figure 7. Discussion areas.

The three main discussion areas are Adult Learning Principles, General Topics, and Web Instructional Methods.

Create: [Thread](#)

- [Introduction](#)
- [By Thread](#)
- [By Author](#)
- [By Category](#)
- [Roster](#)


[Previous](#) | [Next](#) | [Expand](#) | [Collapse](#)

- [Real Names and Final Comments](#) (Sharon Colton, 12/10)
- ▶ [Situational differences](#) (Sharon Colton, 02/15) **8 Responses**
- ▶ [Individual differences](#) (Sharon Colton, 02/15) **6 Responses**
- ▶ [Self-concept](#) (Sharon Colton, 02/15) **6 Responses**
- ▶ [Mental habits](#) (Sharon Colton, 02/15) **5 Responses**
- ▶ [Prior experiences](#) (Sharon Colton, 02/15) **6 Responses**
- ▶ [Need to know](#) (Sharon Colton, 02/15) **6 Responses**
- ▶ [Orientation & readiness to learn](#) (Sharon Colton, 02/15) **7 Responses**
- ▶ [More Comments on Adult Learning Principles](#) (Sharon Colton, 02/15) **4 Responses**

[Previous](#) | [Next](#) | [Expand](#) | [Collapse](#)

Figure 8. Threaded discussion topics. Under the category of Adult Learning Principles is a series of threads, developed by the researcher, to focus the discussion into the threads.

The following screen capture gives a view of the screen after opening one of the threads.

Sharon Colton 
sharonc1@aol.com
 Saturday, 1/13/2001 05:21 PM
 EST
orientation to learning
Category: Adult Learning Principles

Create: [Thread](#) | [Response](#)

[Home](#) | [Forum](#) | [Help](#)

[Previous](#) | [Next](#) | [Return](#)

E. Adult's orientation to learning is problem-centered, thus they are motivated to learn to the extent that they perceive that learning will help them perform tasks or deal with problems that they confront in their life situations.

WC: 37

 [Read Entire Thread](#)

[\[Previous Main Topic\]](#)

[orientation to learning](#) (Sharon Colton, 01/13) ← **You are here.**

- .. [Re: orientation to learning](#) (Mango Penname, 01/20)
- .. [Re: orientation to learning](#) (Celery Penname, 01/21)
- .. [Re: orientation to learning](#) (Broccoli Penname, 01/22)
- ... [Re: orientation to learning](#) (Tomato Penname, 01/26)
- .. [Re: orientation to learning](#) (Kiwi Penname, 01/29)
- .. [Re: orientation to learning](#) (Artichoke Penname, 01/31)

[\[Next Main Topic\]](#)

[Previous](#) | [Next](#) | [Return](#)

Figure 9. Sample discussion thread.

Upon opening a discussion thread, the user can view the list of postings and has the option to read any one posting or to read the entire thread.

The various draft instruments were attached (uploaded) to the forum, as was a compilation of previous discussions, and the three voting forms. As revisions were made to the instrument, it was updated and re-posted to the Web site. The Eduprise system records the number of comments from each panel member. A few times, the researcher was asked for help from expert panel members in accessing the site or in opening a PDF (portable document format) document.

The voting procedure was conducted by placing a Web form on the discussion forum with directions for its use. Participants were notified by e-mail that a voting ballot was ready and they would have a specified amount of time to respond. The completed form with an identifying penname was then automatically e-mailed to the researcher after each participant voted. Participants did not see each other's completed ballots. After all votes were in, descriptive statistics on each question were posted to the forum. Edits were made to the list of instructional methods based on the results of the vote, comments on the voting ballot, correspondence, and references from the literature where necessary.

The instrument was then updated and re-posted to the forum. Comments by panel members were archived and posted to the site for ongoing reference. The discussion and any correspondence was archived in Appendix D: Delphi discussion, comments, and correspondence.

Delphi procedures

The Delphi process was conducted in stages, or three rounds, with feedback by which the group attempted to reach consensus. Although the essence of the method is in the feedback and resulting discussion, not at forcing a quick compromise (Turoff & Hiltz 1995). The facilitator analyzed the comments and produced a draft instrument upon which the panel discussed and voted. Additional comments could be given at any time by the expert panelists, even after a vote is taken. Turoff, in recommending using the Internet for discussion, emphasizes that the most important criterion to Delphi process design is allowing any panel member to "choose the sequence in which to examine and contribute to the problem solving process" (p. 2).

The researcher posted the discussion threads in order to focus the discussion process. In Delphi studies, postings may be anonymous, coded, or by actual name, although the latter is not recommended in the literature (Delbecq, VandeVen, & Gustafson 1975). The present study used anonymous pennames for the expert panel members. Turoff and Hiltz (1995) suggested that respondents can choose when to use their real names but the researcher insisted that pen names be used for the duration of the study in order to reduce bias and promote participation.

The following pennames were chosen for this study because they were thought to be non-political, gender-free and bias-free as much as possible: peanut, celery, tomato, potato, apple, kiwi, orange, artichoke, radish, mango, broccoli, and pineapple. These pennames and the actual names of panel members were not linked for identification. Also, using a forum located on a distant server precludes a virus from being transmitted by e-mail to the panel members' computers.

The Delphi questions were constructed from a review of the literature (Zagari, et al, 2000). Designing a Delphi includes the process of designing a survey. As such, guidelines on good survey design and applicable analysis methods appropriate to a survey are potentially appropriate for the Delphi process (Turoff & Hiltz, 1995). From the review of literature, the researcher compiled a list of adult learning principles to serve as the potential structure of the instrument, subject to review and voting approval by the expert panel. The researcher included the adult learning principles as defined by Malcom Knowles. The decision on how to exactly word each principle was first made by the researcher based on wording deemed appropriate to the construction of the instrument and as identified in the literature.

Also from the literature review, a list of instructional methods was compiled by the researcher that potentially demonstrate or facilitate one or more adult learning principles (see Appendix A: Item pool). The list is extensive and is put in table form with each instructional method cited. The validation of any proposed content for the instrument was decided upon by vote of the expert panel.

Approval of a first questionnaire/survey/interview study by the University of Louisville Human Studies Committee (University Human Studies Committee, 2000) was completed prior to the initiation of the Delphi process.

Prior to the start of the Delphi process, the original list of adult learning principles (draft #0 in Appendix E: Draft instruments) as derived from the literature was subjected to a readability analysis by a group of online course developers and edited as a result of their input. Each questionnaire should be pre-tested by university faculty or staff who are not involved in the process in order to identify confusing statements (Linstone & Turoff, 1975, Dobbins, 1999) (see Review for Readability in the Instrument section for details). The next section describes the Delphi process used in the present study.

Round one. The objective of round one was for the expert panel to reach consensus on the adult learning principles for inclusion in the instrument and on the wording of each principle. The sections of the draft instrument (draft 1#) were based on the nine to eleven adult learning principles as listed by Malcolm Knowles and other theorists including Houle and Brookfield. (See Appendix E for draft instruments. Note that the first Delphi round did not include instructional applications.) Based on the threaded discussions by Delphi expert panel members, revisions were made to the list of adult learning principles (draft #2) and a vote was taken to end the round.

Instructions for round one (Tasks #1 – discussion, and Task #2 – review draft instruments) were posted on the discussion forum and sent to each participant by e-mail. The complete instructions for Task #1 as sent by e-mail can be found in Appendix F: Instructions to expert panel members.

The detailed directions for task #1 and task #2 on the Delphi website are displayed by figures 10 and 11.

[Welcome](#)

1st Task: Discuss adult learning principles

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[Assignments](#)

Due: Thursday, 01/25/2001

Comment on and make suggestions to the adult learning principles as listed by "thread" in the discussion forum (see "Forum" link above). The main points of consideration are: Is the principle relevant to web-based course development, and, if so, is it worded correctly? Please keep in mind that this list of principles in its final form will serve as the structure of the instrument.

You will have one week for discussion. You may also comment on any of the following: collapsing any two principles into one, separating one complex principle into two separate principles, wording and phrasing, anything else that comes to mind. I can add a new "thread" anytime someone asks or as I see it necessary to do so. A draft copy of the instrument is attached to Task 2 (see assignments).

On or about January 26th I will revise the list of principles as suggested and you will be asked to vote on each adult learning principle. The overall vote will determine if a particular principle will be included in the final instrument.

Figure 10. Website directions for task 1

Specific directions were posted in the discussion forum for each task to be completed.

[Welcome](#)

Task #2: Instrument Draft (most recent)

[Calendar](#)

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[Assignments](#)

Due: Tuesday, 03/06/2001

Please read recent drafts of the instrument (see attachments below left). You will need Adobe Acrobat Reader (available at www.adobe.com) to view the instrument. You may print it if you wish.

The drafts of the instrument contain the structure of the proposed instrument. Please feel free to comment on any version of the draft instruments in the discussion thread in the Forum which has been set up for more comments about the instrument.

The draft instrument has been reviewed and edited for readability and that process will continue. However, comments from this panel about improving its readability are most welcome.

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Figure 11. Website directions for task 2.

This figure displays the detailed directions for task #2.

As this was the first time for the expert panel members to access the threaded discussion forum, specific directions for use of the forum were made available upon entering the forum area (see Figure 12).

Create: [Thread](#)

→ [Introduction](#)

[By Thread](#)

[By Author](#)

[By Category](#)

[Roster](#)

Welcome to the Delphi Research Forum!

Below are some instructions for using the forum.

Instructions:

1. Please read each of the threads in the category in which you wish to comment.
2. Make any comments or suggestions (in the form of a message).
3. Sharon will add additional threads as they are suggested.

To read messages:

1. Click a link in the navigator on the left (e.g., "by thread").
2. Click a right-pointing blue triangle (called a "twisty") to display messages in that area.
3. Click on the topic to read the message.
4. Follow the onscreen instructions to respond to a message.
5. Enter a topic, or subject, then select a category from the drop down menu.
6. Click in the text box and type your message.
7. When you've finished entering the message, click on the "submit" button.
8. To return to the discussion forum, click the "Return" link in the upper right.

Anonymity policy:

1. Do not use your real name, only your "pen name."
2. Do not refer to any institution with which you are affiliated.
3. If you need to refer to your publications, please use the 3rd person to insure anonymity.

For more detailed help, click the Help button in upper right.

Figure 12. Website directions for using the discussion forum.

The introductory screen of the discussion forum lists the general instructions for using the discussion forum and has a review of the anonymity policy of the study.

At the end of the discussion time, the researcher revised the instrument (draft #2) using suggestions from the discussion then, task #3 called for a vote (vote 1) to end the round (see ballot for vote 1). An e-mail was sent to all expert panel members advising them of the vote and giving directions on how to proceed. The text of the e-mail message can be found in Appendix F: Instructions to expert panel members. The following is a screen capture of the website instructions for task #3, vote 1.

[Welcome](#)

[Calendar](#)

[Assignments](#)

Task #3: Vote on Adult Learning Principles

Due: Wednesday, 01/31/2001

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Please vote on each of the following adult learning principles. You are voting to answer the question, "Does this adult learning principle apply to Web-based courses or course development for an adult audience?"

You will have four voting options for each principle:

If you DO NOT want a principle included in the final instrument, choose: (1 - does not apply, or, 2 - moderately applies).

or

If you DO want a principle included in the final instrument (3 - applies, or, 4 - strongly applies).

Also, please include your pen name at the bottom of the form.

[Voting Form](#)

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Figure 13. Website directions for task 3, vote 1

Tasks were described on the Web forum and often attachments were added such as the Voting Form attached to the above page.

The researcher uploaded to the Delphi Web Site the edited instrument (draft #2) divided into adult learning content items and with no instructional methods. Final voting on this round was by means of a Web form returned by e-mail to the researcher. The Web form listed the adult learning principles as revised by the expert panel. A Likert scale was posted with each principle. The Likert scale ranged from 1 to 4: 1 - does not apply, 2 - moderately applies but not strongly enough to use in the instrument, 3 - applies enough to be included in the instrument, and 4 - outstanding application and definitely include in the instrument.

The web voting form was housed on the Eduprise server in North Carolina and the voting content with comments provided by expert panel members was then sent to the UNIX Athena server at the University of Louisville where it was captured in a text document, then e-mailed to the researcher's America Online e-mail address. The following three items are (a) the voting form (ballot), (b) a sample of the capture text document at the University of Louisville server site, and (c) the vote as received on the researcher's e-mail. Figure 14 below is a screen capture showing the content and form of the voting ballot for vote 1.

Voting Ballot for Content Validation of a List of Adult Learning Principles.

Below is the list of adult learning principles, first obtained from a review of the literature, then revised by this expert panel. Please vote on this list using the following Likert scale. (NOTE: By voting either a 1 or 2, you are deciding that the item does not belong in the final instrument.) There are also two other items to vote on (E2 and I) and you may want to look at them first.

- 1 - does not apply, do not use for the instrument.
 - 2 - moderately applies, but not strongly enough to use in the instrument.
 - 3 - applies, enough to be included in the instrument.
 - 4 - strongly applies, and must be included in the instrument.
-

A. Adults become ready to learn those things they need to know and be able to do with which they can relate to their real-life situations or experiences.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

B. Adult learners need to know how learning will be conducted, what learning will occur, and why learning is important.

- 1 does not apply
 - 2 moderately applies
 - 3 applies
 - 4 strongly applies
-

C1. Adults come into an educational setting with a wide range of experiences that can serve as a basis for new learning.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

C2. Because of prior experiences, adults tend to develop mental habits and biases and may need to reassess their beliefs in order to adopt alternate ways of thinking.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

D. Adults have a self-concept of being responsible for their own decisions, for their own lives, their own learning. They need to be provided the tools and opportunities for independent, self-directed learning.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

E1. Adult's orientation to learning is problem-centered, thus they are motivated to learn to the extent that they perceive that learning will help them perform tasks or deal with problems that can relate to their life situations.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

E2. Should #A and #E1 be collapsed into one principle?

- yes or, no

F. Although it is a combination of internal and external factors that motivate people, the most powerful motivators for adults are internal.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

G. In any group of adults there will be a wide range of individual differences, thus the individualization of learning experiences is important in many adult situations.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

H. Situational differences, or the context of the learning environment, impact the learning process for adults.

- 1 does not apply
- 2 moderately applies
- 3 applies
- 4 strongly applies

I. The above list of principles all contain the word "adult" in the principle. Should this be changed (as suggested) away from being centered on "adult" to instead be centered on "Web-based learning systems?" (e.g., Web based learning systems can and should empower role playing and simulations where situational differences can be exploited to enrich learning activities.)

yes or, no

Your pen name:

Figure 14. Screen capture of vote 1 ballot

The voting information once captured on the University of Louisville UNIX server named Athena, is then sent to the researcher's America Online account as shown above. The capture text document located on the UofL UNIX server:

```
to:sharonc1@aol.com
Subject: delphi panel experts
*****
[penname],[ready to learn],[need to know],[prior experiences],[mental
habits],[self
concept],[orientation],[collapsed],[motivation],[individual],[situational],[web
based]
```

Note in the figure below that the sender was the University of Louisville Athena server.

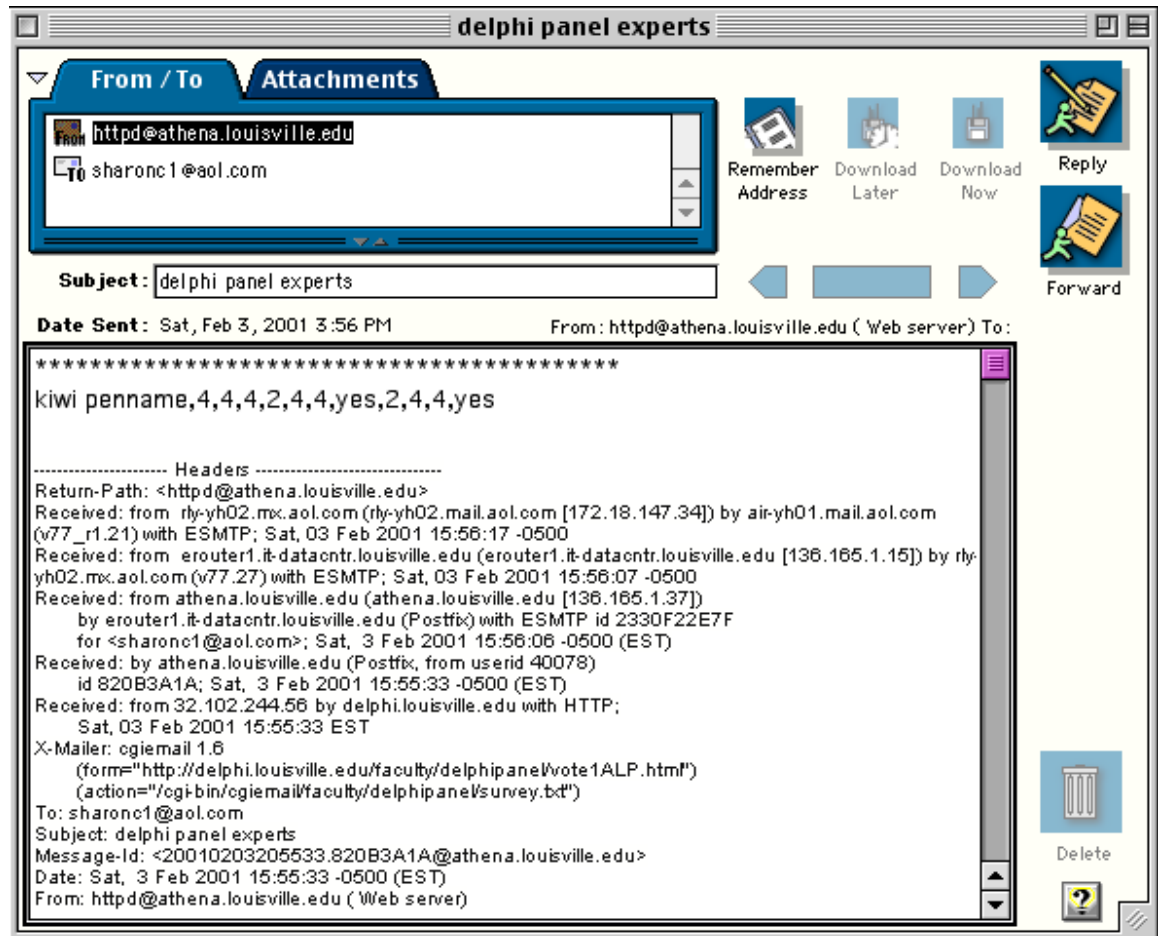


Figure 15. Example of a vote as received by e-mail

The vote is sent from the server at the University of Louisville to the researcher's America Online e-mail account.

The following descriptive statistics were then calculated for each item: mean, median, mode, standard deviation, skewness index, interquartile range, and rank to establish the degree of consensus. The items with the lowest means were candidates for elimination. An item with both a low mean and low variability (low standard deviation and low interquartile range) was definitely considered for elimination as on the average everyone says it should be eliminated and there is not much variability or disagreement about this judgment. In each case, comments from the expert panel members were taken into consideration in the decision to retain or to eliminate an item. The outcome of the vote was then posted to the Expert Panel Web site along with an updated instrument (draft #3).

Round two. The objective for round two was for the expert panel to create and comment on a list of instructional materials and correlate them (by sorting) to the list of adult learning principles from round one, then vote on the list. The vote ended the round. Dalkey (1975b) described the process of asking Delphi participants to list appropriate items (item pool) and categorize them. In the Delphi process, this is referred to as an item pool (Linstone & Turliff, 1975, Dalkey, 1975b, Carman, 1999, SeEVERS, 1993). He

suggests the facilitator start with a potential item pool to get the process started. In this study, however, no original list was presented because it was assumed the panel members, given their expertise and experience, could easily create their own list, which they did. (See Appendix D: Delphi discussion, comments, and correspondence for items generated by panel members. The draft instruments provide an edited list of instructional items generated by the expert panel members.) The researcher had the option to present the item pool derived from the literature, but did not find it necessary to do so because of the number and quality of instructional items generated by the expert panel members (see Appendix A for item pool examples from the literature).

E-mail was sent to the expert panel members to start the round and instructions (task #4) were posted to the Delphi website as was the latest draft instrument (draft #3). The second round e-mail directions are located in Appendix F: Instructions to expert panel members.

The second round website directions were:

Task #4: Identify instructional methods**Due: Thursday, 02/22/2001**

This next Delphi round is the "heart" of the research project and is critical to the development of the instrument. The process of identifying the measurables starts now. Please read the following instructions, then access the discussion forum (see link above) and you will find the familiar list of adult learning principles, edited as a result of the vote.

Your task is to list at least one instructional method under each adult learning principle section head which applies that principle to Web instruction or training. List as many as you believe apply and, yes, it is OK for now, to have duplicate instructional methods under different principles. Think of this as a brainstorming exercise. After a week, I'll post (and e-mail) an unsorted list of any additional instructional methods derived from the literature for your consideration. Your list for each ALP can be contained in one note (reply). Please complete this task during the next week. On February 21st, I will upload a document (and send e-mail to you) with any additional instructional methods, derived from the literature, for your consideration.

Once this task is completed there will be a vote as before. The vote at the end of this round will be used to include or exclude suggested instructional methods.

Although you may add any instructional methods in any format, I am suggesting the following format, unless there is panel consensus for me to use a different format:

A. Adults' orientation to learning is problem-centered, thus they are motivated to learn and are ready to learn to the extent that they perceive that learning will help them perform tasks or deal with problems that can relate to their life situations.

Although you may add any instructional methods in any format, I am suggesting the following format, unless there is panel consensus for me to use a different format:

A. Adults' orientation to learning is problem-centered, thus they are motivated to learn and are ready to learn to the extent that they perceive that learning will help them perform tasks or deal with problems that can relate to their life situations.

1. The course assignments are problem-based or task oriented rather than fact-gathering exercises.
2. The course and exercises are titled to reflect adult life situations.
3. etc.

If you have any questions about this important part of the project, please call or e-mail me. Thanks for your continued support in this project.

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Figure 16. Website directions for task 4

The directions are a step-by-step procedure for completing task 4.

Although there are numerous examples in the literature, the researcher stressed the importance of adding as many items as possible in this round. This was not yet the time for final item selection. It was the time for compiling and sorting the item pool. There may be duplicates under different adult learning principles (Jackson, 1998, Linstone & Turoff, 1975).

During the discussion process of round two, edits were made by the researcher to the list of instructional methods, based on new comments from the panel, resulting in instrument drafts #4 and #5.

The second objective of the second round was to vote on the instructional items and their application to or facilitation of adult learning principles in a Web-based course. Voting took place on the Web using a Web form and when complete, the form was sent by e-mail to the researcher as before. The purpose of this round was primarily to generate a large pool of instructional methods which apply adult learning principles to online learning, to sort those principles according to the adult learning principle to which each applies, and to vote on the result, setting the stage for further discussion and round three.

The draft instrument (draft #5), listing the first round adult learning principles and the sorted instructional methods listed in the second round, were displayed on the Web site. The expert panel members were sent an e-mail to inform them of the posting. They were asked to read and reflect upon the draft instrument and its components.

The screenshot shows a website header with the logo 'UofL Online Courses' on the left and 'Delphi Panel Research' on the right. Below the logo are navigation links: 'Welcome', 'Calendar', and 'Assignments'. On the right side, there are links for 'Home', 'Forum', 'Help', 'Previous', 'Next', and 'Return'. The main content area features a task announcement: 'Task #5: Continued discussion of the adult learning principles structure to the instrument' with a due date of 'Wednesday, 02/28/2001'. The text below the task states: 'A discussion forum thread has been created for additional comments on the question, Is the principle relevant to web-based course development, and, if so, is it worded correctly?' and provides instructions on how to interact with the instrument draft, including viewing attachments in PDF format.

Figure 17. Website directions for task 5

This set of directions is to aid in completing task 5.

The third directive to the panel concerns the second voting process (Dalkey, 1975, Turoff & Hiltz, 1995):

The e-mail directions for vote 2 can be found in Appendix F: Instructions to expert panel members. Figure 18 below shows the website directions for vote 2.

[Welcome](#)[Calendar](#)[Assignments](#)

Task #6: Vote on instructional methods (measurables)

Due: Wednesday, 12/05/2001

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This assignment is complete. The last assignment is #7.

This is the most important vote of the Delphi process. You will be voting on the instructional items that make up the measurables of the instrument. Although the voting ballot is available for you to use today, I am asking that you first review carefully the latest draft instrument (#5 - see attached below) and reflect on it. You may find that printing it out and using it as a preliminary ballot will be more efficient for you.

The ballot is long due to the numerous excellent suggestions for instructional methods. The ballot is divided into sections with each instructional item set up for voting on a Likert scale of 1 to 4 (as before). In addition, I have provided a space for your comments after each section. Your comments may include suggestions for combining any two or three instructional methods into one, splitting one multi-part instructional method into two, re-wording the instructional method, etc.

The ballot is long due to the numerous excellent suggestions for instructional methods. The ballot is divided into sections with each instructional item set up for voting on a Likert scale of 1 to 4 (as before). In addition, I have provided a space for your comments after each section. Your comments may include suggestions for combining any two or three instructional methods into one, splitting one multi-part instructional method into two, re-wording the instructional method, etc.

To summarize, your tasks are:

1. read and reflect on the latest draft instrument (#5).
2. vote on each instructional item (you are stating your opinion on the validity of the instructional method to apply a principle of adult learning to Web instruction).
3. If there are two or more similar instructional methods in one section and you agree that each applies but could be collapsed into one, vote yes for each, then suggest collapsing in the comments section.
4. add your comments for each section.
5. include your penname (important!)
6. Comments can be added to the ballot or send by e-mail.

If consensus is reached on every item, the Delphi procedure is concluded. Any instructional methods not consensed to will be brought back for one more vote only. Any instructional item not consensed to will be deleted from the instrument.

Again, my thanks to you for your participation.
Sharon

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Figure 18. Website directions for vote 2

It was important to be very clear and detailed about the directions and expectations for each vote.

The text of the ballot for vote 2 is in Appendix G: Ballots. The format was similar to vote 1.

The following is the Athena UNIX server capture text for vote 2:
to:sharonc@aol.com

Subject: delphi panel vote 2

A1:[A1],A2:[A2],A3:[A3],A4:[A4],A5:[A5],A6:[A6],A7:[A7],A8:[A8],A9:[A9],A10:[A10],A11:[A11],A12:[A12],A13:[A13],Comments A: [commentsA],

B1:[B1],B2:[B2],B3:[B3],B4:[B4],B5:[B5],B6:[B6],B7:[B7],B8:[B8],B9:[B9],B10:[B10],B11:[B11],Comments B: [commentsB],

C1:[C1],C2:[C2],C3:[C3],C4:[C4],C5:[C5],C6:[C6],C7:[C7],C8:[C8],C9:[C9],C10:[C10],C11:[C11],Comments C: [commentsC],

D1:[D1],D2:[D2],D3:[D3],D4:[D4],D5:[D5],D6:[D6],D7:[D7],D8:[D8],D9:[D9],D10:[D10], Comments D: [commentsD],

E1:[E1],E2:[E2],E3:[E3],E4:[E4],E5:[E5],E6:[E6],E7:[E7],E8:[E8],E9:[E9],E10:[E10], Comments E: [commentsE],

F1:[F1],F2:[F2],F3:[F3],F4:[F4],F5:[F5],F6:[F6],F7:[F7],F8:[F8],F9:[F9],F10:[F10],F11:[F11], Comments F: [commentsF],

G1:[G1],G2:[G2],G3:[G3],G4:[G4],G5:[G5],G6:[G6],G7:[G7],G8:[G8],G9:[G9],G10:[G10],G11:[G11],G12:[G12],G13:[G13],G14:[G14],G15:[G15],G16:[G16], Comments G: [commentsG]

[penname]

Some expert panel members were sent additional e-mail notes prompting them to vote on each instructional item in the draft instrument as follows:

Expert Panel Members:

Many panel members have completed task #6, which was to vote and comment on the draft instrument (see original instructions below). I appreciate your hard work because this task was very time consuming and tedious. It is probably the most important part of the instrument development process. Some went way beyond the call of duty to add extensive comments and I thank you for your extraordinary effort. We are nearing the end of the Delphi process so let us wrap this process up. Some panel members have task #6 to complete. When that is finished I will revise the instrument for the final vote (which will be short and straightforward).

For the panel members who have task #6 to complete and have maybe struggled with it, the most important part of task #6 has been the comments. There is no question that much revision needs to be done. I need responses from two more panel members in order to proceed with the final vote. Please set aside some time this week (one hour) to complete

this task and offer your expert comments on the validity of each part of the instrument.

After task #6 is complete, then when the final vote (task #7) is complete it will be the time for each panel member to identify him/herself to the other panel members. Anonymity will no longer be required.

A Web form was posted on the website with the draft instrument divided into adult learning principles with instructional applications listed as suggested and sorted by the expert panel. Upon completion of the ballot, the panel members clicked on the submit button to automatically e-mail the completed ballot to the researcher.

Consensus is assumed to be achieved when the votes fall into a cluster, however, results of bimodal or flattened distributions are also important and should be looked at carefully (Scheibe, Skutsch, & Schofer, 1975). Turoff (1975) noted that humans are good at ranking. Items for which consensus have not been achieved can be debated in the third round if necessary. The researcher then tabulated the results, calculated the mean, mode, median, rank, and standard deviation for each item and calculated the interquartile range and rank. Results were posted on the Expert Panel Web Site in the form of a revised draft instrument (draft #6).

Round three. The purpose of round three was to continue to define the instrument and to attempt to reach consensus on those items where consensus has not already been

reached, according to the statistical analysis performed on each item. Consensus is considered to be achieved if the interquartile range is no larger than one unit on a 4 or 5-unit scale (Wilhelm, 1999; Principia Cybernetica Web, 2000; Linstrom & Turoff, 1995). Because the comment sections on the ballot allowed participants to qualify their vote, edits were made to the draft instrument reflecting both the vote, the comments, and also outside correspondence. Because of the editing, and because many items had a mean above 3.0 but an interquartile range of 2 (weak consensus), expert panel members were asked to vote on every item in the revised draft instrument for this final vote (vote 3). A discussion thread continued to be available for any contested items. Descriptive analysis was conducted as before and all comments were taken into consideration. The instrument was again edited and any items still deemed to be contested were then eliminated from the instrument. The e-mail directions for vote 3 are located in Appendix F: Instructions to expert panel members. Web-site directions for the panel are shown in Figure 19 below.

Due: Friday, 12/21/2001

This is the last assignment.

This is the most important vote of the Delphi process. You will be submitting a final vote on the instructional items that make up the measurables of the instrument. Please review carefully the latest draft instrument (#6 - see attached below) and reflect on it. You may find that printing it out and using it as a preliminary ballot will be more efficient for you.

The ballot is somewhat shorter than before as much editing has been performed, thanks to the many helpful suggestions. The ballot is divided into sections with each instructional item set up for voting on a Likert scale of 1 to 4 (as before). In addition, I have again provided a space for your comments after each section. Your comments may include suggestions for combining any two or three instructional methods into one, splitting one multi-part instructional method into two, re-wording the instructional method, etc.

To summarize, your tasks are:

1. read and reflect on the latest draft instrument (#6).
2. vote on each instructional item (you are stating your opinion on the validity of the instructional method to apply a principle of adult learning to Web instruction).
3. If there are two or more similar instructional methods in one section and you agree that each applies but could be collapsed into one, vote yes for each, then suggest collapsing in the comments section.

Figure 19. Website directions for task 7, vote 3

The following is the Athena server capture text:

to:sharonc1@aol.com

Subject: delphi panel vote 3

A1:[A1.],A2:[A2.],A3:[A3.],A4:[A4.],A5:[A5.],A6:[A6.],A7:[A7.],A8:[A8.],A9:[A9.],A10:[A10.],A11:[A11.],Comments A: [Comments A],

B1:[B1.],B2:[B2.],B3:[B3.],B4:[B4.],B5:[B5.],B6:[B6.],B7:[B7.],B8:[B8.],B9:[B9.],B10:[B10.],B11:[B11.], B12:[B12.],Comments B: [Comments B],

C1:[C1.],C2:[C2.],C3:[C3.],C4:[C4.],C5:[C5.],C6:[C6.],C7:[C7.],C8:[C8.],C9:[C9.], Comments C: [Comments C],

D1:[D1.],D2:[D2.],D3:[D3.],D4:[D4.],D5:[D5.],D6:[D6.],D7:[D7.],D8:[D8.],D9:[D9.],D10:[D10.], Comments D: [Comments D],

E1:[E1.],E2:[E2.],E3:[E3.],E4:[E4.],E5:[E5.],E6:[E6.],E7:[E7.],E8:[E8.],E9:[E9.],E10:[E10.], Comments E: [Comments E],

F1:[F1.],F2:[F2.],F3:[F3.],F4:[F4.],F5:[F5.],F6:[F6.],F7:[F7.],F8:[F8.],F9:[F9.],F10:[F10.], Comments F: [Comments F],

G1:[G1.],G2:[G2.],G3:[G3.],G4:[G4.],G5:[G5.],G6:[G6.],G7:[G7.],G8:[G8.],G9:[G9.],G10:[G10.],G11:[G11.], Comments G: [Comments G]

[penname)

Panelists may change their previous votes at any time (Turoff & Hiltz, 1995). If consensus is not achieved on an item, that item may be dismissed for the present, subject to a later revision. Brockhoff (1975) states that variance reduction, or consensus, almost always occurs in Delphi groups between the first and fifth rounds but the best results, as a rule, are already known by the third round. Thus, any additional discussion may not be necessary.

Among the disadvantages of the Delphi technique are the large amounts of time required to conduct several rounds, the complexity of data analysis, the difficulty in maintaining participant enthusiasm throughout the process, and the problem of keeping statements value free and clearly defined (Webber, 1995).

In order to address the time commitment and motivation issues, the researcher maintained a calendar and worked with the expert panel to proceed through the Delphi process, adjusting to their time limitations, to provide feedback on progress, and to keep the panel on track. Clearly, the primary, or only, incentive for panel members was to participate in the authorship of the instrument, which, in itself, became a substantial incentive for most of the panel members.

Development of instrument items

The Online Adult Learning Inventory was intended to benefit Web course developers in constructing an instructional or training course for an adult audience. The instrument can also be used as an evaluative tool for educators and researchers.

Rating scales are used to measure the effectiveness or application of numerous theories, products and services (Spector, 1992). According to Aiken (1996, pp. 12-13), checklists, otherwise known as dichotomous rating scales or single score inventories, can be more cost-effective, more efficient, and more reliable than multiple score rating scales. Checklists record the presence or absence of a characteristic. This research plan used a checklist system of evaluation. Examples from the literature of binary rating scales are the Minnesota Multiphasic Personality Inventory (MMPI), the California Personality Inventory, and the Millon Clinical Multiaxial Inventory (MCM) (Orey, 1995), Secondary Reading program Inventory (SRPI) (Cooter, 1983) and an Evaluative Instrument for Academic Library World Wide Web Sites (Stover, 1997).

An inventory is a checklist or rating scale consisting of numerous questions or statements, in this case concerning instructional methods for Web courses, pertaining to characteristics of the topic in question, which is various adult learning principles. The questions can be answered with a rating scale or by “yes – no” as used for this checklist or “true – false.” In some inventories, a “don’t know” is included, but was not included in this checklist. If not included, the survey respondent may leave some questions blank or unanswered (Jackson, 1998; Linstone & Turoff, 1975). The researcher did not include the “don’t know” choice because there is no overall score computed for this inventory, and as its purpose is for the development and evaluation of Web-based instruction, raters may choose to leave some questions blank if necessary. The key to the inventory is marking the presence of an instructional item. This study used the checklist format for the Online Adult Learning Inventory instead of a Likert scale. Checklists record the presence or absence of a characteristic. Rating scales are used to measure the effectiveness or application of numerous theories, products and services (Spector, 1992). According to Aiken (1996, pp. 12-13), checklists, otherwise known as dichotomous rating scales or single score inventories, can be more cost-effective, more efficient, and more reliable than multiple score rating scales.

Burisch (1984a) lists three major strategies in constructing inventories or rating scales – deductive, inductive, and external. The deductive strategy, of interest for this dissertation, is content-based and construction may be made by a researcher working alone from the theoretical literature or by a group of experts with the ultimate purpose of measuring the construct under consideration. This instrument was constructed using the deductive strategy. Most rating scales are constructed with the deductive approach and they are more economical to construct (Aiken, 1996).

At all stages of the measurement process, sensitivity was maintained toward cultural and gender bias (University of Arizona, 2000).

Validity of the instrument

A content validation study assesses whether the instrument items represent the construct of interest (Crocker & Algina, 1986). “The validity of an account is relative to the standards of a particular community at a particular place and time. The validity of an account by interpretation is judged in terms of the consensus about words, concepts, standards, and so on in a given community of interpreters” (Schwandt, p. 169). Content

validity relies on human judgment and this judgment emanates from experts in the field or from relevant literature (Aiken, 1996, p.90). Content validity was established through both methods. Items were first grounded in the literature using established filters for quality. Then the Delphi panel discussion and vote confirmed the content validity of the adult learning construct and of each item in the item pool and made changes or additions as necessary. Dissertations and other studies following this model of content validity include DeLap (1998), Wishart (1981), Stover (1997), Dobbins (1999), Wilhelm (1999), Chao & Dugger (1996), Jackson (1998), Ryan, Carlton, & Ali (1999).

Field test for reliability of the instrument

After completion of the Delphi process and an agreed-upon instrument was drafted, a field test was conducted to give an indication of the reliability of the instrument. Reliability for an instrument indicates that it is relatively free from random errors of measurement. The reliability coefficient ranges from .00 to 1.0. According to Aiken (1996), indicators of reliability range from .65 for grouped ratings to .85 for individual item ratings. Approval of a second survey study (University Human Studies Committees, 2001) was completed prior to the initiation of the field test.

An invitation was sent to all online course developers or course evaluators at a California community college to participate in a field test and tutorial on the principles of adult learning. Fourteen of the faculty members agreed to participate and signed letters of informed consent. They were recruited to use the draft instrument to evaluate a specified instructional Web site, an introductory course at Monterey Peninsula College titled, PERS 51, Career Planning Throughout the Lifespan (3 credit units). The course, located on a WebCT server, was full-featured and intended for a first-year college student enrolled in general education or a technical or vocational program of study. Permission was obtained from the course developer to use the Web course for the field test.

An indication of the reliability of the instrument was determined using interrater reliability, a standard type of reliability evidence for binary checklists (Aiken, 1996, pp. 81). "Two or more observers independently evaluating the same Web site using the same checklist should come up with similar scores." (Streiner, 1996, p.81). The single measure intraclass correlation and the average measure intraclass correlation measures were used as an indication of interrater reliability (Guilford & Fruchter, 1978). The single measure intraclass correlation is simple the average of the intercorrelations of the raters. The average measure intraclass correlation is essentially the same as the Cronbach alpha internal consistency reliability coefficient. The expected range is from zero to 1.0. According to Streiner, intraclass correlation coefficient is preferable to other reliability measures such as the Pearson correlation coefficient as it gives a more accurate estimate with bias present (1993, p.144).

The process for the field test was as follows:

Table 2
Field test procedures

Facilitator	Participant	Statistics
Letters were sent to invite participants.	Participants sent RSVP. Participants signed consent form.	
Participants gathered in a computer lab; the researcher gave an overview of adult learning principles (1-hour)	Participated in discussion of adult learning principles.	
The web address for one instructional Web site, chosen by the researcher for its availability and for being representative of college Web-based courses was given to the group; copies of the draft instrument were handed out; participants were asked to review the site and fill out the instrument; comments could be added (1 hour).	Participants reviewed the instructional Web site and completed the instrument questionnaire, and added any comments.	A list of comments was compiled for commonalties used as revisions for specific wording of the instrument. Single measure intraclass correlation and average measure intraclass correlation were computed for each section of the instrument. Comments and correlation statistics were used to revise the instrument.

Table 2. (continued)

A recorder wrote down comments from the participants. (The first part of the proceedings, overview, was videotaped in order to have a record of the process for future reference and to assure consistency of the overview process for future field tests.)	Participants were free to comment during the proceedings but not collaborate on marking the instrument.	A list of comments was compiled for commonalties used as revisions for specific wording of the instrument.
The researcher asked for additional comments after completion of the instrument.	Final comments were given.	List of comments was compiled for commonalties used as revisions for specific wording of the instrument.
A follow up with a thank you note completed the field test.		

The participants were given the following instructions:

Review the Web course carefully in light of the instrument before you. For each item, the default answer is NO, unless you find evidence of the item being present to your satisfaction, then answer YES. You may not collaborate with anyone else on marking your answer. Please do not leave any blanks. The purpose of the field test is to determine an indication of reliability of the instrument. What this means is that the researcher will look at how each of you rated an item – yes or no – to see how many of you rated an item the same way. In a perfect world all of you would rate each item the same as everyone else.

The researcher demonstrated the navigation system of the course. The faculty group then proceeded to rate the course in relation to the instrument. Some participants continued to encounter difficulty in navigating parts of the course and asked questions that were answered for the benefit of the group as a whole.

Upon completion of the statistical analysis and review of comments of the field test, the instrument was revised. An indication of reliability was assigned.

This research study was exploratory in nature and designed for two reasons: (a) to incorporate the theoretical foundations of distance education, instructional design, and adult learning into an instrument to apply adult learning principles to fully-mediated World Wide Web instruction or training, using an expert panel for content validity; and, (b) to explore the use of the World Wide Web in facilitating a Delphi research study with experts, anonymous to each other. This study developed a validated instrument that will help educators, researchers and instructional designers evaluate and apply the use of adult learning principles to fully-mediated World Wide Web-based distance education courses and training.

Delphi research process

Although the Delphi research method was used to construct and validate the content of the instrument, the method as developed and used in the present study is worthy of discussion. The Delphi research method is a procedure for structuring a communication process among a group of experts to effectively deal with a complex question or problem, or reach consensus on a body of knowledge (Linstone & Turoff 1975). In reflecting on the Web-based Delphi method as used in this study, it provided the venue and structure for a rich and deep discussion by the expert panel members and provided the means through voting to reach consensus. Many dissertations in the past used the Delphi method (DeLap, 1998, Cooter, 1983, Carman, 1999, Miller, 1995, Jones, 1997, Friebel, 1999) but none were identified that used a Web-based Delphi.

For this Web-based Delphi study, the researcher developed a Web site with a threaded discussion forum, a calendar for task assignments, Web forms for voting, and an archive for previous discussions, results of votes, and various versions of the draft instrument in PDF format. Scheele (1975, p 44) described the final product resulting from a Delphi as a “reality construct for the group” and the final product for this study, the Online Adult Learning Inventory, encompasses the expertise and collaboration of this group of experts.

How can Web-based Delphi processes be used to answer difficult questions, compile a body of knowledge from experts, or solve a problem? (4) Because of its more qualitative online discussion environment, does the Web-based Delphi procedure result in stronger validation of content than the traditional paper-based Delphis?

Research methods for validity included (a) a thorough review of the literature to construct an item pool of instructional methods and (b) Delphi expert panel consensus. The mean, mode, standard deviation, interquartile range, and skewness of the data were calculated from the voting procedures for determination of consensus. Evidence of reliability was indicated by the interrater reliability coefficient from a field test. In addition, an informal review of readability was conducted to improve the readability of the instrument and the Gunning Fog Index (1983) for readability was calculated.

