# A Qualitative Assessment of Systematic Instructional Design Training by CLS Faculty Members

VICKI FREEMAN, CAROL LARSON, J DAVID HOLCOMB

**OBJECTIVE:** To determine the perceived value clinical laboratory science (CLS) faculty members gave to their participation in workshops on the use of a modified systematic instruction design (SID) model to develop curriculum and on-line courses.

**DESIGN:** A survey assessing the perceived value of SID training was sent to 27 CLS faculty members. The survey asked the respondents to assess the value of the training that they received in developing their skills in Web-based, distance learning course development and teaching, and expanding their skills in traditional course development and teaching. The eight components of SID were listed and the respondents rated each component as to its value to them on a 5-point Likert scale of 5 = very valuable to 1 = not very valuable. In addition to rating the value of each SID component, the respondents were asked if they would like more training in any of the eight components.

**RESULTS:** A majority of the18 respondents (67%) reported that the training in SID was valuable to them. A strong majority of the respondents indicated that their training in goal and instructional analyses (96%), media selection (94%), and aligning objectives, assessments, and instructional strategies (94%) were valuable to their distance education programs and their traditional teaching skills.

**CONCLUSION:** Faculty members who actively participated in SID training valued their new skills in developing distance education courses as well as improving their traditional teaching activities. Research is needed on the effect these new teaching skills have on student learning.

*The peer-reviewed Research and Reports Section seeks to publish reports of original research related to the clinical laboratory or one or more subspecialties, as well as information on important clinical laboratory-related topics such as technological, clinical, and experimental advances and innovations. Literature reviews are also included. Direct all inquiries to David G Fowler PhD CLS(NCA), Clin Lab Sci Research and Reports Editor, Dept of Clinical Laboratory Sciences, University of Mississippi Medical Center, 2500 North State St, Jackson MS 39216. (601) 984-6309, (601) 815-1717 (fax). dfowler@shrp.umsmed.edu*

**ABBREVIATIONS:** CETs = content expert teams; CLS = clinical laboratory science; SID = systematic instructional design; WBE = Web-based education; WebCLS = Web-based education in clinical laboratory science.

**INDEX TERMS:** clinical laboratory sciences; faculty development; systematic instructional design; Web education.

**Clin Lab Sci 2005;18(4):248**

*Vicki S Freeman PhD CLS(NCA) is Professor and Department Chair, Department of Clinical Laboratory Sciences, University of Texas Medical Branch, Galveston TX.*

*Carol Larson MSEd CLS(NCA) is an Assistant Professor, Division of Clinical Laboratory Science/Medical Technology, University of Nebraska Medical Center, Kearney NE.*

*J David Holcomb EdD is Associate Dean, Allied Health Programs, Director, School of Allied Health Sciences. Baylor College of Medicine, Houston TX.*

***Address for correspondence:** Vicki S Freeman PhD CLS(NCA), Professor and Department Chair, Department of Clinical Laboratory Sciences, School of Allied Health Sciences, University of Texas Medical Branch, Galveston TX 77555-1140. (409) 772-3056, (409) 772-9470 (fax). vfreeman@utmb.edu*

Web-based education (WBE) is a form of distributed learning in which the WWW, Internet, and intranets are used as the vehicle for delivering the training to learners anywhere and at any time. WBE is transforming the delivery of education at all levels, from kindergarten through post-graduate education. It allows educators to bring learning to students instead of bringing students to learning. By defying the constraints of time and distance, WBE education makes it possible for more individuals than ever to access knowledge, to learn in new and different ways, and to embrace lifelong learning. However, when reviewing the current proliferation of Web-based courses, one finds that they either mimic traditional correspondence mail models or simply make traditional lecture based materials available on-line.

According to Mishara, most Web-courses are "nothing more than classroom lecture materials posted on to the Web".[1] Carr-Chellman and Duchastel state that "many on-line courses lack basic design considerations and that the Web is simply being used as a medium for the delivery of instruction created within another framework".[2] As a result, while educational opportunities are increasing for students, the quality of the educational experience is not necessarily increasing. This medium is capable of supporting a wide range of multimedia technologies, making it an ideal environment for learning. Web-based instruction can make use of hyperlinking, synchronous and asynchronous conferencing and interactions, real-time audio and video, and even 3-D virtual reality that are generally not possible with traditional computer or classroom delivery alone. Other advantages of WBE include: accessibility (platform-independent and to world-wide audience); relatively low development and distribution costs; ability to link to other programs and resources; interactivity possibilities; ability to restrict use, if desired; and ability to provide just-in-time learning 'on-location'.[3] The availability of e-mail, on-line discussion boards and chats increases the ease of interaction between classroom participants.[4] However, the instructional materials to be used in this type of medium must be designed with these characteristics in mind in order to construct quality course modules.

Delivery of education via the Web can enable educators to center learning on the student instead of the classroom and to focus on the strengths and needs of the individual learner. However, according to the Web-based Education Commission (WBEC), "The power of the Internet to transform the educational experience is awe-inspiring, but it is also fraught with risk".[5] The Commission found that teachers were the key to the effective use of Web-based tools and applications. However, almost two-thirds of all teachers felt they were either not at all prepared or only somewhat prepared to use technology in their teaching.[6] In 1999, 70% of educators polled regarding technology in instruction put professional development at the top of their list of technology challenges.[4] Respondents reported that both initial training for those just beginning to use technology and on-going training to support the growth of innovators were needed. Five consecutive years of surveys in higher education showed the same thing: institutions ranked their greatest technological challenge as "assisting faculty to integrate information technology into instruction".[7] WBEC's Report included the need to provide continuous and relevant training and support for educators and to develop high quality online educational content that meets the highest standards of educational excellence.[4]
During traditional classes, a good educator can often make up for poorly designed instructional materials by facilitating or adding unplanned interactions that were not designed as part of the original teaching materials. When the teacher is removed from the immediate classroom, it becomes essential that key online interactions are designed and planned. According to Hirumi, in WBE, "opportunities to interact and adapt instruction based on spontaneous verbal and non-verbal cues are relatively limited. Furthermore, the use of interactive technologies does not ensure that interactions will take place. Key interactions must be planned and sequenced if they are to occur consistently as an integral part of WBE".[8]

Ely stated that "there is growing evidence that the use of instructional design procedures and processes leads to improved learning without regard to the hardware and software that is used".[9] He believes that the design of instruction is "a more powerful influence on learning than the system that delivers the instruction". What is instructional design? According to Wilson, "instructional design involves the preparation, design, and production of learning materials".[10] The instructional design process includes establishing learning goals and objectives, the methods to assess the learning outcomes and the content, learning interactions, and student activities to help the student progress in attaining the goals and objectives. The purposes of SID are to improve learning and instruction through a variety of means including problem-solving and feedback, management of the design and development, improving evaluation processes and testing and/or building learning by instructional theory.[11]

In 1999, the Department of Clinical Laboratory Sciences at The University of Texas Medical Branch received a grant from the Department of Education to pursue the development of a Web-based curriculum. The project, titled Web-based Education in Clinical Laboratory Sciences (WebCLS), was carried out over a three-year period. The goal of the project was to develop, implement, and evaluate an interactive Web-based curriculum model for baccalaureate-level clinical laboratory science (CLS) education. This model was to include Web-based course materials, on-line interactive course laboratories using video and animation, interactive discussion and chat sessions, on-line testing and evaluation, comprehensive on-line review materials, and a pilot demonstration of a virtual practice laboratory. Ten collaborating institutional partners supported the development and dissemination of this interactive model for laboratory oriented Web-based educational instruction including CLS and CLT faculty members from four universities and three community colleges, faculty and graduate students from an instructional technology graduate program, and representatives from the Southern Regional Education Board (SREB), and from the National Laboratory Training Network (NLTN).

Faculty members from collaborating institutions participated in a series of training sessions designed to guide them in the design and development of interactive, student-centered courses. With this training, faculty members were empowered to develop and maintain their course Web sites.

This paper presents information on 1) how the SID process was used to prepare CLS faculty members to develop Web-based, distance education; and 2) the perceived value CLS faculty members gave to their participation in the training activities. Lastly, recommendations for further research and development in designing distance education are made.

## METHODS

This project used a modified version of Dick and Carey's instructional systems design model.[12,13] The Systematic Instructional Design Model, promoted by Dick and Cary involves a systems approach that focuses on what the learner is expected to be able to do at the completion of instruction.[1] This approach connects the instructional strategy to the desired learning outcomes and provides linkages between each component in the model. The nine components of the Dick and Carey Model include: 1) goal identification, 2) instructional analysis, 3) learner and context analysis, 4) definition of objectives, 5) assessment instrument, 6) instructional strategy, 7) materials development, 8) formative evaluation, and 9) summative evaluation of instruction. By following this model in the development of the WebCLS course models, the teams were able to follow a consistent, development process.

### Stage I: Analysis phase

Content expert teams (CETs) consisting of faculty members in the disciplines of clinical microbiology, clinical immunology, clinical chemistry, and clinical hematology respectively, worked together during the analysis phase of each course. Each team focused on their specific area of expertise and developed different courses. It was critical that discipline-specific faculty agreed on what content must be taught and how the course would be organized.

### Stage 2: Design phase

At this point, the CETs divided their assigned course into modules in order to expedite the completion of courses. CET subgroups selected an appropriate instructional strategy to use and developed the actual content for a specific course module. As the module was being designed and developed, it was reviewed by the discipline specific CET and a consensus was obtained.

### Stage 3: Development phase

During the development phase, the faculty subgroups worked with a development team to program the modules. A preliminary set of storyboards and flowcharts were created based on the instructional strategies operationalized during the design phase. A series of rapid prototypes were then created and tested to facilitate the development process using formative and usability testing techniques. Once an effective and efficient module had been completed, templates were generated to facilitate the development of the remaining modules. The prototypes were reviewed periodically by the CETs to ensure consensus with the content and tasks being presented. The prototypes were then programmed into actual on-line modules by the development team.

### Stage 4: Implementation phase

Upon completion of the development of the course module, the module was pilot-tested by CLS and CLT students and laboratory practitioners. Modifications were made based on feedback from the pilot testing.

### Faculty training

To prepare CLS faculty members for this extensive curriculum development effort, six training workshops were provided to give guidance in each phase's activities. The workshops were conducted by a SID expert. A faculty Website was established to support faculty participants between workshops. In addition, numerous teleconferences and small group meetings for module and project development were held over the course of the project.

### Project evaluation

At the end of the three-year project period, data were collected from the workshop participants regarding their perceptions of the value of the SID process in developing their skills in Web-based, distance learning course development and teaching, and their skills in traditional course development and teaching.

A survey was developed in which the eight components of SID were listed and the respondents rated each component as to its value to them on a five-point Likert scale of 5 = very valuable to 1 = not very valuable. In addition to rating the value of each component of SID, the respondents were asked if they would like more training in any of the eight components.

The survey was sent via e-mail to 27 CLS faculty members who had participated in the training activities consistently over the entire period of the project. After three requests for responses, 24 participants completed the survey for an overall 89% response rate. Of the 24 respondents, 14 (58%) had participated in each of the SID workshops. An additional four respondents attended four of the six workshops. The responses of these 18 respondents (75%) were reported in this paper.

## RESULTS

A majority of the respondents reported that all of the SID training components were valuable to them (Table 1). A strong majority of the respondents indicated that training in goal and instructional analyses (96%), media selection (94%), and aligning objectives, assessments, and instructional strategies (94%) were valuable to their distance education development and teaching skills.

In regard to the perceived value of the SID training to the participants' traditional course development and teaching skills, the percentages of respondents who indicated that the training was valuable were somewhat lower when compared to the value the respondents gave the training for distance education, but overall they were mostly positive. However, only 44% felt that the training they received in flowcharting, storyboarding, and rapid prototyping was valuable in improving their traditional course development skills. Specific training areas that faculty members found of value for traditional CLS teaching included the "flowcharting of instructional analysis to include all aspects of objective preparations and organization of order of subject matter presented to create flow of learning and reviewing" and the "study of teaching strategies to ensure presentation of material in a systematic strategy to ensure coverage of material and reinforcement and assessment (are) relate(d)."

Fewer respondents reported that training in flowcharting, storyboarding, and rapid prototyping was valuable in developing their distance education or traditional course development and teaching skills. However, a majority did indicate that they wanted more training in this area (Table 2). A majority of the respondents also indicated that they would like more training in alternative instructional strategies, media selection, and aligning objectives, assessments, and instructional strategies.



**Table 1.** Perceived value of SID training in developing respondents' distance education and traditional teaching skills

| | Distance Education Skills | | | | Traditional Teaching Skills | | | |
|---|---|---|---|---|---|---|---|---|
| **Training Component** | **Respondents*** | **% Valuable†** | **Mean‡** | **S.D.** | **Respondents** | **% Valuable** | **Mean** | **S.D.** |
| Goal and instructional analyses | 18 | 96 | 4.11 | .82 | 17 | 84 | 4.12 | .46 |
| Context and learner analyses | 17 | 83 | 3.94 | .56 | 17 | 76 | 3.94 | .66 |
| Generating, clustering, and sequencing objectives | 14 | 79 | 4.14 | .77 | 16 | 94 | 4.06 | .44 |
| Alternative assessment methods, e.g., checklists/ portfolios | 15 | 73 | 3.93 | .70 | 16 | 81 | 4.66 | .68 |
| Alternative instructional strategies and grounded events | 15 | 80 | 4.00 | .85 | 16 | 81 | 3.86 | .72 |
| Media selection | 15 | 94 | 4.20 | .56 | 15 | 87 | 4.07 | .59 |
| Aligning objectives, assessments and instructional strategies | 16 | 94 | 4.38 | .62 | 17 | 94 | 4.24 | .85 |
| Flowcharting, storyboarding, and rapid prototyping | 16 | 63 | 3.88 | .81 | 16 | 44 | 3.19 | .83 |

* Includes only those respondents who attended the training sessions (range of 14-18 respondents per component)

† Represents the combined percentages of respondents who indicated that the training component was very valuable or valuable to their course and teaching skills development.

‡ Represents the mean response to each training component on a 5 point scale where 5 = very valuable; 4 = valuable; 3 = uncertain; 2 = not valuable; and 1 = not very valuable.

Fifteen respondents (62%) reported that their participation in the WebCLS training activities improved their on campus (traditional) course development and teaching activities. Collectively, they reported that the training in SID helped them to: 1) move toward student-centered activities that included higher-level learning objectives; 2) organize their content to flow from learning objectives to teaching strategies to techniques to assess students' knowledge and skills; and 3) expand their teaching strategies to include both traditional lectures and Web-based instructional activities concurrently.

**DISCUSSION**

This project addressed the WBEC's report on the need for continuous and relevant training and support for faculty when developing Web-based course materials.[4] The SID sessions allowed the faculty to gain insight into good educational practices regarding Web-based education. Additionally, these sessions on instructional design gave faculty the tools to develop quality instructional units. The benefits to participating in the project included a systematic evaluation of the entire CLS curriculum and an opportunity to compare goals and objectives with other partners. The workshops also increased the Web-based development skills of the faculty and enhanced the quality of existing on-campus courses.

Participant comments indicated that they found that their courses were better aligned with the learning objectives and the anticipated outcomes, that the course organization improved with the use of flow-charting, and that they found alternative methods of delivering course material. One faculty member even found that sharing the systematic process with the students increased their learning of specific concepts.

Additionally, the participants found that they had increased the amount of student interactions, changing their teaching strategy from a lecture format to a more interactive format. Several faculty members indicated that they found ways to involve the students more in the learning process through on-line discussions and student centered learning activities. This outcome corresponds with Hirumi's hypothesis that key interactions must be planned for them to occur consistently throughout online learning.[10]

**Table 2.** Respondents' desire for more training in SID by training component (n=16)

| Training Component | Yes responses | % of Total |
|---|---|---|
| Goal and instructional analyses | 4 | 25 |
| Context and learner analyses | 5 | 31 |
| Generating, clustering, and sequencing objectives | 7 | 44 |
| Alternative assessment methods, e.g., checklists and portfolio assessments | 8 | 50 |
| Alternative instructional strategies and grounded events | 11 | 69 |
| Media selection | 11 | 69 |
| Aligning objectives, assessments and instructional strategies | 10 | 63 |
| Flowcharting, storyboarding, and rapid prototyping | 13 | 81 |

**CONCLUSIONS**

The data from the survey of CLS faculty must be considered qualitative and preliminary. Furthermore, there are limitations that must be considered: 1) the number of respondents to the survey was small and may not represent CLS faculty, generally; 2) as with most self-administered surveys, the chance of misinterpretation of survey items or inflation or deflation of perceptions is possible; and 3) the respondents were CLS faculty members who volunteered to participate, so they may have had some previous experience in or bias toward Web-based course development.

A strong majority of the faculty members who actively participated in the SID training valued their new skills in developing distance education courses, and improving their traditional teaching activities. Several respondents reported that they would like to have more training in specific components of the SID System. Additionally, the skills learned during the development of course materials in the WebCLS project were used by faculty members to improve their on-campus courses as well as with their Web-based courses. Based on these findings, further study using larger samples of CLS faculty members is recommended. Also, further study is warranted on the effect on student learning that could be attributed to the use of SID.

This project was funded, in part, by a grant from the United States Department of Education, Fund for the Improvement of Post-Secondary Education (FIPSE).

## REFERENCES


1. Dick W, Carey L, Carey J. The systematic design of instruction. 5th Ed. New York: Longman: Addison-Wesley Educational Publishers; 2001.
2. Mishra S. A design framework for online learning environments. Br J Educ Tech 2002;33(4):493-6.
3. Filipczak B. 1996. Training on intranets: the hope and the hype. Training 33 (9):24-32.
4. Kearsly G, Schneiderman B. Engagement theory: a framework for technology-based teaching and learning. Educ Tech 1996;38(5):20-3.
5. The Web-based Commission. The power of the Internet for learning: moving from promise to practice. August 25, 2000. http://interact.hpcnet.org/webcommission/doc.htm. Accessed August 6, 2005.
6. United States Department of Education, National Center for Education Statistics. Fast Response Survey System, Public School Teachers Use of Computers and the Internet, FRSS 70, Washington DC; 1999.
7. Green KC. 2001 October. Campus Computing Project. The 2001 National Survey of Information Technology in US Higher Education. http://www.campuscomputing.net. Accessed August 5, 2005.
8. Hirumi A. 2002 Summer. A framework for analyzing, designing, and sequencing planned elearning interactions. Quarterly Review of Distance Education 3(2):141-61.
9. Ely D. Toward a philosophy of instructional technology. Br J Educ Tech 1999;30(4):305-10.
10. Wilson BC. Adoption of learning technologies; toward new frameworks understanding the link between design and use. Educ Tech 1999;39(1):12-6.
11. Andrews DH, Goodson LA. A comparative analysis of models of instructional design. J Instructional Dev 1980;3(4):2-16.
12. Dick W, Carey L. The systematic design of instruction. New York: Harper Collins;1996.
13. Hirumi A. Training faculty in the systematic design of interactive distance education: a case study. Concurrent session held at the annual Association for Educational Communication and Technology conference. 1997 February; Albuquerque NM.