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LIS Student Learning Styles and Online Instruction Methods

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ABSTRACT: This article looks at learning styles of library and information science (LIS) students. Felder and Solomon's Index of Learning Styles was administered to 108 LIS students between 2001 and 2002. These results were analyzed with respect to results from learning style assessments administered in the 1980s. Learning style preferences were compared between students in traditional and distance education courses. Teaching suggestions are offered for maximizing LIS student learning in Web-based instruction.

KEYWORDS: LIS education, learning styles, distance education

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INTRODUCTION

Library and information science (LIS) programs educate students for future roles as librarians, corporate information specialists, and Web developers. LIS education has adopted the dual role of providing theoretical education, as well as practical training, and thus, attracts students with a variety of learning styles. With four or more years of college education already behind them, LIS students have learned to adapt their learning styles to various teaching styles. In general, however, LIS students have both stronger and weaker learning areas. While much research involving the learning styles of LIS students was published in the 1980s, relatively little has been done more recently. Since the 1980s, as a result of libraries' widespread adoption of computers and other technology, the field has changed dramatically. LIS education itself has changed, with the adoption of technology-mediated education (especially Web-based education).

This article looks at learning styles for current LIS students (2001-2002) and compares them, insofar as is possible, to previously documented learning styles. To do this, students from seven LIS classes were asked to complete an online questionnaire about their learning preferences. This article describes the results and addresses two research questions. First, have LIS student learning styles changed since the original assessments in the 1980s? Second, do learning styles differ between students taking Web-based classes and those taking face-to-face classes? The conclusion reviews teaching methods that are recommended to meet the needs of graduate students in LIS, particularly those involved in Web-based education.

LITERATURE REVIEW

Librarians' and LIS students' learning, thinking, and cognitive styles have been studied in some depth in the past. Considerable study was undertaken in the 1980s. Less study has been

done in the new, technology-saturated era of the 1990s and 2000s. Ironically, during the same time period, at the university level, there has been an increasing focus on classroom accountability, student engagement in learning, and effective teaching. This new focus on teaching has been coupled with an increasing trend toward distance learning as a model for LIS education. However, distance learning methods limit the way students can interact with the instructor and each other. There is a particular imperative for LIS instructors to know how their students learn and to give those students a quality education.

Results from several versions of learning, thinking, or cognitive style inventories have been reported in LIS literature. This review summarizes three reports using Hill's Cognitive Styles Inventory (CSI) in 1980, 1981, and 1983; three reports using Kolb's Learning Styles Inventory (LSI) in 1984, 1989, and 2004; three reports using the Myers-Briggs Type Indicator (MBTI) in 1984, 1994, and 2002; and results of other inventories reported in 1981, 1985, 1999, and 2002.

HILL'S COGNITIVE STYLES INVENTORY (CSI)

In an article published in the *Journal of Education for Librarianship* in 1980, Susan and Cecil McIntire suggested using the CSI to counsel people into or out of school library media (SLM) studies. The authors tested ten students in school librarianship, and mapped their cognitive styles against the map of the ideal SLM specialist. Their results suggested that SLM students had a strong values orientation, considerable self-knowledge, appreciation for beauty, and sensitivity to the needs of others. The results also suggested that SLM students found meaning from seeing words, found meaning by noting similarities in objects, exercised independent decision-making, and were equally able to use categorical reasoning, one-to-one contrasts, and synthesis.[1]

Using the CSI in a study published in the *Journal of Education for Librarianship* in 1981, David Jonassen and Gerald Hodges assessed 61 graduate library students enrolled at the University of North Carolina, Greensboro.[2] While McIntire and McIntire had limited their sample to SLMS students, Jonassen and Hodges tested students in a required foundations-level course. Students indicated strong enjoyment of beauty, the ability to perceive meaning through tactile experience, were strongly influenced by ethical codes and by time expectations, preferred to receive meaning from seeing words, had considerable self-knowledge, and had sensitivity to others' feelings. In 1983, Barbara Stein and Herman Totten replicated Jonassen and Hodges' study, using 70 library school students enrolled at the North Texas State University (now the University of North Texas).[3] Their results were very similar. Their students also indicated a strong orientation toward tactile learning, appreciation of beauty, self-knowledge, learning by seeing words, values orientation, and time orientation.

MYERS-BRIGGS TYPE INDICATOR (MBTI)

MBTI indicates ways that an individual prefers to interact with the environment, by measuring that individual on four scales. The first scale, Extraversion-Introversion, indicates whether the person gets energy from interaction in the outer world or reflection in an inner world. The Sensing-Intuition scale measures how information is perceived, through the senses or through unconscious reflection. The Thinking-Feeling scale indicates how decisions are made, whether by considered analysis or by subjective values. The last scale, Judging-Perceiving, indicates how an individual relates to the outer world, through structure and organization or through flexibility and spontaneity.

Julia Rholes and Judith Droessler administered a mail-back version of the Myers-Briggs Type Indicator (MBTI) to 114 academic reference librarians in 1983, and at the National Online Meeting in 1984, they reported their findings.[4] They found that the most frequent type combination for librarians was INTJ (Introvert-iNtuition-Thinking-Judging). In 1992, Mary Jane Scherdin and Anne Beaubien administered the MBTI to 1,600 librarians selected from the American Library Association and Special Library Association membership lists.[5] The scales on which librarians were more heavily represented were Introversion (63 percent), Intuition (59 percent), Thinking (61 percent), and Judging (66 percent). Female respondents were slightly more likely than males to rank on the Feeling scale.[6] In a 2002 issue of *School Libraries Worldwide*, Anne Russell reported MBTI results for 70 Australian teacher-librarian students.[7] Of those students, 66 percent were Introverted, 61 percent were Sensing, 71 percent were Feeling, and 77 percent were Judging.

KOLB'S LEARNING STYLES INVENTORY (LSI)

LSI categorizes respondents based on their preference for active experimentation versus reflective observation and their preference for concrete experience versus abstract conceptualization. Jana Varlejs administered the LSI to 84 continuing education students at Rutgers University between 1984 and 1985, and she reported her findings in a book entitled *Continuing Education: Issues and Challenges* edited by Esther Horne.[8] Varlejs' participants showed a slight preference for abstract conceptualization over concrete experience, and a stronger preference for active experimentation over reflective observation.

Jin Choi assessed 140 academic librarians using Kolb's LSI, publishing the results in a 1989 issue of *College and Research Libraries*.[9] Choi's participants also showed a preference for

abstract conceptualization over concrete experience, as well as a slight preference for active experimentation over reflective observation.[10] He found that male librarians tend to prefer abstract conceptualization, and that librarians aged 30-to-40 show a greater preference for concrete experience.[11] In a 2004 article, Carol Simpson and Yunfei Du used Kolb's LSI to predict student satisfaction with online learning. Kolb's LSI was administered to students in 2001, and results indicated that the largest number of students were "Convergers," preferring abstract conceptualization and active experimentation, or "Assimilators," preferring abstract conceptualization and reflective observation.[12] These students "understand and perceive information best through concepts and symbols," rather than through immediate experience. They differ only in the respect that some prefer applying that information immediately and some prefer having time to reflect on the information.[13] This tends to reinforce Varlejs' and Choi's findings, which showed a slight preference for abstract conceptualization and active experimentation.

FIELD DEPENDENCE & FIELD INDEPENDENCE

Kerry Johnson and Marilyn Domas White looked at cognitive styles of library science students, specifically assessing field dependence and field independence, and they published their research in a 1981 issue of *Library Research*.[14] Gathering data from 179 students at the University of Maryland, their aggregated results demonstrated that, although a variety of results were obtained, results were generally skewed toward greater field independence.[15] They reported that field dependent individuals had better social skills, while field independent individuals had better analytical skills and were able to work alone.[16]

ENTWHISTLE'S SHORT INVENTORY OF APPROACHES TO STUDY & STUDY PREFERENCE QUESTIONNAIRE

Using Entwhistle's Short Inventory of Approaches to Studying & the Study Preference Questionnaire, Nigel Ford assessed 38 LIS students at the University of Sheffield; his results were published in a 1985 issue of *Education for Information*.[17] The Short Inventory of Approaches to Studying assessed students' preferences for comprehension, operation, and versatile learning styles. Students were mixed, with 19 having comprehension learning styles, 17 having operation learning styles, and 1 having a versatile learning style. The Study Preference Questionnaire determined their preferences for holistic or serialist learning. Results here were also mixed, with 16 having a holistic preference, 18 a serialist preference, and 3 no preference at all.

SQUIRES' THINKING STYLES TEST

In a 1992 issue of *Library Administration and Management*, David Squires, Helen K. Hoopes, and Gary P. Gillum reported the results of a test given to 106 library employees at the Brigham Young University library.[18] They found that professional librarians were verbal thinkers, with tendencies toward logic and organization. By contrast, paraprofessionals tended to be visual thinkers, with increased creative abilities. The majority of library employees (professionals and paraprofessionals) were Verbal Convergent Thinkers with "computational skills, logical imagination, and . . . reserved and controlled emotions."[19] The next largest categories were Verbal with Visual Support, who "tend to be quite efficient, to live by the system, to prefer hands-on skills . . . , to be task oriented, to be creative on demand, and to seek personal reinforcement."[20] The third largest group was Verbal Divergent Thinkers, with

tendencies toward "strong logical and computational skills, to seek leadership roles, to have logical ideas but are able to expand ideas … and to avoid tight limits."[21]

INQUIRY MODE QUESTIONNAIRE

Linda Marie Golian administered the Inquiry Mode Questionnaire to 132 academic librarians, and she presented her results at the Ninth National Conference of the Association of College and Research Libraries in 1999.[22] Her results suggested that librarians had a "flat" thinking style, that is, one that was "associated with a natural predisposition toward using all five thinking styles with equal effectiveness."[23] The five thinking styles in question were synthesist (focused on integration of ideas), idealist (focused on process and values), pragmatist (focused on end results), analyst (focused on method), and realist (having a situational, empirical focus).[24]

CATTELL'S SIXTEEN PERSONALITY FACTOR QUESTIONNAIRE

Anne Goulding, Beth Bromham, Stuart Hannabuss, and Duncan Cramer administered the Sixteen Personality Factor Questionnaire to 239 undergraduate and postgraduate LIS students in the United Kingdom, publishing their results in *Education for Information*.[25] The students gave themselves high ratings on their reliability, friendliness, open mindedness, and work ethic; they gave themselves low ratings on their confidence, meticulousness, innovative ability, and analytical skills.

A summary of these various learning and thinking style assessments is somewhat forced, since each inventory measures different styles. Librarians and LIS students who participated in these research projects exhibited a variety of learning, thinking, and cognitive types. When taken cumulatively, however, some tendencies emerge. The subjects showed a strong orientation

toward the self and individual learning and decision-making. At the same time, their concern for and willingness to work with other people was also evident. In general, librarians tended toward logic, reason, and analytical skills, and seemed capable of using various types of reasoning to make meaning from information. They were thinkers, using imagination and intuition to understand problems. Librarians were responsive to value systems, had a sense of work ethic, and were accustomed to dealing with deadlines and time demands. They seemed to prefer visual modes of learning, particularly word-based learning, and also exhibited strengths in kinesthetic or hands-on learning.

TEACHING RECOMMENDATIONS FOR FACE-TO-FACE CLASSES

Basing their work on inventory results, Jonassen and Hodges made some teaching recommendations in their 1981 article, in order that instructors might teach to the strengths of their students: use reading assignments, independent study, visual and hands-on instruction, role playing, and inductive reasoning.[26] They also recommended using group projects as a way to accustom students to future work experiences. Stein and Totten also suggested some areas for improvement: training students to strengthen their auditory communication skills, leadership skills, and even developing recreational activities to enhance students' athletic self-esteem.[27] Varlejs, using Kolb's LSI, noted that librarians were capable of using a variety of learning styles. She recommended caution, however, in developing exercises based on abstract conceptualization, noting librarians' preference for concrete experience instead.[28]

DISTANCE LEARNING IN LIS EDUCATION

LIS education is increasingly becoming available away from campus. Daniel Barron has defined LIS distance education as an environment "in which the learner and teacher are separated by time and space, but are connected by technology and commitment."[29] Barron also pointed out an increase in distance education offerings, from 38 schools offering 408 distance courses in 1990 to 44 schools offering 489 distance courses in 2000, with more schools offering Internet-based courses.[30] This increase was reinforced in a 2004 article, which indicated that Internet-based course offerings doubled between 2001 and 2002.[31] In a 2002 issue of the *Journal of Education for Library and Information Science*, James Carey and Vicky Gregory reported that LIS students enrolled in Web-based classes at the University of South Florida spent more time working on Web-based classes than on face-to-face classes, but also felt that they learned more from these classes, as well.[32] In the *Journal of Education for Library and Information Science* in 2002, Elisabeth Logan, Rebecca Augustyniak, and Alison Rees suggested that students of Web-based courses take more responsibility for their own learning, finding that course interaction differed between face-to-face and distance students.[33] Distance students' discussions focused more on logistics than content, while face-to-face students spent a greater percentage of time discussing content.[34] Students in Web-based courses also seemed to regard creation of community as an essential component of effective classroom relations.[35]

THE CHALLENGE OF WEB-BASED INSTRUCTION

Web-based instruction (WBI) has been praised for its efficacy in delivering content. Nonetheless, discussions of WBI, according to Insung Jung, often show "little linkage to established pedagogical theory."[36] In a 2001 issue of the *British Journal of Educational Technology,* Jung asserted that WBI is different from other integrated instructional technologies

in its ability to create a learning environment integrating text, pictures, video, and audio into one system. WBI allows a content-rich environment, while offering relatively simple and flexible interaction between user and technology. This flexibility allows students the freedom to control their own learning.

Learning style has been shown to play a role in students' online learning success. Martin Graff's investigation, published in a 2003 issue of the *British Journal of Educational Technology,* suggested that analytic learners, those who learn by taking information in small, sequential chunks, might not fare as well as "wholistic" learners in online instruction.[37] When content was segmented into small chunks online, this exacerbated analytic learners' tendency to process only that bit of information, interfering with their ability to grasp the larger picture. Graff also concluded that "verbalisers," students who are verbally oriented, did not perform as well as imagers when presented with segmented course information. These results were supported in a study of undergraduate students at British Open University conducted by Hillary Cunningham-Atkins, Norman Powell, David Moore, Dave Hobbs, and Simon Sharpe.[38] Imagers, those who thought in mental images, were more likely to complete the course than Verbalisers.

In a 2002 issue of *School Libraries Worldwide,* Anne Russell analyzed comments from students in a teacher-librarianship (i.e. school library media specialist) course, based on their MBTI types.[39] She noted that "Introverted" students were comfortable participating in asynchronous discussion forums, while "Extraverted" students often felt uncomfortable without nonverbal cues. Students with strong "Sensing" scores were able to see the application of theory to real life by discussing situations with their peers and sharing personal responses. "Judging" students preferred a well-structured workshop.

In *The American Journal of Distance Education* in 2002, Charlotte Neuhauser assessed undergraduate business students based on the Learning Modality Preference Inventory and the Keirsey Temperament Inventory.[40] She found that the most successful online students used visual or kinesthetic modalities, and tended to have intuition/thinking (NT) and sensation/judging (SJ) temperaments. She characterized NT students as being independent learners who share ideas and respond to structured presentation of course materials, and SJ students as also wanting structured presentation of material but preferring instruction to be led by the instructor rather than students.[41]

In 2002 in *The American Journal of Distance Education*, Steven R. Aragon, Scott D. Johnson, and Najmuddin Shaik assessed the learning styles of graduate students in human resource management using Kolb's LSI.[42] Compared to face-to-face students, online students were more likely to learn through reflective observation and abstract conceptualization, but less likely to learn by active experimentation. In a similar study, in a 2002 issue of the *Journal of Library Administration*, Katherine Holmes reported that "Accommodators," students who preferred concrete experience and active experimentation on Kolb's LSI, had the least success in online learning.[43] Simpson and Du also found that learning style was a significant predictor of course enjoyment.[44] "Assimilators," who preferred abstract conceptualization and reflective observation, got the greatest satisfaction from their online courses. "Convergers" who preferred abstract conceptualization and active experimentation got the least enjoyment from their online courses.[45] They note that Assimilators made the fewest posts to online forums, while Convergers made the most.[46]

In the *British Journal of Educational Technology* (2003), Khaled Sabry and Lynne Baldwin investigated the sequential-global learning style in relation to student interaction with

information, other students, and the instructor.[47] According to Khaled and Baldwin, interaction helps to personalize the learning experience and helps learners process information.[48] They found that global learners practiced each type of interaction (information, other students, and instructor) more than sequential learners. Over 90 percent of both sequential and global learners felt interaction with information was important to their learning. Slightly more global learners than sequential learners found that interaction with other students was important to their learning, while more sequential learners than global learners felt that interaction with the instructor was important to their learning.[49] This may be particularly important for students who are not accustomed to the college atmosphere: in the *Journal of Latinos and Education* in 2003, Dolores Valencia Tanno noted that, for some students, "university success . . . is correlated with personal, consistent, face-to-face interaction with faculty, staff, and students" and the trend toward Web-based education reduces the likelihood of this interaction.[50]

TEACHING RECOMMENDATIONS FOR WEB-BASED INSTRUCTION

Teaching online courses in order to effectively match learners' cognitive styles has been the focus of recent scholarship. In a 2001 issue of *College Teaching*, Dusti Howell recommended three specific course-design principles to minimize student dissatisfaction with online learning: using problem-based learning in lieu of lectures, creating connections between students, and individualizing the course.[51] She recommended the addition of "multiple sensory options" such as video clips and diagrams for visual learners, audio files for auditory learners, or creating online "manipulative" teaching aids for haptic learners.[52] Katherine Holmes also supported this, advocating the incorporation of a variety of information types, including text, graphics, audio, video, and simulation, to ensure that library tutorials maximize learning opportunities for all

types of students.[53] In addition, in 2002, Charles Notar, Janell Wilson, and Karol Ross offered a list of thirteen design factors to enrich distance learning.[54] Like Holmes, they recommended the use of pictures and active learning. They also recommended presenting material from multiple perspectives, building links among concepts which allow learners to synthesize information, and encouraging collaborative learning.

METHODOLOGY: THE POPULATION

LIS students at two different institutions, the University at Buffalo and the University of Missouri, were asked to complete a Web-based learning styles assessment form.[55] A total of 108 individual students submitted usable results between 2001 and 2002. The students came from a variety of courses, including several required courses (Reference Sources and Services, Foundations of Library and Information Service, and Information Storage and Retrieval) and elective courses (Public Libraries, Youth Services in Libraries, Digital Information Retrieval, and Information Systems Analysis). Preliminary results for this study, incorporating 56 students' results, were presented at the 68th Conference of the International Federation of Library Associations and Institutions (IFLA) in Glasgow, Scotland, in 2002.[56]

METHODOLOGY: THE INSTRUMENT

The Index of Learning Styles (ILS) was created by Richard M. Felder and Barbara A. Solomon; it measures students on four scales: sensory versus intuitive, visual versus verbal, active versus reflective, and sequential versus global. In a 1995 issue of *Foreign Language Annals*, Richard M. Felder and Eunice R. Henriques defined these styles by asking some questions:

> What type of information does the student preferentially perceive: sensory—sights, sounds, physical sensations, or intuitive—memories, ideas, insights? Through which modality is sensory information most effectively perceived: visual—pictures, diagrams, graphs, demonstrations, or verbal—written and spoken words and formulas? How does the student prefer to process information: actively—through engagement in physical activity or discussion, or reflectively—through introspection? How does the student progress toward understanding: sequentially—in a logical progression of small incremental steps, or globally—in large jumps, holistically?[57]

These styles indicate how students most effectively perceive, process, and understand information, which is crucial to the learning and teaching process.

The ILS instrument asks 44 questions, 11 for each scale. Student results are rated by giving "points," and those points are summed up to determine where the student falls on the learning style scale. If a student answers questions on the Active-Reflective scale, for instance, that student will accrue two points for each Reflective answer and no points for each Active answer. A student with a score of 0 is completely Active; a student with a score of 22 is completely Reflective. In reality, most students fall somewhere in between these extremes.

RESULTS: LEARNING STYLES OF LIS STUDENTS, 2003

Figures 1 through 4 indicate where LIS students placed on each of these scales. Figure 1 represents student placement on the Sensory-Intuitive scale, Figure 2 on the Visual-Verbal scale, Figure 3 on the Active-Reflective scale, and Figure 4 on the Sequential-Global scale. The X-axis

for each figure represents the number of respondents who fell into each category on the ILS scale, while the Y-axis represents where in the ILS continuum those students fell.

The mean for the Sensory-Intuitive scale was 9.02, and the mode was 4. As demonstrated by Figure 1, 48 students fell into the more-sensory learning type (0-8), while 40 were balanced types (10-14), and only 20 were more reflective learners. This suggests that LIS students will be more receptive to sensory information, such as the sight of a computer workstation, the sound of the professor's voice, or the smell of a new book. According to Felder and Henriques, "Sensors like facts, data, and experimentation; intuitors deal better with principles, concepts, and theories."[58] Instructors might find it necessary to make concrete connections and provide examples when discussing abstract concepts such as ethics and theory.

The mean for the Visual-Verbal scale was 9.67, while the modal scores were 12 and 14. Although there was a preponderance of visual learners in this sample, it is more evenly mixed than was the sample for the Sensory-Intuitive group. Figure 2 shows that 35 students were mostly visual learners (0-8), while 58 were mixed visual-verbal learners (10-14), and 15 were verbal learners (16-22). Previous research projects found that LIS students preferred to receive information by seeing words, which supports the slight visual preference of these students.

The mean score on the Active-Reflective scale was 10.74 and the modal score was 10, suggesting that LIS students are almost evenly balanced between active and reflective learning styles. Figure 3 shows that 64 students are mixed active-reflective learners (8-14), while 25 were mostly active learners (0-8), and 19 were mostly reflective learners (16-22). Again, these results are supported by previous research that suggests librarians have a preference for active experimentation over reflective observation.

The mean for the Sequential-Global scale was 10.91, with modal scores of 8 and 12. Figure 4 indicates that 62 students fall in the middling range (8-14), while 23 students are strong sequential learners, and another 23 are strong global learners. Felder and Henriques likened the sequential preference to field independence and serialistic thinking, while the global preference was likened to field dependence and holistic thinking.[59] Interestingly, in previous studies, Johnson and Domas White reported that American students showed a tendency toward field independence, while Ford reported that British students were fairly evenly mixed in terms of serialistic and holistic thinking styles.[60]

The results of previous learning and thinking style assessments suggested that librarians were internally oriented and individualistic, with strong analytical skills and an orientation toward visual learning. Current results support previous findings that LIS students tend toward visual learning, prefer active learning situations, and lean toward sequential learning styles. Previous findings on the efficacy of hands-on learning may support the preference for sensory learning styles indicated here.

RESULTS: LEARNING STYLES IN FACE-TO-FACE & WEB-BASED COURSES

From the 108 responses, 50 were determined to be from respondents enrolled in face-to-face classes, and 44 from students in Web-based classes. Using *SPSS 11.0*, an independent-samples T-test was performed, which found that there were no significant differences in learning styles between students who chose face-to-face and students who chose Web-based course delivery modes. A comparison of means is shown in Appendix A.

LIS student learning styles seem to have undergone little change in the twenty years since learning style preferences were originally reported. Results from this study suggest that students

have stronger preferences for sensory and visual learning styles, combined with moderate preferences for sequential and active learning styles. There was no significant difference between students in Web-based and face-to-face classes, though these results are complicated by the fact that students frequently take classes as they are offered. Their preference is not for format, but for availability.

CONCLUSION

The main criterion for professional employment in LIS is a master's degree from a school accredited by the American Library Association. With only 56 LIS schools in the United States and Canada, however, LIS catchment areas are necessarily wide. There is a natural tendency for LIS educators to turn to the Internet and the World Wide Web as the preferred delivery method for distance education. First, we profess to teach Web content analysis and development skills, and our credibility would suffer if we did not demonstrate those skills ourselves. Second, the Web is what Marshall McLuhan would call a "hot" medium.[61] Web content engages the learner visually, orally, and kinesthetically, and the Web allows a high degree of interaction of the learner with the environment, with other students, and with instructors. It permits both individual and group learning, in both synchronous and asynchronous modes.

Sensory learners learn information optimally when received through their sensory perceptions. They prefer gathering data by seeing, hearing, touching, smelling, or tasting it. They deal best with facts, and they prove theories through experimentation. They prefer practical course materials and highly structured classes, and they are tolerant of repetitive learning strategies. Asynchronous Web-based instruction may restrict learning opportunities for sensory learners by relying too heavily upon a de-contextualized and text-based medium.

However, Web-based instruction can be supplemented with out-of-class experiences, such as site observations.

Visual learners prefer to receive sensory information by seeing it, and ideally by seeing it in graphical form. Web-based learning does offer many opportunities to present visual information, in that it allows instructors to embed pictures and video into their course materials. LIS instructors frequently include visual materials in lectures: diagrams of library architecture, photographs of library settings and printing presses, and video clips demonstrating actions and summarizing lecture content.

Active learners want to be able to do something with the information they are receiving: experiments, discussions, or direct applications of learning. Unfortunately, Web-based instruction does not encourage active and immediate application of new information. Students in a Web-based class cannot role-play patron conflicts or demonstrate children's programs. However, many LIS instructors have noted that students are better able to learn library concepts and theories if they can apply their knowledge to their work situations. Online discussion boards can be used to simulate classroom discussion about students' work activities. Additionally, case studies can be used with small discussion groups, to help students apply their classroom learning to "real life" situations. Short quizzes embedded into Web lectures may help active learners monitor their learning.

Sequential learners want step-by-step instruction connecting smaller bits of information into a larger whole. Global learners prefer to understand the whole before they dissect that whole into parts. LIS students are relatively well balanced between sequential and global learning styles, which presents an opportunity for instructors of Web-based courses. Classes might begin with an overall introduction of the relevance of the topic—for example, discussing organization

of information as a method of facilitating information access, before taking on the intricacies of cataloging rules. Web-based instruction also encourages the creation of highly structured course materials. This may be problematic, however, if Graff's observations of sequential learners holds true for LIS students as well.

The Web would appear to be ideally suited to LIS programs, whose students are often employed full-time and located at a considerable distance from the campus. However, the Web presents a series of conundrums for educators who are concerned with learning-style-sensitive instruction. The Web may present problems for sequential and aural learners. In a lecture situation, students must attend to and assess the messages of one person, the instructor. Distance learning formats, such as discussion boards and chat sessions, place more emphasis on student participation, which increases the time-burden necessary to interact effectively.

Visual and intuitive learners may gravitate to the Web with ease. The Web and the browsers that allow access to it are intensely visual, replete with icons to be clicked, images that both supplement the text and distract users from it. Not all Internet services are as primarily visual as the Web. Internet chat sessions, discussion boards, and electronic mail are primarily text based, and while they can accommodate the needs of textual learners, they reduce the number of communication channels, depriving participants of body language, tone of voice, and gesture, with attendant loss of context.

When it comes to delivering rich conceptual content, the lecturer in absentia has no recourse but to assign fairly lengthy texts. The Web may present problems for those who prefer not to read large quantities of text. If most LIS students are sequential, active, visual learners, the designers of LIS distance education programs would do well to provide clear pathways through the material, to include interactive testing and online exercises involving cataloguing tools, and

to ensure that plenty of diagrams and photographs are provided to supplement the necessary predominance of text. Just as with classroom presentations, distance education programming demands the employment of a variety of teaching methods to accommodate a variety of learning styles. While the evidence suggests that there has been little change in the learning styles of the majority of LIS students over the past few decades, employing a variety of teaching methods is an effective strategy for accommodating those who do not fit the dominant profile. Designers of distance education who are sensitive to these propensities and preferences would do well to take advantage of the variety of Internet delivery mechanisms available.

Figure 1. LIS Students on the Sensory-Intuitive Scale

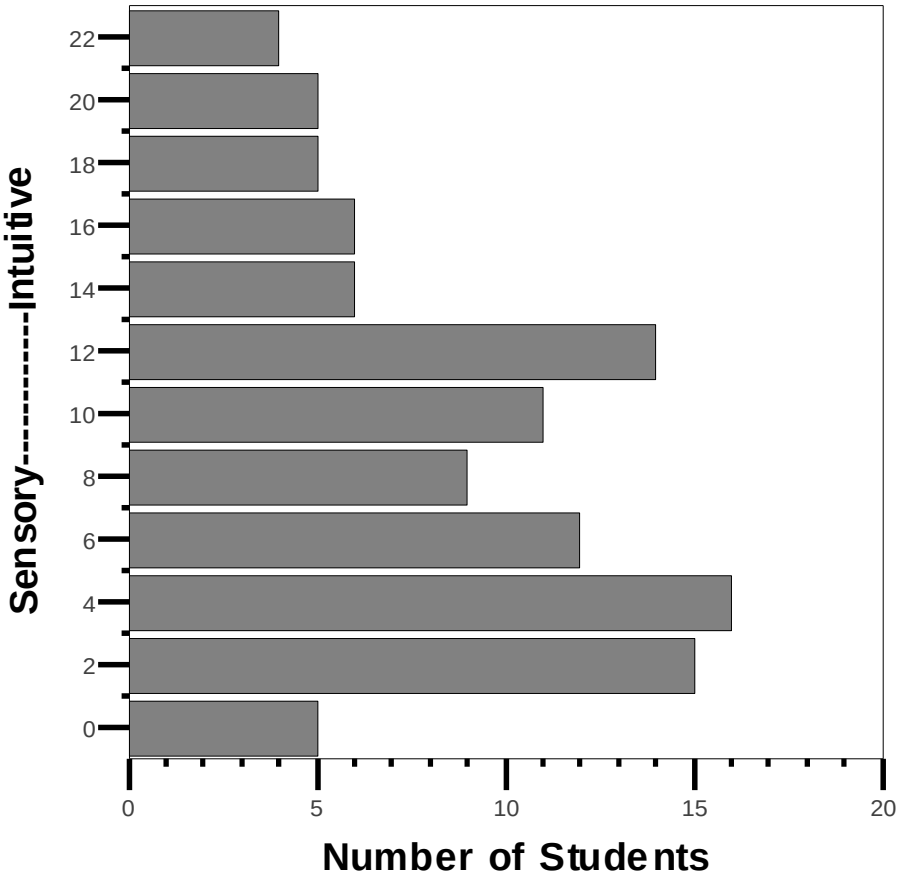


Figure 2. LIS Students on the Visual-Verbal Scale

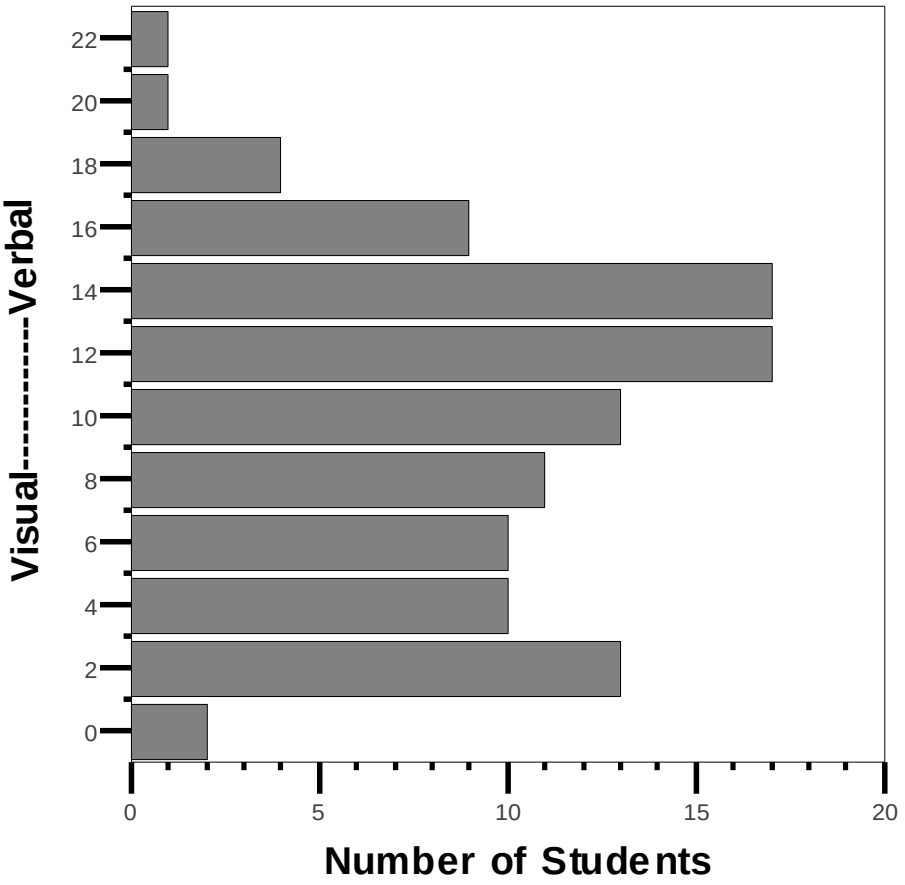


Figure 3. LIS Students on the Active-Reflective Scale

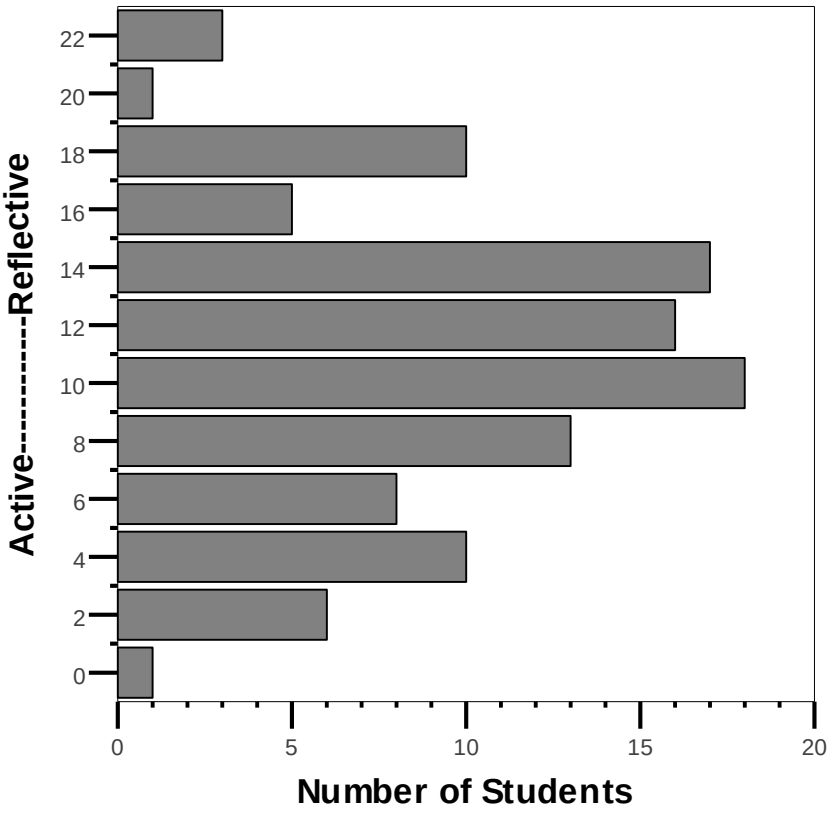
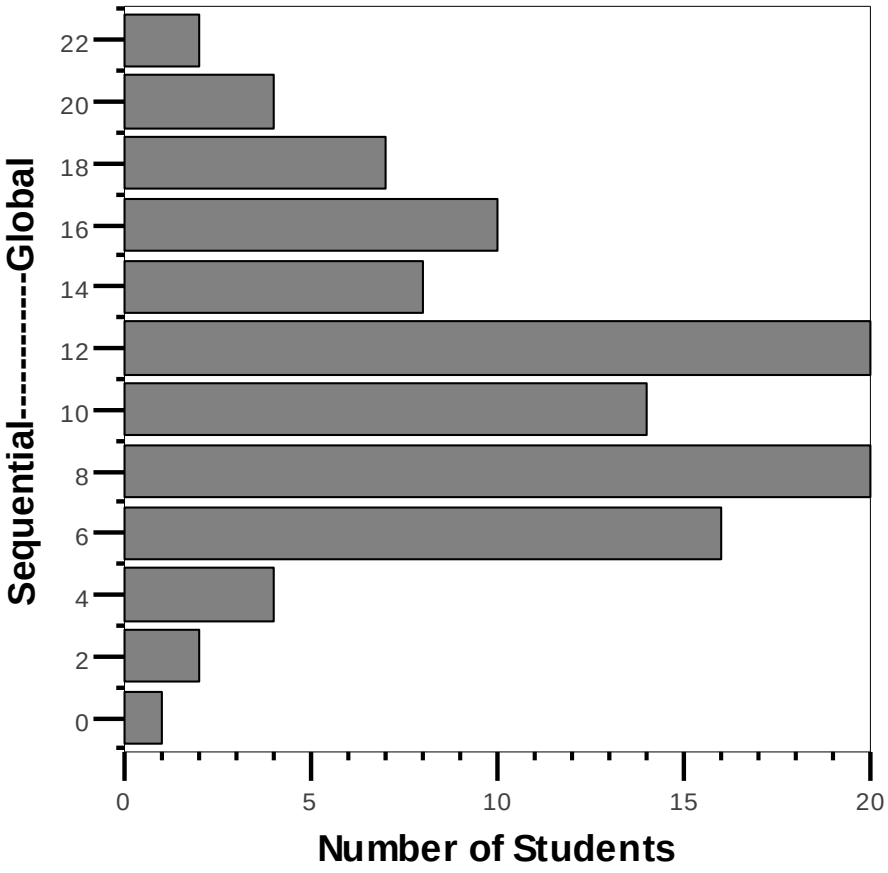


Figure 4. LIS Students on the Sequential-Global Scale



APPENDIX A

Means for Face-to-Face and Web-Based LIS Students' Learning Styles

Learning Styles	Delivery Mode	N	Mean	Std. Dev.
Active-Reflective	Face to Face	50	10.88	4.80
	Web-based	44	10.91	5.02
Sensory-Intuitive	Face to Face	50	8.64	6.23
	Web-based	44	9.36	6.19
Visual-Verbal	Face to Face	50	9.48	5.23
	Web-based	44	9.59	5.11
Sequential-Global	Face to Face	50	9.92	4.57
	Web-based	44	11.41	4.54

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