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Design of Web-Based Courses for Secondary Students

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INTRODUCTION In 1985 the Government of Newfoundland and Labrador commissioned a study of small schools which called for “a Distance Education School to be established and . . . distance education courses [to be delivered] by correspondence, computers, videotapes” and with delivery using Memorial University’s Tele-Medicine system (Riggs, 1987, p. 28). In 1988 the Government implemented a distance education programme to provide students in small schools with courses that were important for post-secondary admission but which were difficult to offer in rural schools because of small student enrolment numbers. In the programme’s first year, there was one course with an enrolment of 36 students in 13 schools. By 1999 to 2000 there were 11 courses with 898 enrolments (Brown, Sheppard, & Stevens, 2000).

The Government appointed a Royal Commission in 1990 which recommended “that a School of Distance Education and Technology be established” utilizing the TETRA/Tele-Medicine model, along with CD-ROMs, electronic bulletin boards, and computer databases (Williams, 1993, p. 321). Individual school districts began to experiment with Web-based methods of delivery. For example, in 1999 the Centre for TeleLearning and

Rural Education and the Vista School District created the *Vista School District Digital Intranet: The Delivery of Advanced Placement Courses to Young Adult Learners in Rural Communities*, which saw the development of four courses for Web-based delivery.

In 1999 the Government appointed a ministerial panel which recommended the creation of the Centre for Distance Learning and Innovation (CDLI) based on a Web-based model which would not be “totally dependent on high bandwidth technologies and [would have a] minimal reliance on synchronous communications, fixed schedules or other constraining elements,” as had been evolving throughout the province (Sparkes & Williams, 2000, p. 65). The CDLI began in 2001 to 2002 with ten courses piloted in ten districts (i.e., one course per district). After the pilot phase, the CDLI expanded its course offerings and students from all over the province could access any course. At present, the CDLI offers 27 courses, with 11 others in development.

This article reports the initial findings of a study that investigated design characteristics of a Web-based distance education programme for rural secondary school students who were unable to access a full range of courses at their school. Discovering the

characteristics perceived to be important by course developers and teachers of Web-based courses along with the perceptions of the secondary students themselves was central in this study, which was guided by the research question: What characteristics do developers, teachers, and students perceive as important for an effectively designed Web-based course for secondary school students?

LITERATURE REVIEW

According to Roblyer and Knezek:

Three assumptions educators often make about research on technology-based (i.e., computer-based and online distance learning) methods are that: (a) it has a commonly-held, theory-based agenda, (b) findings provide convincing evidence about unique ways modern technologies enhance achievement and motivation and (c) these findings shape practice in the field. The last thirty years of educational technology research notwithstanding, none of these assumptions are currently true. (2003, p. 60)

In relation to this, Gallini and Barron believe:

An increasing number of educators in K-12 and postsecondary settings are experimenting with the potential of the technologies for instruction and learning, but all of this is happening at a pace that is far surpassing the collection of useful data to test the mediational effects of the tools (2001-2002, p. 143).

The virtual high school movement is an example of change happening at a pace

that is surpassing the collection of useful data. According to Clarke (2001) there have been 14 U.S. state-sanctioned virtual high schools since 1997 (pp. i-ii), while according to Vail (2001) there were "more than 50 charter and public school online programs running in at least 30 states, and demand for them continues to grow." With the growing number of virtual high schools, there is a concern that Web-based distance education may not be suitable for all secondary students (Mulcahy, 2002).

There has been much research on Web-based course design. Collis (1999, pp. 204-206) sets out ten guidelines for instructional designers, which are summarised here:

1. Plan for flexibility and adaptation when the World Wide Web-based course-support system is defined.
2. Design for a variety of roles for both instructors and students; allow roles to be interchangeable or modifiable.
3. Do not assume students will use the course-support site as a primary source of course content.
4. Use the course-support site to supplement study materials, and to integrate and manage student study activities.
5. Design the Web site so that students and instructors can input and make use of a variety of combinations of supplemental media and resources.
6. Design for minimal levels of technical support, for minimal levels of computer-related skills and competencies, for minimal levels of online time.

7. Reduce text fixed on the screen to a minimum; use a minimum of graphic and iconic elements and provide context-sensitive help.
8. Offer a flexible assortment of tools which can be combined for different communication configurations.
9. Design to organisational flexibility, so that courses of different lengths, offered at a variety of times, and with different types and levels of prerequisites and examination/assessment requirements can be supported.
10. Be realistic about what instructors can and will do.

Gallini and Barron (2001–2002) found “Most students (77%) prefer a course structure with clear guidelines along with opportunities in the course to suggest alternative approaches to meeting course objectives [and] approximately 97% [of students] indicated that they communicated more with their instructors and peers in courses that integrated Web-based components than in courses that did not” (p. 149). Stein (2004) found “Contrary to theories of transactional analysis that state that low structure, the ability to negotiate with the instructor, and the autonomy that online learning offers are valued at a premium . . . that structure was the most important factor in online learner satisfaction and community formation” (p. F1). However, this research focused upon post-secondary institutions and corporate America, both of which have adult learners as their primary interest (see also Duchastel, 1997; McKnight, 2004; Murphy, 2003; Twigg, 2001; Zhu & McKnight, 2001). In a review of distance education, Gunawardena and McIsaac (2004, pp. 369–370) only refer to the

K to 12 education system once, in a two-paragraph discussion of the use of personal digital assistants in distance education. In the same publication, Hill, Wiley, Nelson, and Han (2004) make no specific references to Internet-based learning within the K to 12 environment. This lack of research on the secondary school learner is an important oversight because there is a difference between how adults learn and the way adolescents learn. The former—*andragogy*—is defined by Darkenwald and Merriam (1982) “as a set of assumptions and methods pertaining to the process of helping adults learn . . . Knowles (1970) . . . argued that pedagogy—which we use here to mean an approach to childhood learning—is inappropriate for adults and thus its use should be restricted to children” (cited in Merriam and Brockett, 1997, p. 135). More specifically, Knowles (1970) states:

Andragogy is premised on at least four crucial assumptions about the characteristics of adult learners that are different from the assumptions about child learners on which traditional pedagogy is premised. These assumptions are that, as a person matures, 1) his self-concept moves from one of being a dependent personality toward one of being a self-directing human being; 2) he accumulates a growing reservoir of experience that becomes an increasing resource for learning; 3) his readiness to learn becomes oriented increasingly to the developmental tasks of his social roles; and 4) his time perspective changes from one of postponed application of knowledge to immediacy of application, and accordingly his

orientation toward learning shifts from one of subject-centeredness to one of problem-centeredness. (p.39)

Even in his harsh critique of Knowles's concept of andragogy, Bright (1989) states, "It is not being suggested that there are no differences between adults and children. On the contrary, there are probably many" (p.55). This distinction between andragogy and pedagogy provides a strong rationale for research into the characteristics of effective Web-based design for secondary students.

THE STUDY This study was the initial portion of a study on perceptions of the characteristics of effective Web-based design for secondary school students within the CDLI environment. This initial portion explored the perceptions held by an administrator of the CDLI, course developers, and teachers.

Data Collection

The data collection process involved telephone interviews with course developers, teachers, and individuals who have held both roles for the CDLI. An e-mail was sent to twenty-four teachers (eight of whom were also developers) and four course developers. Four others were not contacted: three had retired from teaching and the fourth's e-mail address was unknown. Four individuals agreed to participate: two course developers and two individuals who were both course developers and teachers. The participants were:

- John, who was one of the initial developers (and was perceived as one of the stronger course developers).
- Cliff, a retired teacher who spent 29 years in the classroom before designing his first course.

- Norman, one of four original developers who went on to teach online. He also developed sections of two other courses and at the time of the research was teaching a second Web-based course.

- Bill, who was about to begin his thirtieth year of teaching, that last three as an e-teacher. He was another of the initial developers.

In addition, an administrator with the CDLI was interviewed. George had been involved in distance education in the province of Newfoundland and Labrador for the past decade and a half, first as a distance education coordinator in a rural school, then as an instructor and content developer, and later with a Web-based programme.

The main sources of secondary data were the CDLI home page and the CDLI developers' server. The CDLI home page includes all Web-based course content developed for the CDLI, along with a variety of multimedia learning objects. The developers' server contains support material for Web-based course designers and multimedia learning object designers. For the purpose of this study, the developers' template included on the server was of particular interest. This template provides the structure that CDLI course developers use to plug the content (i.e., text, image, and multimedia objects) into the actual course Web pages.

Data Analysis

Because of his experience with the CDLI and other Web-based initiatives directed at secondary students, the researcher developed potential analytical categories prior to the interviews being conducted. During the transcriptions of the interviews, the researcher began to identify themes that emerged during

each of the interviews (Kvale, 1996). As themes were identified, each one was written in the form of a statement and the transcripts were again analysed for quotations that would support or detract from each of the statements (Shank, 2002). These statements formed the basis of the preliminary findings.

The analysis of the secondary data consisted of the researcher reviewing the documents initially for examples that would support or refute the statements mentioned above. After this was completed, the researcher again reviewed the documents for further evidence that would be useful in addressing the research question. In addition, analysis using a grounded design technique was also used. Grounded design as described by Hannafin, Hannafin, Land, and Oliver (1997) has four conditions necessary for design practice to be grounded:

First, design must be based in a defensible theoretical framework. The framework must be public; that is, it can be both articulated clearly and differentiated from other perspectives . . . Next methods must be consistent with the outcomes of research conducted to test, validate, or extend the theories upon which they are based. . . . In effect, grounded designs reflect a close link between empirically verified approaches and those employed in a given learning system. In addition, grounded designs are generalisable, that is, the methods can be applied more broadly than only to a specific setting or problem. . . . Finally, grounded designs and their frameworks are validated iteratively through successive implementation. (p.103)

The grounded design approach was used to compare the actual design of existing courses to the beliefs espoused by the course developers and teachers to determine if the CDLI courses were grounded in an instructivist or a constructivist framework.

Preliminary Findings

The statements taken from the interview transcripts yielded ten initial guidelines that course developers seem to use when designing courses for secondary school students.

1. Developers should, in John's words, "try to develop a good set of notes [and] a good set of worked examples" for the students. Many of the interviewees indicated that students, especially those of average ability and below average ability, do not read their textbooks and when they do they have poor strategies for finding important material. They also referred to the fact that students should be shown how to respond to the questions they may be presented with. By providing the students with a good set of notes and worked examples, the course developer will give the student the opportunity to achieve the lesson outcome.

2. It was found that the students tend not to use the "You will learn" and "You should know" sections in the developer's template.

They don't read . . . "You will learn" . . . "You should know," they go . . . right to the "Lesson." (John)

Instead of going . . . "You will learn," or "You should know," and so on, they'll click right to the "Lesson." . . . If I have any activities assigned to them, they'll

simply just go right to the “Activities,” they won’t even bother with the “Lesson” itself. (Norman)

The only things that are looked at . . . are the “Activity” sections . . . the other parts . . . there’s nobody looking at them . . . they go right to the “Activities” . . . to see what they have to produce. Then they’ll go back to the “Lessons” to get the background . . . to the activities. (Bill)

Based on these observations it seems course developers should also include the information about lesson objectives in the text of their “Lesson,” in most instances in the first paragraph.

3. The lesson should provide students with clear instructions and expectations. Students “need to have clearly defined what has to be done [over] a certain period of time” (John). “The directions and the expectations [need to be] precise enough so students can work effectively on their own, not providing a roadblock for their time” (Bill).

4–6. The next three guidelines relate to text, images, and interactive items. In addition to providing clear directions and expectations, course developers also should ensure there is not too much text to read. Unfortunately:

You’re trying very often to explain things [that are] difficult to understand. The more explanation you have there the less chance . . . students are going to read it, but some of the concepts are just too difficult to be . . . presented very concisely. (Bill)

This requires course developers to use strategies to shorten long portions of text.

One thing a course developer can use is an image. “By providing students a visual cue with the written information it does provide a connection for them” (Norman). Using images, course developers can break up the amount of text that is presented to the students and visuals are also useful to “communicate abstract ideas” (Cliff).

Another way of imposing the learning experience for students can be through the inclusion of interactive items. These do not have to be sophisticated pieces of computer programming, but may be for example, a graph where students can “move their mouse over a point [and] it would identify what that is, and tell them the purpose of it on the graph” (Norman). However, when selecting interactive items, developers should ensure that selections are based on solid content or pedagogy. “There should not be a lot of distractions there with things that . . . might be gimmicky” (Bill). Too often, “trying to be too flashy . . . really may distract . . . from the lesson itself and students may miss the message” (Norman).

7. Content developers also should consider the use of real-life examples. It is important to have students “looking a lot at their own lives [and] their own communities” (Bill). “For example, if it’s . . . a student in Newfoundland and Labrador, you would use organisms that would reside in the province themselves,” which “can provide [the students] with something a little more sustentative and relate to where they are” (Norman).

8. Developers should not use the same format for every lesson.

[Each lesson] has to offer a certain sense of choice to the student's preferred style or mode of learning. Some students learn better by reading, some . . . with their hands, [and] some . . . by discussing items. Now a well-designed lesson would either a) provide a couple of approaches or b) at least in the long scheme of things the lessons taken in aggregate would provide . . . a varied approach." (George)

9. Lessons should be designed for the average ability or below average student. "Appropriateness . . . [is] an important thing . . . because a lot of . . . people who develop courses . . . design . . . for . . . top students . . . but we're also going to have some very, very weak students . . . so even if you're into doing complicated material . . . keeping it as simple as possible" (Bill). Always remember "students are still students and . . . we shouldn't assume that they're all self motivated. . . . It's much better to shoot . . . for the average and below average student . . . making sure that . . . there's a structure in place that guarantees they're doing their . . . work" (Cliff).

10. Course developers should plan their entire course before they begin. More directly:

Do not attempt to write anything, do not attempt to construct anything, until you have designed your project out from end to end, from start to finish. . . . If you fail to do this, here's what happens . . . if you get in there and get on with it and make a misstep, . . . undoing that mistake usually means changes that

percolate right through the web of work that you've constructed. So, undoing your mistakes is horrendously difficult. Second thing is that when you take the time to lay your project out from start to finish, the chances are you will confer with other people and that means that you will add layers of . . . important content . . . to your project that would not otherwise have been there if you did not take the time. (George)

DISCUSSION The purpose of this study was to generate a list of characteristics of effective Web-based design specifically for secondary students. As discussed earlier there are differences between the ways in which adults learn and how adolescents learn. Considering the ten guidelines discussed in the previous section, it should be noted there was little similarity with the ten guidelines for instructional designers illustrated by Collis (1999), which was provided for a higher education (i.e., adult) audience. Based upon the interview transcripts, one of the reasons for this difference may be the maturity of the adolescent learner.

In listing a set of four assumptions solely concerned with adult learner characteristics (noted earlier in this paper), Knowles (1970) argued that adult learners were different from child learners. Many of these assumptions were counter to the picture presented by the interviewees of their experiences with adolescent learners.

The secondary analysis considered whether the courses, and specifically the CDLI course template, are grounded in the same epistemological beliefs held by the course developers. All of the developers interviewed made comments

that indicated they attempted to design their courses in a constructivist fashion. John said he looked for “a way of guiding [students] through the course.” Norman stated, “What I am trying to do is I’m trying to draw [the students] . . . to understand or to lead them to an understanding of certain content.” And Bill commented, “The teacher being able to . . . guide the students and . . . be able to monitor . . . when the students weren’t grasping something.” Cliff’s comments referred to some of the strategies he used:

I have always found that effective because [you’re] getting the response early because the activity is early and you use that as a teaching tool rather than

the students becoming like passive sponges and you give them information and . . . then evaluate them on whether they’ve got the information.

These statements indicate the developers believe that the teacher is more of a “guide on the side,” whereas the structure of the developer’s template is more representative of a “sage on the stage” perspective. Based upon an analysis of the developer’s template, there are many similarities between its individual components and Robert Gagné’s nine events of instruction. The table below compares these nine events of instruction with the developer’s template.

Table 1 CDLI course and behaviourism (Gagné’s nine events of instruction)

Gagné’s Nine Events of Instruction	CDLI Template / Courses	Rationale
Gaining attention	N/A	There is no piece for this in the developer’s template and typically was not done in the courses reviewed. It is assumed that students will bring this with them.
Informing the learner of the objective	You Will Learn	This section provides a list of learning objectives for the lesson, written in student-friendly language.
Stimulating recall of prerequisite learning	You Should Know	This section provides a list of learning objectives that the students should know before starting the lesson, written in student-friendly language.
Presenting new material	Lesson	This section provides students with the instruction of the lesson, giving them information about the topic and examples of worked problems (if applicable). This is the section where the majority of learning is planned to take place.
Providing learning guidance		
Eliciting performance	Activities	This section provides students with readings along with online and/or written exercises for them to complete and receive feedback from the teacher.
Providing feedback about correctness		
Assessing performance	Test Yourself	This section, in most instances, provides students with an interactive quiz they can take, have marked, and receive feedback on all by clicking a few buttons.
Enhancing retention and recall		

This comparison illustrates the behaviourist tendency of the developer's template. This contradiction, along with the interviewees' comments about how students use the various components of courses, may provide a reason for the CDLI to revisit the developer's template.

CONCLUSION While still a work in progress, the ten guidelines from the five initial interviews provide a promising start to answering the research questions. With the declining population in many rural areas and the necessity for the delivery of instruction to students in these schools, the number of Web-based course offerings will continue to increase. During this period of growth it is imperative that the design of Web-based courses allows all students to take advantage of the opportunity they afford. Otherwise, as George said, "Undoing [those] mistakes will mean changes right through the web of work that [has been] constructed."

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