

**Author:** Myrdal, Sigurjón / Kearney, Nicholas A. / Jakobsdóttir, Sólveig / Ágústsson, Haukur.

**Title:** On-Line Distance Learning Environment and Tools to Create It: Design Based on Theory and Practice.

**Source:** <http://www.edu.helsinki.fi/media/mep8/Islandi.pdf> [12-08-2003]. Helsinki. P. 1-14. Published with kind permission of the authors.

---

*Sólveig Jakobsdóttir/Sigurjón Myrdal/Haukur Ágústsson/Nicholas A. Kearney.*

## **On-Line Distance Learning Environment and Tools to Create It: Design Based on Theory and Practice.**

### **Abstract**

In the 1997 European Commission Multimedia Joint Call Proposal “Educational Bank of Europe<sup>1</sup>”, the authors of this paper were asked to develop a new, ideal authoring tool, based on a pedagogical approach as a basis for design, for creating on-line learning environments (the “Network Education Databench”). The proposal was not included in the small percentage of projects selected for funding, but we believe that the rationale for its development is highly valid and that powerful authoring tools are still needed for designers and developers of distance education materials. We also believe that educational needs rather than technological developments should increasingly drive the design of tools for on-line teaching and learning. In this paper, we will outline some pedagogical needs that could drive the design of on-line environments and the development of tools to create them. Such a summary could also help educators select from the range of distance education authoring tools already available.

*Keywords:* Authoring tools; on-line teaching and learning; distance education materials.

---

1 Pétur Thorsteinsson was the main author of the proposal. Pétur is well known in Iceland as an educator but especially for his role in establishing the Icelandic Educational Network in 1992. Its roots go back to 1988, when IMBA, the Icelandic schools computer centre, began operation at Kópasker, in north Iceland where Pétur Thorsteinsson was principal. The Icelandic Educational Network was established primarily to meet the needs of educational institutions and their workers.

---

To develop our design recommendations, we explored pedagogical methods described as effective in the distance education literature and methods that have been used successfully in distance education programmes at the colleges and schools where we work<sup>2</sup>. We then decided what types of features needed to be part of the design of an ideal authoring tool in order to provide maximal flexibility for future course producers, teachers, and learners. We especially recommended that tools should enable the use of methods that had been shown to work well in distance education, methods that were supported by learning theories in relation to computer and Internet technologies, and methods that could aid different user groups with different types of needs (e.g., younger as well as the older population and/or the disabled). Our work in this area revealed the following findings with their design implications.

## **DISTANCE EDUCATION LITERATURE**

After an extensive review of the research literature concerning distance education, Schlosser and Anderson (1994) concluded that distance learners had the potential to learn at least as much and as well as learners taught face-to-face and that good distance teaching pedagogy was not in essence different from good conventional teaching techniques. According to Schlosser and Anderson, research clearly showed that distance education was an effective method for teaching and learning. However, based on the review, they advised distance educators to offer students structured notetaking, interactive study guides, and visuals. Furthermore, Schlosser and Anderson described Perraton's synthesis of existing theories regarding distance education. She emphasized increased dialogue in distance education, for example with group discussion and that multi-media programs were more likely to be effective than programs relying on a single medium. Perraton also emphasised feedback as a crucial part of a distance-learning system and that to be effective, materials should ensure that students engaged in frequent and regular activities over and above reading, watching or listening. In another literature review, Threlkeld and Brzoska (1994) concluded that a multitude of studies suggested that the media itself was not as important to instruction as other variables, such as learner characteristics, motivation, and instructional methods. However, they found that support

---

2 Kennaraháskóli Íslands (University College of Education), Verkmenntaskólinn á Akureyri (Akureyri Vocational College), and Florida Centre de Formació.

for the distance learner was very important, for example, instructor feedback as well as access to library resources and other supporting materials.

Implications from these findings regarding on-line learning environments include, for example, possibilities for on-line note taking, and easy access to on-line communication between students and between students and teachers (or e.g., mentors). In addition, it should be easy to incorporate multimedia based materials.

In the four years since the above literature reviews appeared there has been an explosion in possibilities of using the Internet and/or hypermedia (especially the World Wide Web) to provide distance learning experiences. In the next part of this section we will discuss implications from theory and research in relation to such technology.

## **LEARNING THEORIES AND NEW TECHNOLOGIES**

With the development of new technologies, there has been a pronounced shift in learning theories from behaviorism to constructivism. A new educational system is called for that changes the focus from teaching to learning and integrates technology to improve students' thinking skills and to help them create individual, personal knowledge (Means and Olson 1995; Kizlik 1996) that can be shared immediately with anyone in the world (Kizlik 1996). Students need to learn the skills for creating artistically, analyse logically, communicate clearly and compute efficiently or otherwise to be illiterate for the age we live in (Omori and Bunderson 1995). Constructivism requires a more complex and flexible curriculum than behaviorism and targets cognitive skills (Stahl, Sumner et al. 1995). A setting of resources and activities needs to be provided to serve as catalyst for development of these skills and opportunities should be given for students to articulate evolving understandings (Stahl, Sumner et al. 1995) in collaboration with others. Another important transformation advocated by current educational reform movements is the shift from teaching discrete skills and information within particular subjects to centring instruction around authentic, challenging projects (Means and Olson 1995). The new technologies currently at our disposal do not only provide us and users with opportunities to break new avenues in traditional education, but, more importantly, to explore new dimensions of the very concept of education. The tools presently available make it possible to re-evaluate and rethink educational models and eventually to break away from

the epistemological restrictions of Modernity. The first step could be to rethink the conventional integration of content and method, information and tool, learner and institution in education.

Modern instructional theory is founded on the metaphor of the curriculum (i.e. translated from Greek: the track). It is built around the idea of rationality and linear progress. Also the teacher centred approach has been emphasised. Curriculum theory proposes quantitative objectives determined in advance. In Post-Modern times this paradigm collapses. Open episteme replaces the closed ones, more complicated structures emerge as the learner acquires extensive autonomy and freedom in his or her search for knowledge, skills and values. The belief in gradual collection of stable knowledge has given way to a constant reconstruction of fluid knowledge (Kuhn 1962; Doll 1989). In the modern schools curriculum theory has most often presupposed rigid lesson plans, clear objectives and precise instructional methods. The Post-Modern condition is vague, flexible and transitory.

It should be accepted that educational aims can never be definite, knowledge is relative and the educational process is infinite (Dewey 1974; Hargraves 1994). The rapid evolution of the Internet technology in the last decade or two, e.g. the emergence of the hypertext and multi-media on the multi-dimensional World Wide Web provide us with the educational metaphor of the „fishing net,“ bungled up in an irregular shapeless heap. The „fishing net“ does not predetermine beginning or end. There the value and importance of data, information and knowledge are neither predisposed nor will become finalised.

The multiplicity of the Web (e.g., text, chart, picture, colour, audio, video) and its hypertext character, provides possibilities to create rich educational environments to practice different types of skills and to give students different perspectives and a chance for multidimensional learning. Kellogg and Viehland (1995) also suggested that the global and interactive nature of the Internet, its community of users, and its enormous resources indicate that this technology may be different in crucial ways than earlier technologies used in education. Educators and students can become active participants in the Internet world, which is a real world of people and events that supports and engages users as human beings and global citizens. Research on students' learning with hypermedia indicates that inclusion of images and sounds can improve comprehension and production

of text while more fully bringing culture to students (Ayersman 1996). In addition, students can benefit from constructing products within a hypermedia environment (Turner and Dipinto 1995; Ayersman 1996), for example, in order to develop complex cognitive skills such as decomposing a topic into subtopics, organising diverse data and information, and formulating an innovative and responsible point of view (Turner and Dipinto ).

Course producers and teachers that want to approach students within the constructivist paradigm should be able to have their students engage in, for example:

- Collaborative learning or dialog through on-line communication.
- Activities where students construct something that can be shared and viewed by others on-line (e.g., essays, graphics, computer tools or simulations).
- Activities with opportunities to explore/learn from context and for role play, for example virtual field trips or simulations. Simulation makes possible creation of multidimensional learning environments. Different students/learners can make use of the same virtual context for various purposes. A virtual environment can thrive on various „players“ in different roles, initially produced (by teacher/creator) subsequently shaped by students. For example a learning environment could be produced as a fishing village, where students create imagined community, construct environment and organisation, act out social roles, write culture and histories, institutions, industries, events etc.
- Authentic projects/problems, for example, submitted by companies or institutes that could benefit from student input to solve different types of real problems.
- Design implications from the above include (again) opportunities to communicate and collaborate, opportunities for students to submit/„publish“ their materials, and tools for course producers to create virtual environments. Also, it should be easy to include forums, e.g. where “real” projects could be submitted to be worked on by students.

## **NEEDS OF INDIVIDUALS**

People of all ages (including older adults and/or people with visual and hearing impairment) should be able to take advantage of educational materials created through advanced authoring tools for distance educators. Therefore, the multi-media aspect is especially important and text material should be convertible to audio for the visually impaired or vice versa for the hearing impaired. Also, course materials (teacher or student created) could be automatically translated into different languages for users in different countries.

There are several theories and models regarding learners' motivation. One such model, the ARCS model (Keller 1987) predicts that learners will be motivated with learning materials that hold their attention, that they feel are relevant, that they work on with confidence and from which they derive satisfaction. On the basis of this model, it may be especially important in distance learning materials that course requirements and expectations should be clearly spelled out (Wolcott, Napper et al. 1994) in order for students to work with more confidence. Also, the relevance of information should be emphasised and enthusiasm for the subject should be built, e.g., by allowing learners flexibility in setting their learning objectives and selecting projects to work on. In addition, multimedia design could result in better attention and satisfaction of users.

One approach could have an origin in motivation (a need, an idea), which leads to multidimensional and flexible orientation (search for information). Information consequently produces personal internalisation (ideas, skills, knowledge), and possibly and preferably an externalisation (action) in social context. This again creates motivation to look for further information.

Design implications from the above include possibilities of courses where students can set their own objectives and select their own projects to work on, and course requirements should be clear. Also, multi-media/multi-language options are important for the design of course materials.

## **PRIOR EXPERIENCE**

Finally, we also present design implications that can be drawn from the concrete experiences of providing distance education programmes at different institutions.

Verkmenntaskólinn á Akureyri. Experience from the distance learning initiative at the Verkmenntaskólinn á Akureyri shows a need to match the courses in the program as closely as possible the courses in the traditional program in order to fulfil all requirements for graduation from the high school/ junior college. This experience supports Schwier's (1994) prediction that prescriptive and learner-controlled strategies will coexist in distance education because although there was a growing progression toward increased learner autonomy there was also an increasing pressure for accountability in education. Schwier suggested, therefore, that even if "democratic" models of learning would become popular

there would still be a need for prescriptive, objective-driven instruction. Other experiences at the Verkmenntaskólinn suggest that course materials need to be carefully designed with considerable structure, and students like to be kept on schedule. Tools that are regarded as especially useful and that might decrease the (expensive) need for human interaction are tools for the creation of interactive materials, (such as interactive exercises for immediate reinforcement or correction) and computer-based tests and surveys for the evaluation of student status.

Florida Centre de Formació, Valencia. Two major factors are important regarding distance education experiences in Valencia. The first is that the Spanish education system still revolves around the figure of the teacher as the central provider of knowledge. The implications of that focus are that many students need education in the principles of learner autonomy before they can make full use of materials, and that they require a lot of structure and scheduling to avoid a sense of aimlessness, and consequent high dropout rates. The second factor is what is colloquially referred to as “titulitis”.

Many students will simply not enrol unless there is a recognised qualification to be had. Education as an end in itself is not a common perception. This means that all courses have to be closely linked to traditional official courses. A typical example is the Official School of Languages television course, which allows students to opt for the official title at the end of their studies. As an initiative, this is a very positive idea, and it is too early (3 years from inception) to have a clear idea of the success of the venture. Experience on the ground suggests that many students have problems with the level of autonomy required and end up using more traditional learning environments to complete their studies. These students do, however, tend to be highly motivated and able to articulate their needs, which indicate that the learning curve is probably steep as regards learner autonomy. The increasing use of the Internet and its growing popularity seem also to indicate that there are grounds for optimism with respect to this, as long as the factors mentioned are taken into account.

Kennaraháskóli Íslands. An extensive study by Jónasson (1997) of the distance education program at the University College of Education (the first cohort completing a B.Ed. degree through distance education at the college) showed that structure was very important to the learners. Students wanted a clear overview of each course from the beginning of the

course and liked to have lectures delivered through the Internet as well as instructional modules. Other findings included that students greatly benefited from on-line interaction and discussion. In addition, Myrdal (1994) reported that it was relatively easy to use the Internet for the preparation of teachers, and there were no problems associated with the program implementation that could not be solved (even if several students had no previous experience with computers or the Internet). He also concluded that Internet use opened up possibilities that traditional formats could not and there was a question if the quality of the traditional program could become as high as of the distance education program but not vice versa.

Design implications from the above include the need to link courses to official qualifications and materials used in similar traditional programs when they exist, the need for clear course overviews and high structure. In addition, communication with teachers and other students is very important, and distance learning initiatives can safely take advantage of Internet options in spite of little prior computer and Internet knowledge among students.

## DESIGN GUIDELINES

In Table 1, we provide a summary of the design implications identified so far in this paper: on one hand for an on-line distance learning environment and when relevant for and “ideal” authoring tool to create such an environment. These relate to four different areas: communication/interaction; learning materials, resources, and tools; student-centered learning, and qualifications.

Features of an “Ideal” On-line Distance Learning Environment	“ Ideal” Authoring Tool for Creating Such an Environment
Communications/interaction	

<ul style="list-style-type: none"> <li>• Communication between teachers and students and between students (and others).</li> <li>• Provision of feedback in teacherled courses, and possibly the provision of automatic feedback, e.g., after interactive tests/exercises.</li> <li>• Connections to “the real world”, e.g. forums where businesses and institutions could submit materials (student projects).</li> </ul>	<ul style="list-style-type: none"> <li>• Enables different kinds of communication, e.g. via e-mail, conferences/forums, chats.</li> <li>• Enables provision of feedback, including automatic feedback.</li> </ul>
Learning materials, resources, and tools (table 1 continues)	
<ul style="list-style-type: none"> <li>• Provides learning materials of various types (e.g. text, visual, auditory).</li> <li>• Provides resources of various types (e.g., study guides, translation tools, support materials)</li> <li>• Provides advice and instructions for students on how to use study guides.</li> <li>• Includes interactive exercises and/or tests.</li> <li>• Includes virtual environments.</li> <li>• Includes “authentic problems.”</li> <li>• Note-taking option.</li> <li>• Provides clear overview, complete information about expectations.</li> </ul>	<ul style="list-style-type: none"> <li>• Provides easy access to resources, e.g. to databases of visual and auditory (non-copyrighted) materials for course producers.</li> <li>• Enables inclusion of multi-media materials.</li> <li>• Enables linking to other on-line resources.</li> <li>• Enables translation to different languages.</li> <li>• Provides instructions for designers and teachers to produce good study guides.</li> <li>• Provides a tool to construct interactive exercises and tests.</li> <li>• Provides a tool to enable creation of virtual environments.</li> </ul>
	<ul style="list-style-type: none"> <li>• Provides on-line note-taking feature.</li> <li>• Enables designer/teachers to structure materials easily and give clear overviews.</li> </ul>
Student-centered learning	

<ul style="list-style-type: none"> <li>• Opportunities to create “concrete” materials that can be shared and viewed by others.</li> <li>• Flexibility in setting own objectives and selecting programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Enables creation of forums or “spaces” where students can submit materials and view materials created by others.</li> <li>• Enables creation of forums or “spaces” for different groups/individuals.</li> </ul>
Qualifications	
<ul style="list-style-type: none"> <li>• Official qualifications/links to established programs.</li> </ul>	<ul style="list-style-type: none"> <li>• Encourages/enables creation of a “formal” front (e.g. with course numbers, links to other courses/programs)</li> </ul>

**TABLE 1. DESIGN IMPLICATIONS FOR ON-LINE DISTANCE LEARNING ENVIRONMENT AND AUTHORIZING TOOLS BASED ON RESEARCH FINDINGS AND/OR EXPERIENCE.**

In the next section, we examine how one popular authoring tool measures up to our standard of an “ideal” authoring tool for distance educators.

### EXAMPLE: WEB COURSE IN A BOX

One authoring tool, Web Course in a Box (see e.g., <http://www.madduck.com>) for creating on-line courseware is described in a recent issue of TechTrends by Don E. Descy (1998), and it has also been tested recently in courses at Kennaraháskóli Íslands. It is provided free of charge from the above web site, (which is of course a big plus). When one examines Web Course in a Box with our guidelines (see above) in mind, one can identify both strengths and weaknesses in different areas as shown in Table 2 below.

**TABLE 2. WEB COURSE IN A BOX: STRENGTH AND WEAKNESS.**

+ Strength	- Weakness
Communications/interaction	
<ul style="list-style-type: none"> <li>• Enables use of different kinds of on-line communications including e-mail, postlist, and conferences.</li> <li>• Creates automatic feedback in relation to quizzes.</li> </ul>	<ul style="list-style-type: none"> <li>• Chat option is not available</li> <li>• Conferences/forums are rather primitive. One can, e.g. only view contributions as threaded and by date, not by topics or by sender.</li> </ul>
Learning materials, resources, and tools (Table 2 continues)	

<ul style="list-style-type: none"> <li>• Enables uploading of various file types, text, graphics, audio, and video. (Those accessing the files, however, have to have the capabilities to view the files).</li> <li>• Enables linking to on-line resources: Both easy to access because the authoring environment is on the web and to include in the created environment.</li> <li>• Provides a guide for designers/teachers on web-based learning and how to use the authoring tool.</li> <li>• Provides a guide for students on how to use the web.</li> <li>• Provides a tool to construct interactive exercises and tests (with some automatic feedback).</li> <li>• Enables designers/teachers to structure materials easily and give clear overviews.</li> </ul>	<ul style="list-style-type: none"> <li>• Does not have a built-in database or links to multi-media materials and does not enable the creation of such materials with the tool itself. However, there is, of course, easy access to databases because the authoring environment is on the web.</li> <li>• Has a built-in English vocabulary that can be somewhat manipulated by the webmaster and the designer but there are still core words that will be displayed on the pages in mixture with any language used for the site.</li> <li>• Tool to create tests is not very powerful and teachers have very limited information about students' performance, except for the score.</li> <li>• Does not provide tools to enable creation of virtual environments.</li> <li>• Does not provide on-line notetaking feature.</li> <li>• Built-in structure is very inflexible and in many ways difficult (or impossible) to manipulate.</li> </ul>
<p>Student-centered learning</p>	
<ul style="list-style-type: none"> <li>• Enables creation of forums or "spaces" (open or closed for different groups) where students can submit materials and view materials created by others.</li> <li>• Students can easily create their own homepages that become part of the web.</li> </ul>	<ul style="list-style-type: none"> <li>• The homepages students create with the tool have set categories labeled in English.</li> </ul>
<p>Qualifications</p>	
<ul style="list-style-type: none"> <li>• The environment provides a rather „standard/official course“ look.</li> </ul>	<ul style="list-style-type: none"> <li>• The tool demands course numbers, sections, and term information that has to be included on the site, regardless of whether the information is appropriate or not.</li> </ul>

As can be seen from Table 2, there are features of Web Course in a Box that match our recommendations. However, the tool limits in many ways what could be done to provide a powerful on-line learning environment. The environment could, e.g., provide more and even better ways to communicate, the content structure and language is too hard to manipulate, there is no note-taking feature, and including multi-media materials or multi-language materials could be easier.

## **FINAL WORDS**

The construction of an ideal authoring tool containing open virtual environments can provide a variety of experiences, roles and solutions for the creation of a powerful educational environment. Such a tool should be effective and versatile for accessing instructional and informational material from a comprehensive database, -and in fact from the entire Internet. It should enable course designers and distance educators to create diverse courseware and a wide choice of information packages for use in educational institutions and individuals as well, in e.g. the training of the workforce, for use in intranet situations and answering to the various needs and choices of individuals.

## **REFERENCES**

- Ayersman, D. A. (1996). "Reviewing the research on hypermediabased learning." *Journal of Research on Computing in Education* 28: 500–525.
- Desci, D. E. (1998). "Web-based course authoring tools." *Tech-Trends* 43(1): 3–6.
- Dewey, J. (1974). *The nature of aims. John Dewey on education.* R. D. Archambault. Chicago, University of Chicago Press: 70-80.
- Doll, W. E. (1989). "Foundations for a post-modern curriculum." *Journal of Curriculum Studies* 21(3): 243–253.
- Hargraves, A. (1994). *Changing teachers, changing times: Teachers' work and culture in the postmodern age.* London, Cassell.
- Jónasson, J. (1997). *Evaluation of the distance education (B.Ed.) program at The Icelandic University College of Education, University of Strathclyde, Glasgow.*

Keller, J. M. (1987). "Strategies for stimulating the motivation to learn." *Performance & Instruction* 26(8): 1–7.

Kellogg, W. A. and D. W. Viehland (1995). "Preface." *Computers and Education* 24: v–vii.

Kizlik, R. (1996). "Connective transactions - technology and thinking skills for the 21st century." *International Journal of Instructional Media* 23: 115–122.

Kuhn, T. (1962). *The structure of scientific revolutions*. Chicago, University of Chicago Press.

Means, B. and K. Olson (1995). *Technology's role within constructivist classrooms*.

Myrdal, S. (1994). "Teacher education on-line: what gets lost in electronic communications." *Educational Media International* 31(1): 46–52.

Omori, A. D. and C. V. Bunderson (1995). *Differentiated staffing in a global village learning community*.

Schlosser, C. A. and M. Anderson (1994). *Distance education: Review of the literature*. Ames, Iowa, Iowa Distance Education Alliance.

Schwier, R. A. (1994). *Contemporary and emerging interactive technologies for distance education*. Distance Education:

*Strategies and tools*. B. Willis. Englewood Cliffs, New Jersey, Educational Technology Publications: 213–231.

Stahl, G., T. Sumner, et al. (1995). "Share globally, adapt locally: Software assistance to locate and tailor curriculum posted to the Internet." *Computers and Education* 24: 237–246.

Threlkeld, R. and K. Brzoska (1994). *Research in distance education*. Distance Education: *Strategies and tools*. B. Willis. Englewood Cliffs, New Jersey, Educational Technology Publications: 41–66.

Turner, S. V. and V. M. Dipinto (1995). Peer collaboration in a hypermedia learning environment. Paper presented at the annual meeting of the American Educational Research Association, San Francisco.

Wolcott, L. L., V. S. Napper, et al. (1994). Audio tools for distance education. Distance Education: Strategies and tools. B. Willis. Englewood Cliffs, New Jersey, Educational Technology Publications: 135–164.

An editors' comment: After having submitted their text, the Icelandic authors found an URL they wished to include at the end of their References as an example of relevant WWW sites: <http://www.ctt.bc.ca/landonline/>

*This work, and any part of it, is copyright. Putting any part of this work to any unauthorised use is a punishable offence and liable to prosecution. This applies in particular to reproduction, translation, copying, micro-filming, electronic storage or any other electronic re-working.*