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Preparing and Managing a Course Web Site: Understanding Systemic Change in Education

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Overview

The first author led a doctoral seminar on "Understanding Systemic Change in Education" during the spring semester, 1995. The World Wide Web was used in this course to facilitate student learning of 60 complex systems concepts that were part of an educational theory.

The resulting Web products of these students and their instructor can be viewed at:

http://copper.ucs.indiana.edu/~ist/siggs.html

We encourage you to browse this site as you read. In this chapter, we share some of our experiences from this course, which may be useful if you are planning to use the Web in your teaching or research activities.

About the Course

One goal of the seminar was for students to learn structural and dynamic properties of systems in general. This was a necessary step in order to understand a theory of education that was developed by Maccia and Maccia (1966). We expect this theory to serve as the foundation for a planned computer simulation of educational systems.

Students in the seminar needed to learn the following properties of systems from Maccia and Maccia's SIGGS theory model. SIGGS refers to the integration of set, information, digraph, and general systems theory.

- **Basic SIGGS Properties.** Component, affect relation, information, selective information, system, negasystem, toput (system environment), input, storeput, fromput (megasystem environment), and output.
- **SIGGS Structural Properties.** System complete connectivity, strongness, unilateralness, weakness, disconnectivity, vulnerability, passive dependence, active dependence, segregation, interdependence, wholeness, integration, hierarchical order, flexibility, homomorphism, isomorphism, automorphism, compactness, centralization, size, and complexity.

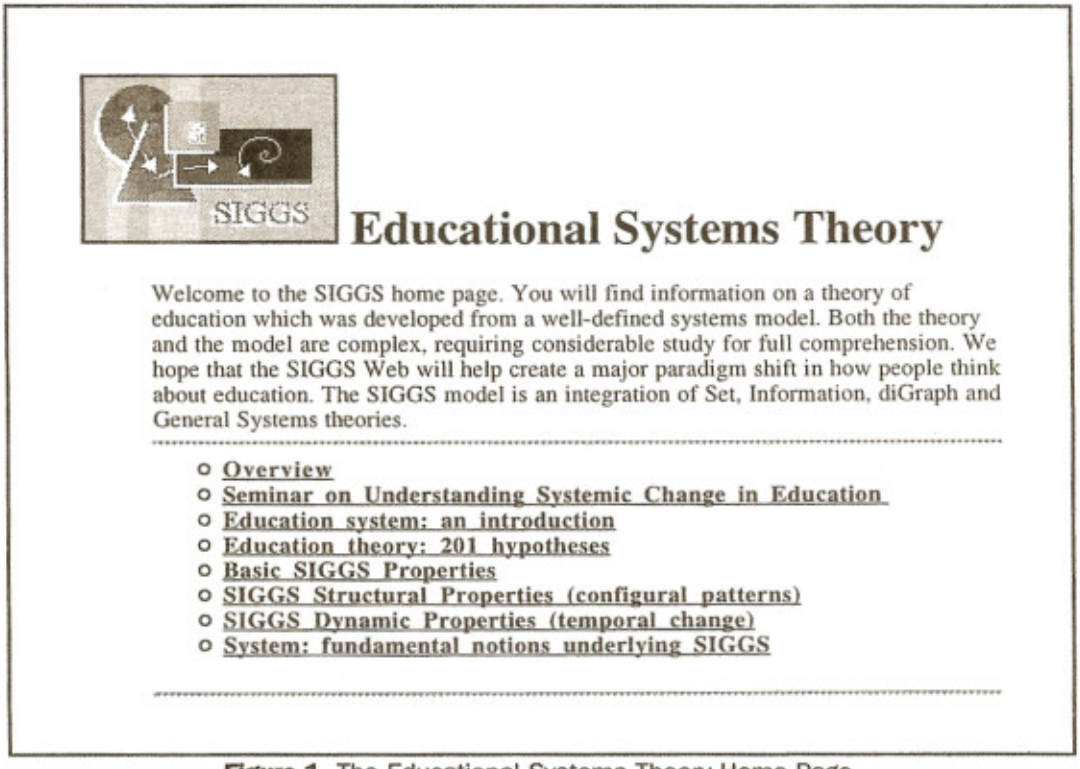

Figure 1. The Educational Systems Theory Home Page.

- **SIGGS Dynamic Properties.** System environmental change, feedin, feedout, feedback, feedthrough, filtration, spillage, regulation, compatibility, openness, adaptivity, efficiency, size growth, complexity growth, selective information growth, size degeneration, complexity degeneration, selective information degeneration, stability, state steadiness, state determination, equifinality, homeostasis, stress, and strain.

Why the Web?

Hypertext appeared to be a useful medium through which students and others could learn these complex and abstract systems concepts. The World Wide Web permitted students in the class to access the SIGGS theory model from many places and from different kinds of computers, so it was the medium of choice.

Furthermore, this seminar was viewed as a step in the direction of eventually designing a computer simulation of educational systems change. Such a simulation must be based on valid rules. Maccia and Maccia's theory—with its 201 hypotheses—appeared to be a good starting place. Each of their hypotheses states a predicted relationship between two or more of the SIGGS properties. If empirically validated, the hypotheses could then constitute the expert system needed for the simulation. The research needed prior to the design of the simulation is expected to take a number of years and will require participation by many inquirers. By putting the SIGGS model, the Maccia and Maccia theory, and subsequent research findings onto the Web, we would make this knowledge accessible to people from all over the world who might be doing research to support or refute hypotheses in the theory.

The Web Was There—and Accessible

We could not have used the Web in this seminar if it were not accessible easily by both the instructor and the students. Fortunately, Indiana University has excellent computing facilities and support services. On the Bloomington campus there are numerous labs with computers connected to the Internet. IU also provides dial-up modems so that students and faculty can access the Internet from off campus.

IU provides a number of computers running the Unix operating system, which does Web serving and provides other Internet services. It is a relatively simple matter to establish departmental and personal computer accounts. Within those accounts a user can establish a directory for Web documents. As soon as documents are created in that directory, they immediately become part of the World Wide Web.

The course instructor chose to use a departmental account on a university computer. All the students in the seminar used the same account and put their Web documents under that account. The reason for doing it this way was that the departmental account will persist over time. If the Web documents were to reside in student accounts, those accounts would normally be deactivated after students graduate, and this would cause long-term maintenance problems.

Instructor Knowledge of the Web and Training Materials

The course instructor was an experienced computer user. He had designed numerous Web documents prior to the seminar, was fluent in HTML, and was experienced in other Web-related matters. In fact, he had been leading efforts in the department and School of Education to help them gain a presence on the Web. As part of that leadership, he and graduate students had developed training materials and job aids for learning to spin the web (Frick & Hansen, 1995).

While it is not necessary to be a computer expert to develop documents for the Web, prior instructor knowledge and experience with Web development prevented many potential problems from occurring in the seminar. And most importantly, the training materials were used in the class, so that students could learn the basics of Web development prior to collaboration on the SIGGS model.

Class Discussions about SIGGS Concepts

Before students in the class could begin creating the SIGGS Web site, they required a better understanding of the properties and hypotheses that form the foundation of the theory. During the first half of the course, the instructor led class discussions about the basics of various system properties, hypotheses, and real life examples of their application. In addition, the instructor and each student had access to e-mail and were on a class distribution list. This list was used to facilitate communication among everyone in the class. Correspondence included questions as well as new understandings and examples of applications of the theory.

As the discussions progressed, each member of the class began to have a better understanding of each of the SIGGS properties, hypotheses, and how they fit together as a whole. Ultimately, this helped the students gain a better understanding of educational and systemic change.

World Wide Web Training

Once the students in the class had developed a basic understanding of the SIGGS theory, it was important that they also understood the basics of creating a World Wide Web site.

There was a wide range of Web development experience among the students in the class. Therefore, the instructor taught the students the basics of using HTML and a simple Unix text

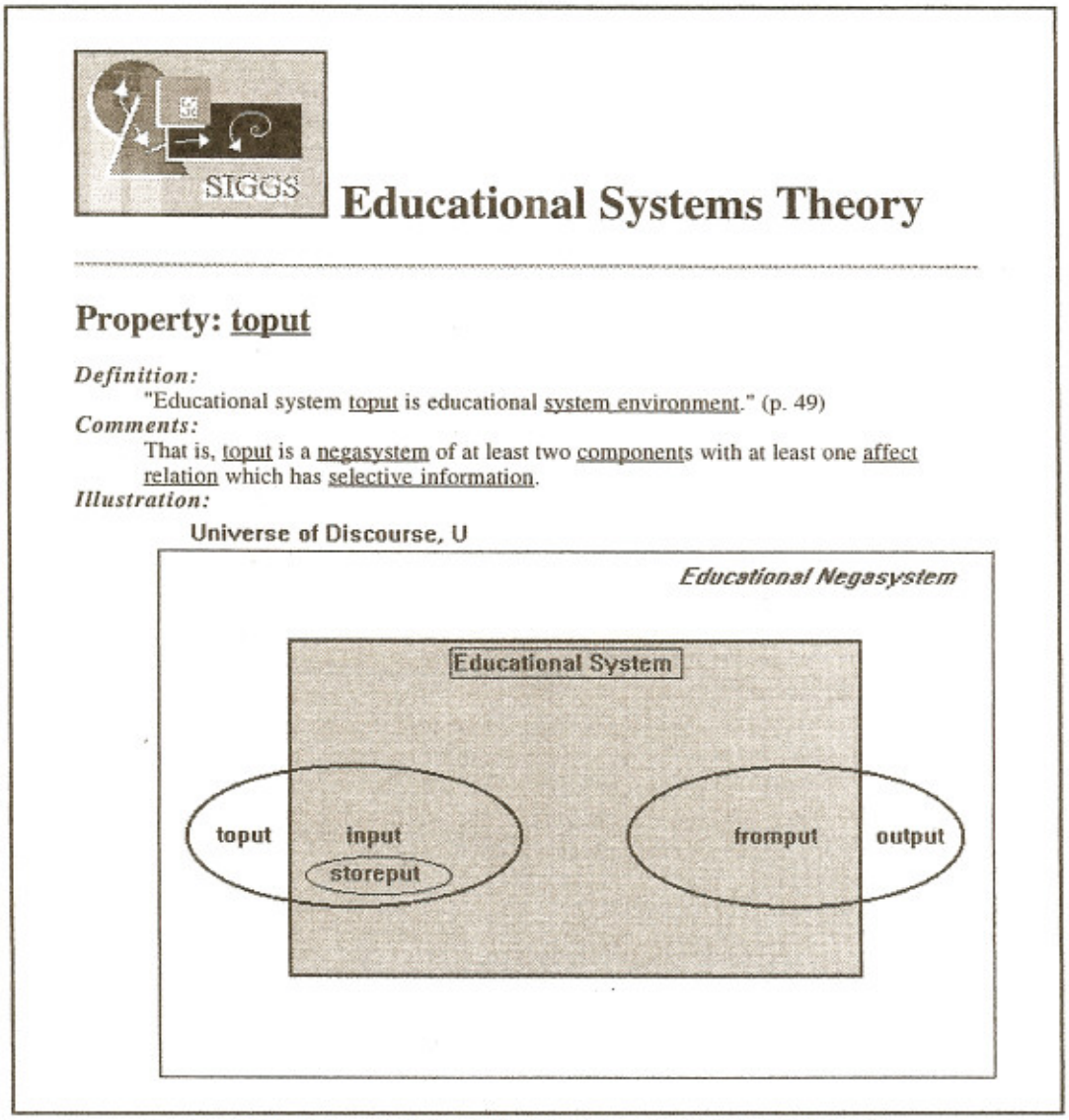

Figure 2. Part of a SIGGS Web Page for the Property 'Toput.'

editor to create Web documents. Many of the more experienced students used HTML editors to do their Web development work.

In addition to the guidance provided by the instructor, materials were used that had previously been developed by Frick and Hansen (1995). These materials took the user step-by-step through the development of a Web document. The materials were geared towards the facilities available to the students in the class.

Organizing the Web Site

Before students could begin creating SIGGS Web documents, it was important to organize the site. We needed to adopt conventions for naming files, since each needed to be unique, and

those names were needed for the hypertext links that were created in HTML documents. For this to work, we needed to specify all file names in advance so that students could use this master list whenever they needed to create a link to someone else's Web document.

Second, the instructor created a template file on the Web, which can be found at:

http://copper.ucs.indiana.edu/~ist/template.html)

This template contains standard headings and subcategories. In addition, it includes place markers where SIGGS information could be added by the students. The template provided an easy way for students to "cut and paste" their information into the template with the result being their own SIGGS Web document. This helped to make the SIGGS Web documents consistent in appearance and structure.

A further issue concerned the graphics used in the Web pages. Each SIGGS Web page needed to include at least one graphic image to help illustrate a particular property. The students and instructor discussed the importance of consistency among the graphic images. We decided that each image should be not be wider than a typical 640x480 Web browser screen. In addition, we agreed that graphic images should use no more than 16 colors (4-bit color), which would result in quicker loading and viewing of the Web pages.

Paper and Web Prototypes

After agreeing on the organization of the Web site, each student was assigned five different SIGGS properties. The students first created paper prototypes for each of their assigned properties.

Students made paper prototypes to ensure their understanding of the SIGGS properties and the accuracy of their examples *prior* to publishing them on the Web. The instructor reviewed the paper prototypes and made suggestions for their improvement.

Next, students created prototype pages on the Web for each of their assigned properties. Again, once this process was complete, the instructor reviewed each of the Web documents to ensure their structure, organization, and accuracy. Any additional suggestions for change were then incorporated into the Web documents.

Review of Site and Better Understanding of SIGGS

After the students completed and revised their Web prototypes, they had the opportunity to review the entire SIGGS Web site. Many commented that this helped them to better understand the SIGGS theory, educational change, and systemic thinking.

The hypertext links among properties gave the students better accessibility to the relationships among properties and hypotheses in the SIGGS theory. To see the definition and examples of a property (e.g., toput), all they needed do was click the mouse on the word, and they would be automatically linked to the document which explained that property.

The other significant accomplishment by students in this course was to make a complex theory more understandable. We provided many commonplace examples in education systems to help the reader understand each system property. We also provided iconic representations to complement the abstract representations (definitions and examples). Finally, we created links to the hypotheses in the theory itself. The resulting SIGGS Web can be seen at:

http://copper.ucs.indiana.edu/~ist/siggs.html

Conclusion

The creation of the SIGGS Web site led to benefits not only for students in the class, but also for a larger audience interested in educational change. For the students in the class, the creation

of the SIGGS Web site brought together a wide variety of concepts, insights, and opinions in a meaningful and orderly manner. For a larger audience, the benefit of the SIGGS Web site has been its accessibility. Before the project began, the theory was only available to those willing to go to the trouble of locating the original publication and ordering it.

As a result of student and instructor collaboration in the seminar, the SIGGS theory is now readily available to anyone with access to the World Wide Web. This has facilitated the theory's use by organizations such as the International Systems Institute at

http://www.clark.net/pub/nhp/isi/homepage.html

and by faculty at other universities who teach courses on educational systems. The SIGGS Web site is being used as a resource for the development of an educational simulation which, when completed, will help educators and others to envision new systems which can better meet the needs of an information society.

In a note to the first author, George Maccia and Elizabeth Steiner (who developed the SIGGS theory model) were delighted that this information is now available on the Web. They are now retired, leaving others such as ourselves to carry their research forward. The Web site which began in a doctoral seminar in 1995 is now available to the world.

References

Frick, T. (1993). A systems view of restructuring education. In C. Reigeluth, B. Banathy, & J. Olson, (Eds.), *Comprehensive systems design: A new educational technology* (pp. 260–271). Berlin: Springer-Verlag.

Frick, T., & Hansen, L. (1995). *Learning to spin the Web: Basic skills you need to create and use World Wide Web documents*. Bloomington, IN: Department of Instructional Systems Technology, School of Education, Indiana University.

Maccia, E. S., & Maccia, G. S. (1966). *Development of educational theory derived from three theory models*. Washington, DC: U.S. Office of Education.

Steiner, E. (1988). *Methodology of theory building*. Sydney: Educology Research Associates.

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