

Chapter X

Concept Mapping to Design, Organize, and Explore Digital Learning Objects

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ABSTRACT

This chapter investigates the problem of connecting advanced domain knowledge (from geography educators in this instance) with the strong pedagogic descriptions provided by colleagues from the University of Southampton, as described in Chapter IX, and then adding to this the learning materials that together comprise a learning object. Specifically, the chapter describes our efforts to enhance our open-source concept mapping tool (ConceptVista) with a variety of tools and methods that support the visualization, integration, packaging, and publishing of learning objects. We give examples of learning objects created from existing course materials, but enhanced with formal descriptions of both domain content and pedagogy. We then show how such descriptions can offer significant advantages in terms of making domain and pedagogic knowledge explicit, browsing such knowledge to better communicate educational aims and processes, tracking the development of ideas amongst the learning community, providing richer indices into learning material, and packaging these learning materials together with their descriptive knowledge. We explain how the resulting learning objects might be deployed within next-generation digital libraries that provide rich search languages to help educators locate useful learning objects from vast collections of learning materials.

INTRODUCTION

This chapter describes two applications of concept maps. In the first, educators used concept maps to guide the revision of a particularly challenging lesson in an introductory postgraduate class in geographic information science and technology. Student ratings and comments are analyzed to evaluate the effectiveness of the concept mapping approach and the learning object model adopted by contributors to the DialogPLUS project. Using the same lesson example, of map projections and coordinate systems, the second part of the chapter demonstrates how concept maps may be used as a framework for organizing learning objects, and for facilitating knowledge discovery by students.

CONCEPT MAPPING TO DESIGN REUSABLE LEARNING OBJECTS

Institutional Context

After a year and a half of planning and course development, the Department of Geography at the Pennsylvania State University (Penn State) began offering an online Certificate Program in geographic information systems (GIS) through the University's virtual "World Campus" in January 1999 (DiBiase, 2000). At first the program consisted of a year-long sequence of four non-credit, instructor-led classes, each ten weeks in length. Each class required 8-12 hours of weekly student activity on average. Although they were expected to complete weekly assignments, students were never expected to log into the class at any particular time or place. Students completed assignments using educational licenses of desktop GIS software (originally Intergraph's GeoMedia, later ESRI's ArcView). Students showcased their achievements in personal e-portfolios. Penn State instructors directed discussions and read and

responded to student questions daily. All class content delivery and communications were mediated through a Web-based learning management system (originally WebCT, later ANGEL, more recently ANGEL and Drupal). From January 1999 through December 2004, 519 off-campus students earned Penn State's Certificate of Achievement in GIS. The program earned ESRI's Special Achievement in GIS Award in 2004 for innovation in GIS education.

In 2004 Penn State's Graduate School and Board of Trustees approved the Department of Geography's proposal to create a new professional degree: the Master of Geographic Information Systems (MGIS). At the same time, the former non-credit Certificate Program was approved as a for-credit offering for postbaccalaureate students (those who already possess bachelor's degrees). Both offerings were approved for online delivery through the World Campus. An expanded curriculum was designed in consultation with an advisory board composed of industry leaders and scholars from four different academic programs and research centers. Students accepted to the MGIS program complete individual study projects supervised by academic advisors that culminate in public presentations at professional conferences with advisors in attendance. Two years after the new programs were approved, the number of distant students pursuing the MGIS degree and the Postbaccalaureate Certificate of Achievement (121 and 533, respectively, in academic year 2006-2007) now exceeds by a large margin the combined number of undergraduate and graduate students who seek the Department of Geography's on-campus academic degrees (BS, MS, and PhD).

Feedback from Students in an Introductory Class

The compulsory introductory class in both the Certificate and MGIS curricula is Geography 482: Nature of Geographic Information (DiBiase,

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