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# Using electronic design process portfolios in networked learning

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## Abstract

*The Design Link for Art and Science project at the University of the Arts in Philadelphia, PA USA has involved four middle schools, an art museum, a science museum and University staff in a collaborative effort to apply design thinking to the teaching of art and science using electronic media, the internet and videoconferencing technologies. The project required development, implementation and assessment in one year of curriculum, technology training, and classroom application.*

*Most of the teachers involved were unfamiliar with design, and technology was not in place at the project's start. Computer-based tools to support design activity, with or without Internet connectivity, were developed. These templates, into which drawings, text, pictures, video and clipart could be easily inserted, were organised to support different modes of design thinking. Teachers learned about designing by using the tools to plan and present their classroom projects. The project portfolios they prepared were then developed by their students into self-assessed electronic "design process portfolios". These multimedia files were exchanged through e-mail, presented and discussed through videoconferencing, and saved to an accessible Intranet server.*

Keywords: designing and learning, project-based learning, design technology, teaching and learning, cross-curricular, collaboration

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## Background

This paper reports work undertaken in The Design Link for Art and Science project at the University of the Arts in Philadelphia, PA, USA. Tools for supporting learning through design were developed and applied by teachers and students at the middle school level using current-generation word processing and presentation software to create multimedia design-process portfolios for exchange over distance learning networks. Funded through Link to Learn, a program to introduce technology into basic education in Pennsylvania, institutional participants included the university, two museums and teachers and students in sixteen classrooms

in four middle schools. The objective was to apply design thinking to enrich cross-disciplinary teaching in art and science using electronic media, the Internet and videoconferencing technologies. The project sought to develop, implement and assess collaborative curriculum development, teacher training, and classroom application within one year, an ambitious and often daunting task.

Institutional participants in the project included the Philadelphia Museum of Art, which provided instructional resources, gallery tours and workshops, videoconferencing support and links to Internet sites related to curriculum goals for art. The Franklin Institute Science Museum provided science-oriented instructional resources, science project workshops, instruction in using e-mail and Internet search engines, an e-mail list serve, shared project workspace on a server, site training and links to Internet sites specific to the science

curriculum goals of individual teachers. The School District of Philadelphia installed T1 level Internet connectivity to participating classrooms at the Conwell, McCall and Thomas middle schools. The William Penn Charter school, a private Quaker academy, was the only participating school with Internet connectivity and experience of teaching through design. The University of the Arts organised and administered the project and developed the resources related to design and programme assessment. Professional development classes for teachers took place at the University, in the museums, and at the schools.

Typically four teachers from different subject areas (including art, science, music, language arts) at each school worked together as a team to develop curriculum units within the framework of a common theme they had jointly chosen. Staff at the museums worked with the teachers to illustrate use of the design model and develop curriculum material appropriate to the chosen themes. Since most of the participating teachers and museum personnel were unfamiliar with teaching through design and the technology was not in place at project start, a pragmatic strategy was adopted in which tools and techniques were developed and introduced to suit the technology as it became available. Computers with small video document cameras were placed in the classroom first, followed by a shared mobile ISDN videoconferencing system, then, Internet connectivity. Paper tools were introduced to support design before electronic ones; e-mail training preceded

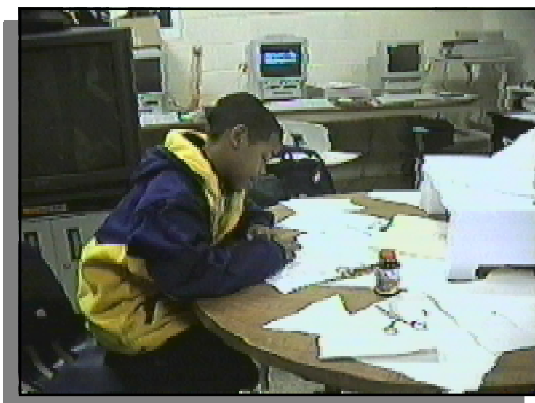


Figure 1 Paper tools used in the classroom were organised to complement computer tools

videoconferencing, which preceded Internet use. A model of the design process that has been at the core of the programme of design based education at the University of the Arts since 1989 provided the foundation for tool development.

### The I/DEPPE/I model

Simply stated this model identifies seven modes of thought in design.

**I** Intend - Focus and direct your efforts to achieve appropriate objectives. Become motivated and involved, recognise need, take initiative, accept responsibility, and commit to goals.

**D** Define - Identify, locate and specify useful information. Describe needs or desires and resources you can use to address them.

**E** Explore - Investigate, organise and compare information and ideas. Imagine, and analyse the advantages and disadvantages of different possibilities.

**P** Plan/Present - Decide, formulate and communicate what to do and anticipate doing it. Present what to do in ways that can be understood and acted on.

**P** Produce - Show how your design will be realised and how it will work. Prepare for, manage and skilfully do or make what you planned.

**E** Evaluate - Be sure that what you create is effective and satisfying. Determine that the problem has been solved, goals attained, and outcomes are good.

**I** Integrate - Consider the significance and usefulness of what you have accomplished. Reflect on how to improve your own abilities and the world around you.

This model of design thinking has proved to be an effective guide to innovative problem solving and group consensus building that is understandable to teachers and students alike. The instructional approach was to use this model as a scaffold to help students (and teachers) distinguish, focus and organise

information while designing, and to provide a common framework for communication, exchange and assessment.

### Implementing the Model

Computers were installed in the classroom of each participating teacher, and computer-based tools to support design activity were developed for their use. Microsoft Word, a word processing program, and PowerPoint, a presentation program, use the same commands for inserting drawings, text, pictures, video and clipart. They also have advanced hyperlinking capabilities that enable sections of a document or documents anywhere on the Internet to be referenced and accessed by clicking the link. Templates were developed in both applications to support the different modes of design thinking identified in the I/DEPPE/I model. These templates took the form of notebook portfolios containing at least one page for information related to or generated by each mode of thinking.

For example, intentions and goals are declared on one page; resources to be used are defined on another; ideas and possibilities are expressed on the Exploring page; formal proposals or solutions are presented on the Planning page; work schedules and methods on the Produce page and a self assessment of progress on the Evaluating page. The Integrating page accommodates reflections, future applications or anything that may relate the project to other aspects of life and learning. Hyperlinks allow quick access from any page to any designated page in the document or any other document on an accessible server. Both teachers and students can insert comments and information in a wide variety of digital forms, taken from any accessible digital source or generated at their computer using cameras, drawing tools and the keyboard.

Teachers learned about designing by using a curriculum-planning guide structured according to the model to plan and present their classroom projects. The project notebooks prepared by the teachers using this tool were then developed by their students into self assessed electronic "design process

portfolios". These multimedia portfolios were exchanged between paired schools through e-mail, presented and discussed through videoconferencing, and saved as HTML to an accessible server.

### Instructional Approach

The instructional approach follows the model:

1. Teachers (and students) use a curriculum-planning guide based on the design model to focus the intentions and document the goals of the classroom project.

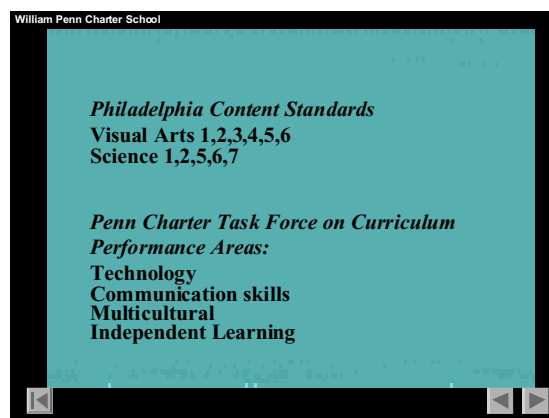


Figure 2 Teachers noted curriculum standards in presentations of their curriculum plan

2. Teachers (and students) establish an explanatory framework and hyperlinks to resources in a project notebook.
3. Students edit, develop and discuss the content of the notebook as they complete the project.
4. Students, teachers and guests exchange and discuss the portfolios, in class, by e-mail, on the Internet or through videoconferencing sessions.
5. Students produce whatever their project requires, documenting what they do in the producing section of the portfolio.
6. Teachers, students and their peers assess the portfolios at various stages in the project to evaluate their learning experience using the assessment tool it contains augmented as needed.

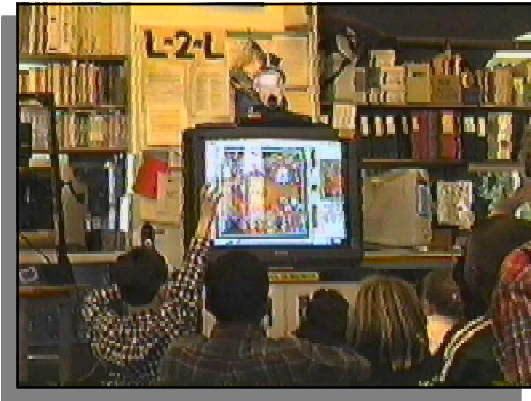


Figure 3 Videoconferencing systems in the classrooms linked schools and museums

7. Teachers and students develop an integrated portfolio to summarise and interpret their class project for others to use and learn from.

### Project Experience

In the Design Link project, an overview of the potentials of electronic media was provided to the teachers who then identified a common theme capable of expressing shared educational objectives. Schools were paired around common projects to promote collaboration and networked communication. The subjects chosen were bridges and shelters. The design model was then introduced during a two-day working session focussed on developing these shared projects. At this stage teachers worked with paper prototypes of the electronic curriculum planning guides and worksheets they would use later. The resources and support services that would be available for curriculum development from the museums were introduced during visits to them. These visitations were followed by sessions in which the computer-based tools were introduced. Instruction typically included cue sheets to support individual learning, opportunities for hands-on practice and peer discussion. Each of the 14 professional development sessions given weekly during the fall sought to integrate curriculum-related material with learning the technology for its delivery. Time was provided for discussions between teachers from different schools about their shared projects. Teachers learned to use the software through

templates similar to those they would use to develop and present their classroom projects. Instruction was also delivered to the teachers through the design model to demonstrate understanding of its application. For example, a lesson on the use of PowerPoint was delivered using a PowerPoint template structured according to the I/DEPPE/I model of design thinking. Teachers could then use or adapt these tools for their own classroom use.

As teachers learned the software they quickly saw ways to use it for their own purposes. For example, one music teacher focused entirely on selecting appropriate background colours and inserting clipart to express music. The presentations were then used as the visual background for a songfest attended by the entire school.

### Summary

Because of the amount of material to be learned and applied and the natural problems arising in such a complex collaboration, uniformity in process and learning was not anticipated or achieved. Field assessments by outside observers and preparation of final deliverables, to be included in the conference presentation, were still underway at this writing.

Developing electronic tools to support learning through design need not be complicated. Common word- processing and presentation software is now able to accommodate multimedia inserts, incorporate hyperlinks to access files anywhere on the Internet with a mouse click, be exchanged through e-mail or quickly saved in html format to an Internet server. By developing templates in this software structured to support design thinking both teachers and students can be encouraged to think creatively and critically and to work collaboratively during project-based learning experiences.

### Websites

- Design Link for Art and Science <http://www.designthinking.uarts.edu>
- Link to Learn Program, Commonwealth of

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Pennsylvania, <http://www.invest.iup.edu>

- Design Based Education K12 <http://www.uarts.edu/~arts>

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