

# The Gateway Coalition Web Repository: Focusing on Digital Resources to Manage Systemic Education Innovation

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## I. Introduction

A major thrust of the National Science Foundation's Engineering Education Coalition's effort has focused on the production, packaging, and dissemination of educational innovations. The Gateway Coalition, along with the other Coalitions, has developed many new curricula materials, explored new teaching methodologies, used the newest technologies for undergraduate education, instituted professional development activities, and institutionalized assessment and continuous improvement in all partner schools as well as actively disseminated these innovations to institutions external to the Coalitions [1]. These developments have served as the elements around which systemic change at individual institutions can be planned and implemented. An unexpected consequence of this intense focus on external dissemination is the facilitation of the Coalition's own change and innovation processes.

This paper explores how the goal of establishing a digital repository greatly facilitated the final stages of the innovation process throughout the Gateway Coalition. Based on the structural definition of the repository and the standards that were established for learning resources, each Gateway Institution was able to better define their product outcomes, monitor the progress towards these goals, and support the measurement of selected outcomes. The authors will discuss how each development phase of the repository coincided with various stages of the overall innovation process. The overall collection process will be described and the strategic value of creating a digital resource will be highlighted.

## II. Background

The *Gateway Engineering Education Coalition Web Repository* (See Figure 1.) evolving at Drexel University, the leadership center of the Coalition, is a result of the extensive product realization efforts of seven major engineering institutions including Columbia University, The Cooper Union, Drexel University, New Jersey Institute of Technology, Ohio State University, Polytechnic University, and University of South Carolina.

For ten years, spanning two award periods, the Coalition has been developing and applying educational innovations for both lower and upper division programs. Based on Drexel's initial E4 integrated freshman design curriculum, the Coalition institutions individually and collectively have spearheaded a number of innovations in such areas as engineering design, concurrent engineering, and such emerging technology areas as biotechnology and earth engineering systems.

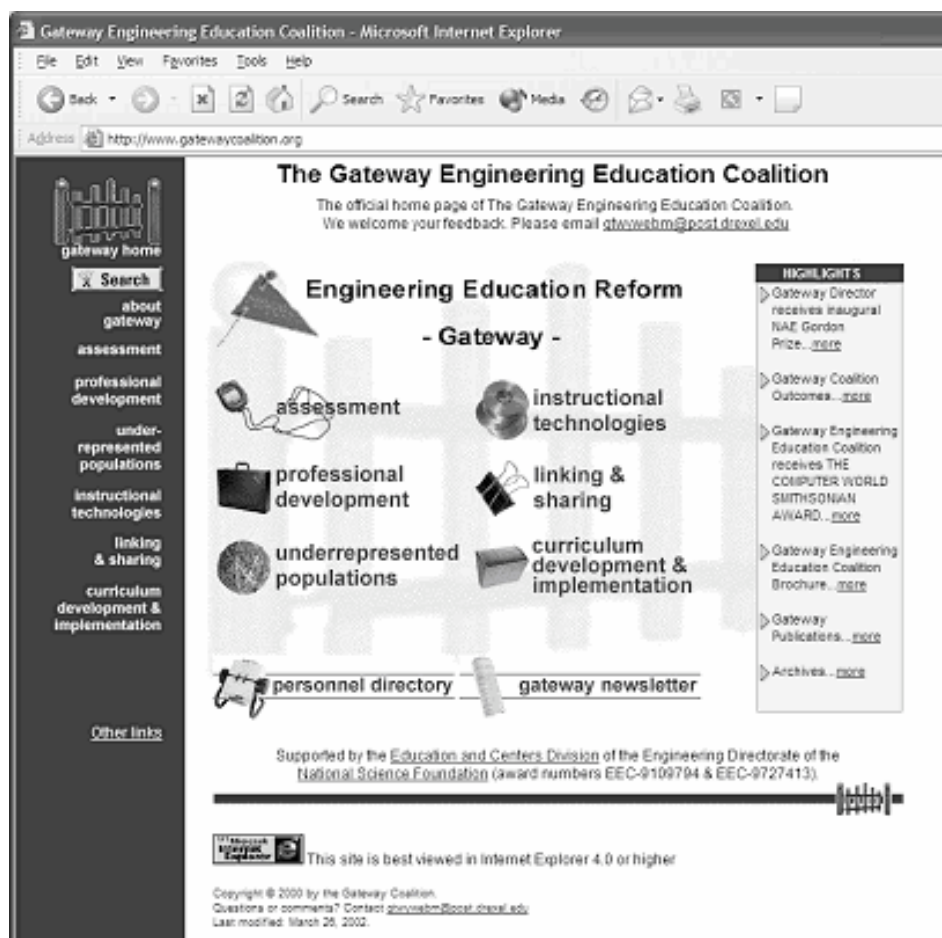


Figure 1. The Gateway Web Repository

The Gateway Web Repository was designed to offer educators the ability to search and download learning resources in the areas of engineering curricula, professional development, student mentoring and retention, and outcome-based assessment. In each category, educators can find resources to support classroom activities as well as faculty development and administrative tools. For example, a series of monographs on student oral and written communication as well as course modules emphasizing ethics can be found on the Coalition's web site. Information on the Coalition's various mentoring and support programs for women and minorities are located on the repository as well. Successful examples include the Women's Leadership Workshops and the Educational Learning Assistants (ELA) program.

### III. The Gateway Collection Process

There are several structural mechanisms that facilitate the strategic management of multi-university coalitions and their innovation processes. For example, objective setting and

quantification of intended outcomes helps each partner school to clarify their objectives and outcomes to all constituents. Many misunderstandings are uncovered during the process. The formal identification of these procedures greatly improves communication both within each school as well as across partner institutions [2].

An unintended consequence of our repository collection efforts was that it served as such a strategic mechanism, enhancing our ability to communicate and guide the final stages of our innovation and development process. As we entered the final stages of our program the ability to focus everyone's attention on the repository, and its related requirements, supported our ability to reach our product realization goals as well as continue to enable further institutionalization at our partner schools.

Several steps were found necessary to solicit, collect, edit, and subsequently enter deliverables into the Gateway Web Repository. Particular emphasis is placed on how the information technology environment influences decisions about the design of the learning resource. For example, in the course of developing many Gateway learning resources, the Coalition leadership and faculty realized that the process of acquiring content for our web repository did not end once the material was received from the contributing faculty member. In many cases, a considerable amount of work was necessary in order to transform the material a teacher had designed for use in his or her own course into a professional educational resource useable on a wide scale. While the finding may be obvious to many, the realization had an impact on faculty by making their own teaching style and philosophy more visible to themselves. This new awareness on the part of the instructor can lead to changes in thinking and teaching behavior.

Another outcome of the above realization was a push to create an audio-video component to major learning resources. It became clear that an explanation and context is essential for an appreciation, understanding, and use of the materials. Through the use of audio overlays or edited video segments, we were able to add immediate context through the use of narratives or interviews so that it will be apparent to the user what the associated textual documentation and visual examples refer to. We assumed that not all viewers would be familiar with the materials and, therefore, planned to make it so anyone could view one of the pieces and quickly understand the usefulness of the associated documentation. Thus, for example, materials from an engineering design course would be accompanied by a video segment of students working in the classroom on a project.

At a broader level, the focus on the collection process for the repository helped faculty to review their materials from a quality perspective. There were several levels of guidance that the Coalition provided to faculty to support submission of web repository resources including issues of navigation, standards, and quality assessment. To advance populating the Gateway Repository, it was critical that each content provider review his or her product entries prior to final insertion into the collection. To support the product review process, we provided our content developers with a Product Review Form (See Figure 2). The form helps the author(s) to systematically review issues of product introduction, labeling, categorization, navigation within the product, and multimedia enhancements.

Questions	Responses					
Have you provided the latest version of all relevant files? If this is a duplicate OR outdated file superseded by another OR should not be included in the Gateway Web Repository please indicate in the comments section.	YES		NO			
Have you provided introductory paragraph(s) to describe the product? If not, PLEASE DO SO.	YES		NO			
Is the navigation among related files clear to potential users? If not, PLEASE PROVIDE SUCH A DESCRIPTION	YES		NO			
Are additional instructions required?	YES		NO			
Are enhancements suggested? (Detail in Comments Section)	YES		NO			
Would you suggest adding any multimedia to enhance the product?	AUDIO		VIDEO		OTHER	
What primary Gateway category should the product be listed under?	CI	PD	UP	TE	LS	AS
What subcategory of the existing Gateway site (www.gatewaycoalition.org) would you place it under?						
Would you list it under a secondary category?	CI	PD	UP	TE	LS	AS
What subcategory of the existing Gateway site (www.gatewaycoalition.org) would you place it under?						
Would a new subcategory be helpful for listing this product adequately?	YES		NO			

Figure 2. Questions in the Product Review Form

We found that this review process reinforced the quality commitment that the Coalition leadership had agreed upon.

Finally, the overall structure of the repository directly mirrored the major goals and themes of the Coalition. This structure served as reinforcement to all participants as well as those external to the coalition identifying our main strategic objectives as well as intended outcomes. Sometimes even a simple debate as to what category a resource belongs would shed further light on our thinking, thus clarifying our goals and intentions.

#### IV. Final Thoughts

The role of digital libraries are in the process of transitioning from the repository format to a technology-mediated environment that is more of a resource center supporting a community of educators. The development of web repositories and digital libraries for engineering education will grow as interest in online resources grows, and the tools for creating such resources become more available. Individual faculty will be able to create their own small libraries, departments may create libraries that support their curriculum, professional societies are already making their professional journals available on line, and groups of faculty with special interests, e.g., teaching bioengineering ethics, may come together to create special collections of materials. The potential impact on engineering education and future innovation is significant. The Gateway Repository is a small experiment that provides some experience on how the act of creating a repository can serve as an enabler in the innovation process.

1. Fromm, E., (2003). The Changing Engineering Educational Paradigm. *Journal of Engineering Education* April, pp 113-121.
2. Fromm, E., and McGourty, J. (2001). Measuring Culture Change in Engineering Education. *Proceedings of the American Society for Engineering Education Conference*, Albuquerque, NM