

Using Resources Across Educational Digital Libraries

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ABSTRACT

This article reports on analyses of usage and design activities by users of the Instructional Architect (IA), an end-user authoring tool designed to support easy access to and use of NSDL and online resources in creating instructional materials. This analysis provides a unique window for understanding how users use resources from multiple digital libraries, and the related issues of resource granularity and context dependence. Analyses suggest that active use and design with online resources is relegated to ‘early adopters’. These users designed significantly more instructional projects with more content and more online resources than less-active users. Users in general appeared to value digital library resources, and at a smaller granularity than cataloged.

Categories and Subject Descriptors

H.5.2 [Information Interfaces and Presentation]: User Interfaces – *User-centered design, Evaluation/methodology*; K.3.1 [Computers and Education]: Computer Uses in Education – *Computer-assisted instruction (CAI)*

General Terms

Human Factors, Experimentation

Keywords

Educational Digital Libraries, Empirical Studies, Reuse

1. INTRODUCTION

The National Science Digital Library (NSDL.org) offers access to over 1 million learning resources from over 500 partner educational digital libraries [1]. To support teacher use of these resources, we developed a simple, end-user authoring service, called the Instructional Architect (IA.usu.edu). With the IA, teachers can *find* and *gather* NSDL and Web resources, *create* personal collections of instructional activities, and *share* these with students and peers [3]. For the past 1.5 years, we have also been offering professional development workshops for K-12 educators. The workshops help teachers learn to *use* digital libraries and tools, and *design* instructional activities by adapting learning resources to fit their local needs and context.

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This article first briefly describes the IA, and then reports analyses of usage and users’ design activities. Over 300 of these users are educators who participated in workshop activities; others come from the wider Internet. This analysis provides a unique window for understanding how users use resources from multiple digital libraries, and the related issues of resource granularity and context dependence.

2. THE INSTRUCTIONAL ARCHITECT

The Instructional Architect is an end-user authoring service primarily designed to support use of NSDL resources in instructional contexts. The IA offers several major usage modes. First, users can **register** and create an account. Second, with the ‘**My Resources**’ tool, users can search for, browse results, and save desired NSDL resources for further use. Users can also add any Web resource by entering its URL.

Third, with the ‘**My Projects**’ tool, users can create web pages (called projects) in which they sequence and annotate their selected resources in order to create instructional projects. Finally, users can ‘**Publish**’ these projects to share them with their students (*student* view), or anyone browsing the IA site (*public* view). An example user project can be seen in Figure 1. It shows the instructional annotations added by a teacher, with an NSDL online learning resource (a weather simulator) in the foreground.

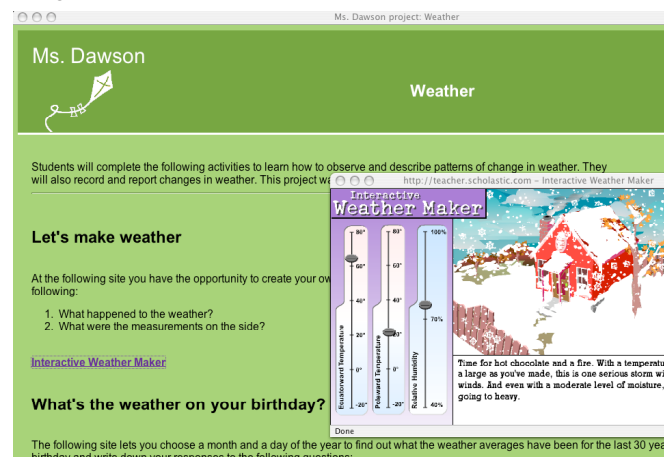


Figure 1. Example IA user project

3. USAGE

Since 2003, over 1000 users have created accounts, with 60% of the users registering in 2005. However, many are one-time users. As such, we defined an ‘active’ user as having logged in within the past 6 months and designed at least three IA projects (containing added content). Active users comprise approximately 10% of the total number of accounts (see Table 1), perhaps representing ‘early adopters’ [2].

Table 1: Usage data (totals and untransformed means for published projects)

	# accounts	# projects	# saved resources	Mean # projects	Mean # resources in projects	Mean # saved resources	Mean # words in projects
Less-active users	916	1188	3625	.38	1.27	3.96	55.64
Active users	97	511	2133	4.06	14.07	21.99	646.35

Table 1 shows differences between active and less-active users, with means reported for *published* projects (as these are good indicators of finished work). To identify significant differences, all data were log transformed to normalize skew (as is common with these type of data). Results from one-sample t-tests showed that active users: a) published significantly more of their total projects, b) included significantly more resources in published projects, and c) saved significantly more resources (all $p < .0001$).

3.1 Resource Granularity

In earlier work, we postulated that resource granularity should differentially impact its use [4]. Because of many internal dependencies, large granularity resources are intended to be used with little modifications, and the number of contexts in which they can be applied is small. For example, a semester course is probably best used unchanged because of the many interdependencies between course components. Conversely, small, self-contained resources afford greater teacher improvisation and adaptation in a wider range of situations.

Table 2. Resource usage: totals (percent)

	Saved from NSDL	User-added Web resources	
		DN in NSDL	DN not in NSDL
# saved resources (%)	2122 (36.7)	2257 (39.1)	1400 (24.3)
# used resources (%)	1185 (30.8)	1664 (43.2)	1000 (25.9)

Table 2 shows the number of resources saved directly from an NSDL search, comprising 37% of the total. However, in our observations, we noted that often workshop participants located a resource within an NSDL digital library (at a smaller level of granularity than cataloged), and then saved its URL in the IA. Thus, although this resource was discovered within a digital library, it simply appears as a Web resource.

To address this issue, we wrote a script that queries the NSDL to determine if the resource (or its domain name (DN)) resides in NSDL metadata repository (MR). This analysis revealed that the domain name of 40% of the user-added resources (and 43% of those used in projects) exist in the NSDL MR. From this we infer that NSDL resources appeared to be of high value to users: they preferred resources that are from domains cataloged by the NSDL, but apparently at a smaller granularity than cataloged.

Slight inconsistencies exist in the results due to discrepancies uncovered in the NSDL search index, and problems related to metadata quality. Also, we found that approximately 10% of the NSDL resources saved by users were subsequently deleted from the MR. This lack of permanence may have important usability implications.

Adding context. Digital libraries offer opportunities for users to collaborate, contextualize, and share resources [1]. With the

IA, users can add textual annotations as they incorporate saved learning resources into their projects. Table 1 shows the mean number of words in published projects for active and less active users. A one-sample t-test on the log transformed data showed that active users added significantly more words per published project ($t(91) = 15.51$; $p < .0001$). This provides some support to our earlier assertion that small granularity resources require user-added context.

4. DISCUSSION

Although still in its infancy, our analyses suggest that the IA is a growing service. Yet ‘active’ use still seems relegated to ‘early adopters’. Analyses suggest that active use and design with online resources is relegated to ‘early adopters’. These users designed significantly more instructional projects with more content and more online resources than less-active users. Users in general appeared to value NSDL resources, and at a smaller granularity than cataloged.

However, without additional observations, it is hard to know what kind of role online resources play in learning contexts. In addition, these findings may be influenced by the nature of user interactions within the IA, with its emphasis on gathering and annotating resources. It may also be due to teachers’ reluctance or discomfort with replacing entire aspects of their curriculum with digital library resources.

In future work, we plan to analyze project content to better characterize what users are designing. We also plan to examine the impact of our teacher professional development programs by comparing the content and quality of participants’ projects with those coming from the wider Internet.

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