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Variable Appropriation of an Online Resource Discovery and Sharing Tool

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Abstract
Even when following best practices for participatory design, the appropriation of tools in formal education settings can be hampered by a number of factors. Drawing from a case of a web tool built to help teachers in five school districts find and share free resources in an educational digital library, we describe patterns of tool use and provide some explanations for variability in tool appropriation. We also suggest that future research consider school districts as complex systems of professionals whose interactions and inter-relationships may yield unexpected technology adoption behaviors.

Author Keywords
Digital libraries; school districts; Earth Science

ACM Classification Keywords
H.3.7. Digital Libraries; K.3.1 Computer Uses in Education

Introduction
A substantial investment (over $100 Million) was made by the United States Federal Government to create the National Science Digital Library (NSDL.org) and other more subject specific science digital libraries for education, such as the Digital Library for Earth System Education (DLESE.org). One hope in making this investment was that these libraries would be valuable

and highly used tools by high school science teachers. However, like a "field of dreams", simple content availability did not guarantee that teachers would seek nor use this content for the design and implementation of their instruction [3]. Instead, there had to be a more thoughtful integration with the professional practices of teaching and alignment with the workplace demands being placed in teachers.

Enter the Curriculum Customization Service

The Curriculum Customization Service (CCS) represents one such effort to respond to that need. The development team led by computer scientists and educators, and acting in partnership with urban teachers and district leaders at a major school school district, ultimately developed and released a version of the service to improve teacher access to DLESE that emphasized three features [4]. These include:

1. An interface that was built to highlight and support purposeful planning around district learning goals goals and the discovery of online resources from a trusted repository aligned to these goals. Education is atypical from other fields for technology use in that teachers are tasked with getting students to meet prescribed learning objectives and they are continuously bombarded with recommendations and solutions that all purport to support their work.

2. A space where teachers can 'bookmark' and store resources that they personally found interesting and potentially useful for their teaching, called "My Stuff" area. This feature was designed in order to help teachers to keep track of the smaller subset of resources of the thousands they could access, in the way that a file cabinet or binder with favored materials would in a paper based system.

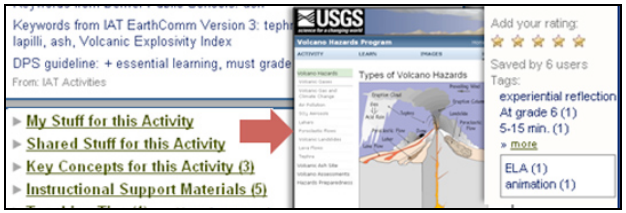

Figure 1. A screen capture of some of the features in the CCS interface.

3. An infrastructure for leveraging the "wisdom of the crowds" (or collective intelligence [1]) where resources discovered, created, or used by other teachers would be highlighted and rated. Teachers can share resources by placing them into a "Shared Stuff" space, along with ratings and annotations. This was designed with the realization that one of the promises of new peer sharing models and crowdsourcing paradigms could lead to better, trusted recommendations for specific online resources.

As a multi-institutional research team, our goal has been to examine how this tool, which followed an iterative participatory design model in one district context with continuous input and feedback from a team of Earth Science teachers, was appropriated across five school districts during a single school year.

Ultimately, the position we take is that educational systems, such as schools and districts are highly complex bodies that have several influences, both internal and external. All of these will influence adoption of a collaborative technology, and we have to go beyond simple models that focus almost exclusively on teacher preparation and teacher's beliefs if we are to

make real progress. If educators and CSCW wish to move forward with the challenge of supporting technology appropriation in formal educational workspaces, we need to set a course that will build richer understandings of the practices, people, and pressures that exist in schools and districts.

Storing and Sharing Resources

Having completed a year's worth of data collection in the five districts, we have performed multiple interviews with 25 teachers and 5 district science coordinators as well as obtained student content knowledge test score data, teacher and student surveys, and web analytics from the CCS servers.

There are some immediate ways in which the CCS usage matches what we would see in CSCW research on internet collaboration sites. For example, the overall usage of storage ("My Stuff") and sharing ("Shared Stuff") features in the CCS both showed long tail distributions and were consistent with what we would expect in terms of the "90-9-1" rule [2]. That is, only a small number of users actively contribute to the site and most others either lurk or cease using it.

Interestingly, "Shared Stuff" showed overall higher use than "MyStuff." Moreover, use of "MyStuff" was weakly correlated with number of logins (r = .22), whereas contributing to "Shared Stuff" was more highly correlated (r = .67). Finally, use of one feature was very weakly correlated with use of the other (r = .15). Thus, of those teachers apparently motivated by these features, contributing to the collective appeared to have higher priority, and gaining expertise with the CCS, as measured by a higher number of logins, appeared to play a role.

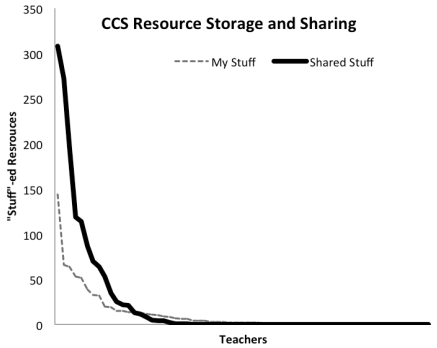

Figure 2. Teachers' use of the "My Stuff" and "Shared Stuff" features, as measured by tagging of resources.

Appropriation of CCS Within Districts

As far as each district went, there were highly variable patterns use, as determined by median teacher logins. On the higher end were the teachers at a site we will call "Valley District" (12 teachers, 40.5 median logins during the year). The lowest district was one which we call "Pioneer" (34 teachers, 2 median logins). What contributed to these differences?

Certainly there were a number of factors at play – such as individual teachers' prior knowledge of the tool, the Earth Science curricula each district had adopted, and the CCS configurations requested for each district - but in addition to those, our review of teacher and district personnel interview data have suggested that there were also some unanticipated, and at times counterintuitive, ways in which the interactions in the district could have influenced adoption. Understanding the nature of these interactions and thinking about them as potential influences is an important future step for both educational technologists

and CSCW researchers interested in the workspace of education.

For example, at Pioneer, the science district coordinator was a vocal champion for technology integration and the use of several platforms for free online resources rather than a conventional textbook. She went out of her way to providing a substantial amount of support and face-to-face collaboration time for her Earth Science teachers. The teachers reported that they were generally pleased with this, although it ultimately appeared from the teachers' accounts that they were being presented with so many options and opportunities to communicate and collaborate with one another that there was little need to log into and share resources using the CCS.

On the other hand, the district science coordinator at Valley presented herself as being hands off with respect to what tools and resources the teachers should find or use, and she was most comfortable relaying information about the CCS to teachers throughout the year. She did not want to actively promote it nor any other tool to her teachers, and this was in her view a sign of respect of the teachers' autonomy to customize their instruction.

Interviews with the Earth Science teachers revealed a need among the teachers to rely on each other and the CCS to get the support that they needed because they felt their status as Earth Science teachers – especially relative to the other sciences - was marginalized in the district, and they lacked respect and support. Therefore, the CCS became a tool to help them find and share resources at a time they felt the district would not play that role. Interestingly, neither site was the one that contributed the team of teachers most heavily involved in the original participatory design. That district, Highlands, actually showed middling levels of CCS usage (50 teachers, median 17 logins). This suggests something else was going on there, despite what should have been a strong fit between tools and specific site needs.

Ultimately, what we suggest is that there are well-established phenomena in the CSCW literature – such as the uneven participation phenomenon - that educational technologists should know and recognize. At the same time, we need to inspect and consider complex relations and interactions at multiple levels in formal educational work systems that may lead to unexpected behaviors involving new technologies.

Acknowledgements

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