“A chimera of sorts”: Rethinking educational technology grant programs, courseware innovation, and the language of educational change

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Received 28 August 2007; received in revised form 12 November 2007; accepted 13 November 2007

Abstract

How do we know when an educational organization, process, or courseware tool is innovative? How do we define the processes that encourage change or the ways in which faculty develop new courseware innovations? The terms innovation, change, and development have been overused in so many contexts that they now seem to have lost their meanings. A review of the literature on innovation and educational change offered no agreed-upon definitions or models. Prior studies that have considered innovations in educational technology have focused on the innovations themselves or the potential barriers to faculty adoption of externally developed innovations. In this study of an educational technology services program that provides competitive grants for faculty-developed technology courseware projects at a large state research university, I shifted the focus to consider: what current and future higher education faculty consider to be an innovative courseware project, and how they conceive of processes for developing such innovations. Results suggested that when it is not reduced to a rhetorical device in a marketing campaign or department instructional technology vision plan, innovation that is defined locally by a community of practice can effectively transform teaching, learning, and the organizations that support these activities.

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Keywords: Courseware development; Innovation; Educational technology; Learning communities; Post-secondary education

Many faculty in higher education consider innovation to be a “dirty word” (Hannan & Silver, 2000, p. 146), a vacuous term employed by administrators fixated on image and the bottom line. Hannan and Silver (2000) have pointed out that “[i]nnovation’ and ‘change’ … had become key vocabularies in educational practice and policy by the 1980s. They were used as headings in national reports, were fundamental to government department and agency initiatives in information technology and in teaching and learning” (p. 10). The practice of regularly invoking innovation continues. Utah State University, for example, has trademarked its Innovation Campus, which is idyllically “set amidst the mountains of northern Utah”—“an environment that uses
innovation, [and] critical thinking, to generate new ideas and promote research and discovery” (Information, 2005, para. 1–3). The Stanford Graduate School of Business has a Center for Social Innovation, which has aimed to “strengthen the capacity of individuals and organizations to develop innovative solutions to social problems” (Mission, 2007, para. 4). The goal of the Center for Innovation in Product Development at M.I.T. has been to “unite[] industry representatives with leading research faculty to investigate the end-to-end product development process—from engineering concept to market launch and beyond” (2007, para. 1). My institution, Rowan University, is in the process of constructing The Innovation Center which will be “devoted to laboratory and office space for academic research [with] 20,000 square feet available for private tenants, including a Technology Business Incubator for small startup companies” (Innovation, 2007, para. 1).

A review of the literature on innovation, however, offers no unified or agreed upon definition of innovation, either as a device or as a process; nor is there a singular approach to the study of innovation. There are four main disciplines in which innovation has been extensively studied: economics (Drucker, 1985, 1998; Fagerberg, 2005; Kline & Rosenberg, 1986; Rogers’, 1962; Schumpeter, 1949), sociology (Brown & Duguid, 1991; Fishman, 2005; Tuomi, 2002), engineering (Douthwaite, 2002; Tuomi, 2002; Von Hippel, 1988), and education (Altrichter, 2000; Cardozier, 1993; Fullan, 1991; Fung, 1992; Hall & Hord, 2001; Hannan & Silver, 2000; Kliwer, 1999; Knutel, 1988; Levine, 1980; McDonald & Ingvarson, 1997; Miles, 1964; Morris, 1987; Nelson, 2004). Each of these fields defines and contextualizes the term innovation in multiple ways and employs diverse methods to understanding the implications of innovations. Writing about education, Altrichter (2000) has argued that “[c]hange is ubiquitous, and so is talk about ‘changes.’ ‘Change’ and its family of ‘change-words,’ such as ‘progress,’ ‘improvement,’ ‘evolution,’ and ‘development,’ are among the key concepts of modernity” (p. 1). Hannan and Silver (2000) observed, in relation “to teaching and learning there are often reservations about the value of a vocabulary of ‘innovation’ rather than, say, ‘development,’ which has less of a connotation of novelty and more one of serious and safe planning” (p. 10).

But what precisely do the terms innovation, change, and development mean—especially, as I consider here, in terms of educational technology? How do we know when an educational organization, process, or courseware tool is innovative? When has authentic change taken place? How do we define the processes that encourage change or the ways in which faculty develop new courseware innovations? The terms have been overused in so many contexts that they now seem to have lost their meanings. The challenge, then, is to bring the nebulous terms, innovation, change, and development down from the rhetorical stratosphere by providing concrete definitions informed by the local community members who will develop and then use the new technologies to enhance learning experiences.

This article begins the process of defining these terms locally by presenting the results of a portion of a larger study that analyzed the evolution of a Large Research State University (LRSU) college-level Educational Technology Services (CETS) program that provides competitive grants for faculty-developed technology courseware projects. Prior studies that have considered innovations in educational technology have focused on the innovations themselves or the potential barriers to faculty adoptions of externally developed innovations (Butler & Sellbom, 2002; Johnson, 2000; Knutel, 1988; Pennington, 2004; Smith, 1997). This study shifts the focus by investigating what current and future higher education faculty consider to be an innovative courseware project, and how they conceive of processes for developing such innovations. Results suggest that when it is not reduced to a rhetorical device in a marketing campaign or department instructional technology vision plan, innovation that is defined locally by a community of practice can effectively transform teaching, learning, and the organizations that support these activities.

1. The research site

As the primary instructional technology support organization in the largest college at LRSU, CETS plays a significant role in shaping the present and future directions of the college’s instructional technology goals. The mission of CETS administration and staff is pedagogical: to provide support for instruction. CETS adminis-
In its early years of funding instructional technology, the primary goal of CETS was to provide faculty, students, and staff with access to technology and information that would foster “excellence and innovation.” In 2000 and 2001, as part of the grant proposal form, faculty were asked to provide a description of the project’s goals and/or innovation. Project proposals were evaluated by CETS administrators according to seven criteria: innovation, pedagogical value, appeal and usefulness to students, faculty and departmental commitment, ability to evaluate project success, technical feasibility, and developmental cost. During the spring 2002 semester CETS launched the CETS Grant Program and created the CETS Grant Program Selection Committee, which is comprised of college faculty, students, and CETS administrators. The CETS Grant Program provides opportunities for faculty to submit proposals for educational technology projects in three categories: courseware development, servers and other hardware, and classroom technology upgrades. With the new program came new criteria for selecting courseware development proposals that downplayed “innovation” in favor of “pedagogical effectiveness” with special consideration for projects that showed a high rate of return on investment (for example, projects that reached the most students per dollar spent, such as those that were directed toward large lecture courses rather than seminar courses). Completing the new criteria was a new proposal form which instead of asking for a description of the innovation, asked for a description and defense of the project. The language of innovation in program documents continued to decline: in the organizational plan for 2003–2004, the only mention of innovation appears during a description of the effect of teaching in multimedia- and computer-equipped classrooms; the 2004–2005 and 2005–2006 plans do not contain the word “innovation” or any of its derivatives. Rather, the focus is on supporting courseware development and faculty training.

2. Brief review of the literature on innovation and change

Contemporary theories on innovation and the processes of innovation are founded upon Schumpeter’s (1949) theories on the individual entrepreneur and, later, Rogers’ (1962) theories on innovation diffusion. Kline and Rosenberg (1986), however, have been critical of “linear models” like those described by Schumpeter and Rogers. Linear models are unidirectional; they discount the feedback, revision, and constructive communication that take place among actors in the real-world processes of developing an innovation. Rather, they have suggested that innovation exists within reflexive systems, where both the community and the innovators are working within a cycle of learning and knowledge making.

A contemporary learning process model that informed this study is Douthwaite’s (2002) Learning Selection model—a model informed by Darwinian natural selection and grounded in the motivations of users of a particular technology. Douthwaite argued that we “need to know what motivates people to want to interact with new technology in the first place, and then what is likely to influence the outcomes of the learning selection iterations they go through…” (p. 48). An agricultural engineer, Douthwaite developed his learning-centered approach to innovation after observing Burmese rice farmers struggle with and then improve upon rice harvesters designed en masse and, therefore, not specifically to address local needs (which vary greatly depending on geographical region or if rice is being harvested during dry or monsoon seasons). Douthwaite observed that “successful innovation, as a rule, is based on diversity, on opportunity grasping, and especially on mobilizing creativity among people who are willing to run with a brilliant idea, even if it is still flawed and underdeveloped” (Roling, 2002, p. xv).

Reflective models similar to Douthwaite’s have been discussed in the literature of educational change (see also Fung, 1992; Hall & Hord, 2001; Miles, 1964). Fullan (1991), for example, attempted to bridge the gap between differing pedagogies within institutions and their often conflicting political, social, and financial agen-
das by suggesting that if educators “remind [them]selves that educational change is a learning experience for the adults involved (teachers, administrators, parents, etc.) as well as for the [students], we will be going a long way in understanding the dynamics of the factors of change” (p. 66). By defining the process of change as a learning process in which, at each stage, innovators look to the users and receivers of the innovation, Fullan emphasized the fundamental role that students and teachers can play in, among other areas, the design of educational courseware. Such pedagogical models have taken on renewed urgency as a result of the ubiquitous computing initiatives implemented on college and university campuses (Owen & Demb, 2004) and the changing nature of student learning as a direct result of networked information technology (Brown, 2000).

Hannan and Silver (2000) have attempted to understand educational technology innovations from the perspective of the educators, as well as how environment impacts the design and assimilation of innovations (p. 14). Their two-phase, three-year study (1997–1999) of 16 institutions of higher education in Great Britain suggested that innovation is directly tied to six factors: how various community members interpret an institution’s culture; the level of discord within that culture; how innovations are received over a period of time; reasons provided for change and how those changes are facilitated; the status of communications between central and peripheral parts of the culture; and ideas about the past, present, and future changes throughout the culture (p. 95). It should come as no surprise, then, that faculty often have trouble navigating their path through the labyrinth of the cultures and rhetorical situations surrounding their classrooms. How a particular organization meets these complexities depends on several factors, such as its structure, its experience working with faculty who have different technology needs, its financial situation, and so forth. Defining innovations and environments for innovation at multiple universities and individual university units involves understanding that an “innovation in one situation may be something already established elsewhere, but its importance for this discussion is that initiative takers and participants see it as an innovation in their circumstances” (Hannan & Silver, 2000, p. 10).

As the literature review suggests, and as I will show in the following analyses, the development of courseware innovations at individual institutions of higher education are often unique to their own classrooms, departments, and environments. My discussion helps map this complex territory in two ways. First, I analyze how one large, local community of faculty and graduate students are defining just what is an innovative project. Second, I analyze how that same group is defining a local process for developing instructional technology courseware tools.

3. Study methodology

Based on an annual study commissioned by the Educause Center for Applied Research (ECAR), Information Technology Leadership in Higher Education: The Condition of the Community, my study employed a multifaceted research methodology to gather information about the educational technology climate in the largest college at LRSU. Specifically, the investigation was located in the following areas: a literature review of theories on innovation and change; analysis of the history of CETS and proposals submitted to CETS for funding between the 2000 and 2005 academic years; an interview with a group of CETS Undergraduate Design Assistants (UDAs) who work with faculty to develop courseware tools; and a quantitative web-based survey of randomly selected and targeted college graduate students and faculty members. Survey questions were informed by information learned from the literature review and analysis of the CETS history and grant proposals.

During a 3-week period over March and April 2005, 469 members of the college were asked to participate in an online survey. The population consisted of: 100 randomly selected Masters-level graduate students, 100 randomly selected Doctoral-level graduate students, and 100 randomly selected faculty members. Because one of the goals of the survey was to learn more about the grant process 169 targeted faculty members who were either a department chair or had submitted a CETS grant proposal between 2000 and 2005 were also included in the population (unless otherwise noted, this group will be labeled “Grant/Chair”). Three email listservs were created: one containing graduate student email addresses, one containing faculty email addresses, and

3 Department chairs were included in the targeted sample because of the important role they play in the grant process. After faculty submit proposals, their department chair writes a letter to the selection committee in which they discuss the project’s merit and rank each proposal according to how well it complements the department’s technology goals.
one containing Grant/Chair email addresses. Participants were contacted via an email message. The email message explained the survey rationale and provided a website link to access the survey, where they could log in with their university unique identification number and password. Three follow-up emails were sent.

Participant responses were entered into a Microsoft Access database. When the survey was complete, data was imported to SPSS 13.0. Data was analyzed by employing the following methodology: Frequencies were run on all data to determine if there were any noticeable trends. Chi-square and Fisher’s Exact (2-sided) tests were conducted to discern group differences. If a result was significant \( p < 0.05 \), it was followed by calculating the Adjusted Standardized Residual to determine which groups were responsible for the significant result. Factor Analysis was employed to validate the survey. Pre-determined groupings were confirmed by Pattern Matrix loadings. Reliability Analysis was conducted to determine the reliability of the groupings (Cronbach’s Alpha >0.700 indicated adequate reliability). Certain variables were removed if, upon removal, results indicated a higher Cronbach’s Alpha. Correlations were run to determine how well factor groups correlated. If the Pearson Correlation was \( \geq 0.3 \) for any of the pairings a Multivariate Analysis of data (MANOVA) was conducted; if all pairings were <0.3 a Univariate Analysis of data (ANOVA) was conducted. If Wilk’s Lambda was significant \( p < 0.05 \), it was followed by Tests of Between-Subjects Effects for those variables. If the Between-Subjects Effects test for any of the dependent variables were significant \( p < 0.05 \), Pairwise Comparisons of variable groups were calculated. A significant result \( p < 0.05 \) indicated a significant relationship between groups within a dependent variable.

4. Demographic patterns

Of the 469 invitations to participate sent by email, 5 (1.1%) were returned to the sender as not being active email accounts. A total of 169 (36.4%) members of the population responded to the survey, with “Grant/Chair” making up the largest percentage (39.3%) and MA graduate students the smallest percentage (33.7%) (Table 1). Of those who responded to the survey, 55.3% were female and 44.7% were male; 59.5% had a doctoral degree; and 60.0% had been hired since the popularizing of the World Wide Web in 1994. Survey participants represented 90.5% of the college’s 21 departments. Almost all of the respondents had taught (97.5%) or were currently teaching (87.5%) in a classroom that contained instructional technology equipment (media consoles, document cameras, digital projectors, etc.) that could be used for teaching purposes. Conversely, the majority of respondents had not taught (75.3%) nor were they currently teaching (75.9%) in classrooms that were equipped with a computer for each student. Just over half of the respondents (53.1%) had taught and under half (41.9%) were currently teaching in a classroom equipped with wireless network access.

When asked to select from a five-point Likert scale ranging from Strongly Disagree to Strongly Agree for the statement, “I am an innovative teacher,” 77.1% Agreed or Strongly Agreed. \( \chi^2 \) Test results indicate that these results are consistent across the respondent population, including: gender (\( N = 76, \ df = 3, \ \chi^2 = 3.182, \ p = 0.525 \)), age (\( N = 74, \ df = 6, \ \chi^2 = 6.196, \ p = 0.440 \)), and title (\( N = 81, \ df = 9, \ \chi^2 = 9.153, \ p = 0.334 \)).

5. Defining an innovative project

To determine if respondents shared similar judgments about an “innovative project,” survey participants were asked to read five project descriptions inspired by actual CETS abstracts (Table 2). Participants were
asked to rank the abstracts in order from least to most innovative, with 1 representing least innovative and 5 representing the most innovative. Table 2 lists the abstracts, my expected rankings, and the percentage of respondents who selected a rank that was consistent with what I expected. I determined the expected rankings according to the following criteria: the type and level of technology proposed; project interactivity; collaborative or individual project; and how many people/students the project would reach. For example, Abstract 4 secured my lowest expected innovative rank because the technology was a basic web site. Though the proposal did suggest a desire to upload multimedia and other course-related materials, the site did not support interactivity: students could not upload materials to the site (which they are able to do in Abstract 2). The proposal also reached the fewest students.

Of the 120 possible response combinations for the five abstracts, results showed 42. Of the 42 combinations, only 2.4% of the respondents ranked the abstracts exactly as I would have ranked them. Two combinations, 1–5–3–2–4 and 1–5–4–2–3, had the most respondents (4.1% each). Results showed that a plurality of respondents ranked three of the five abstracts as expected (Abstracts 2, 3, and 4). Each abstract received rankings for all five places on the innovative rank scale. Results suggest the following:

- Not surprisingly, respondents tended to think interactive and database-driven projects were more innovative than course web sites.
- Respondents tended to think having multimedia technology in a project made that project inherently more innovative than one that provides students with the ability to interact with technology. This seems to account for why Abstract 1 received 10 percent more responses than Abstract 4 as the least innovative project.

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4 Of the respondents who ranked the abstracts, 45 did not rank the abstracts according to instructions (for example, a respondent may have rated multiple abstracts with a rank of 3). While these results do provide interesting information about where those respondents thought the abstract fit on the scale, because the results were not anticipated, they were not included in the analysis.
Respondents tended to be able to determine the most advanced use of instructional technology in all the abstracts (Abstract 2), and almost half ranked that project as the most innovative. However, almost one-third ranked a database-driven project as the most innovative. This may be because the project was looking at issues of accessibility for people with disabilities—a hot-button issue at the university. Then again, it could very well be the most innovative.

Overall, these results suggest that, as expected, respondents had different conceptions of the characteristics of an innovative project.

6. Innovation fatigue

Several respondents volunteered comments that questioned the survey’s focus on innovation and the use of technology in the classroom:

- “Why the emphasis on ‘innovation’? It strikes me as a chimera of sorts, followed closely by ‘collaboration.’ I’d place my emphasis on effectiveness rather than novelty any day. And sometimes good work is done largely by individuals.” Professor
- “The IT I use in the classroom is currently rather simple (website linked to readings, some lectures, and a few external links) and I feel that adding technological complexity beyond that would not help me convey any more than I currently convey in my classes. The most important experience my students have is TALKING in class, in front of their peers, not using the computer.” Professor
- “The use of technology in the classroom and to support student learning outside of the classroom is important, I agree. However, it is extremely important that the use of technology is well planned and integrated into the course schedule and curriculum. If ‘technology’ is introduced haphazardly, it may only confuse and distract students from the subject at hand.” Teaching Assistant
- “What we need to focus on, when using technology to teach completely non-technological subjects, is that computers can’t afford insight, creativity, understanding, or assist in clear reasoning. They can facilitate transfer of papers, grades, and some other information. That’s all.” Doctoral Candidate

These comments suggest two things. First, that the college, CETS, and individual departments still have necessary opportunities to discuss with faculty and their students the diverse ways using instructional technology in the classroom can enhance both the teaching and learning experience (the Doctoral Candidate is a case in point). Second, members of the college may be suffering from what I term “innovation fatigue”: the constant calls for innovation in the classroom and for using technology in innovative ways (by the marketplace, accreditation boards, trustees, university administrators, students, and so forth) are driving teachers to question the emphasis on innovation. Instead, their comments suggest that they would like the focus to be on what are effective uses of technology, and how the use of technology improves teaching and learning. Attempting to address this concern may be one of the reasons why the language of innovation has been dropped from CETS publications.

7. Defining an innovation process

In the previous section I analyzed how respondents ranked innovative projects. Results suggest that individual member’s definition of innovation are informed by criteria unique to the individual. In this section, I look further into local community members’ perceptions of innovation by analyzing responses to a question designed to see if participants conceived of a unique process of innovation. To determine how members of the college identified an innovation process, survey participants were asked to rate 15 terms (see Table 3) on a five point Likert scale ranging from Not Very Important to Very Important for the purposes of innovation. With the exception of Secrecy, respondents thought that each of the characteristics listed was More Important or Very Important to the process of innovation (Table 3). Creativity was rated highest (Mean: 4.82), with 83.8% of respondents rating it as Very Important. Other characteristics to be rated Very Important by
50.0% or more of the respondents were: Open-mindedness (65.9%), Flexibility (61.8%), Imagination (82.3%), Vision (59.5%), and Research (55.7%).

The extant literature suggests that innovation processes occur over multiple phases, with each phase consisting of multiple operations. For example, Douthwaite’s Learning Selection model has four distinct stages, and each stage has built into it revision, reflection, and critique. I selected the 15 innovation process characteristics because of the prominent role they tended to play (or played) in innovation processes found in the literature. To determine if there was a distinct process, I attempted to identify discernible patterns in the way participants responded to the 15 innovation characteristics, and then to consider the implications of those patterns in terms of expected results. I applied Factor Analysis to the data. Upon a first run, five factors were extracted, with Secrecy and Research located in a fifth, outlying factor (Table 4). These results were expected; according to the innovation literature, neither Secrecy nor Research is considered to be integral functions of the innovation process. For example, Miles (1964) has argued that “the concept of the innovator as isolated hero seems inappropriate. The progress of any innovation must be examined in relationship to a complex net-

Table 3
Responses for defining characteristics of an innovation process

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>N</th>
<th>Min</th>
<th>Max</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collaboration</td>
<td>132</td>
<td>1</td>
<td>5</td>
<td>3.89</td>
<td>1.086</td>
</tr>
<tr>
<td>Reflection</td>
<td>132</td>
<td>1</td>
<td>5</td>
<td>4.19</td>
<td>0.926</td>
</tr>
<tr>
<td>Research</td>
<td>131</td>
<td>1</td>
<td>5</td>
<td>4.49</td>
<td>0.661</td>
</tr>
<tr>
<td>Secrecy</td>
<td>132</td>
<td>1</td>
<td>5</td>
<td>1.73</td>
<td>0.987</td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>132</td>
<td>1</td>
<td>5</td>
<td>4.56</td>
<td>0.713</td>
</tr>
<tr>
<td>Revision</td>
<td>130</td>
<td>1</td>
<td>5</td>
<td>4.19</td>
<td>0.890</td>
</tr>
<tr>
<td>Flexibility</td>
<td>131</td>
<td>1</td>
<td>5</td>
<td>4.54</td>
<td>0.682</td>
</tr>
<tr>
<td>Critique</td>
<td>131</td>
<td>2</td>
<td>5</td>
<td>4.36</td>
<td>0.724</td>
</tr>
<tr>
<td>Imagination</td>
<td>130</td>
<td>1</td>
<td>5</td>
<td>4.77</td>
<td>0.578</td>
</tr>
<tr>
<td>Creativity</td>
<td>130</td>
<td>3</td>
<td>5</td>
<td>4.82</td>
<td>0.445</td>
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<tr>
<td>Risk-taking</td>
<td>132</td>
<td>1</td>
<td>5</td>
<td>4.10</td>
<td>0.890</td>
</tr>
<tr>
<td>Environment</td>
<td>131</td>
<td>2</td>
<td>5</td>
<td>3.83</td>
<td>0.824</td>
</tr>
<tr>
<td>Vision</td>
<td>131</td>
<td>2</td>
<td>5</td>
<td>4.45</td>
<td>0.757</td>
</tr>
<tr>
<td>Intellect</td>
<td>131</td>
<td>2</td>
<td>5</td>
<td>4.30</td>
<td>0.801</td>
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<tr>
<td>Patience</td>
<td>131</td>
<td>1</td>
<td>5</td>
<td>4.16</td>
<td>0.910</td>
</tr>
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</table>

Table 4
Initial factor analysis pattern matrix on 15 innovation characteristics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Factor 1</th>
<th>Factor 2</th>
<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
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</thead>
<tbody>
<tr>
<td>Flexibility</td>
<td>0.655</td>
<td></td>
<td></td>
<td></td>
<td>-0.244</td>
</tr>
<tr>
<td>Revision</td>
<td>0.636</td>
<td>0.201</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collaboration</td>
<td>0.612</td>
<td></td>
<td>-0.205</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patience</td>
<td>0.574</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reflection</td>
<td>0.574</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open-mindedness</td>
<td>0.380</td>
<td>0.368</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creativity</td>
<td>-0.206</td>
<td>1.1018</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Imagination</td>
<td></td>
<td>0.789</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Risk-taking</td>
<td></td>
<td>0.359</td>
<td></td>
<td></td>
<td>-0.269</td>
</tr>
<tr>
<td>Vision</td>
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<td></td>
<td></td>
<td>0.837</td>
<td></td>
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<tr>
<td>Intellect</td>
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</tr>
<tr>
<td>Environment</td>
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<td></td>
<td>0.644</td>
<td>0.282</td>
<td></td>
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<tr>
<td>Critique</td>
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<td></td>
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</tr>
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<td></td>
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<td></td>
<td>0.211</td>
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</tbody>
</table>

Extraction method: Principal axis factoring.
Rotation method: Promax with Kaiser normalization.

* Rotation converged in six iterations.
work of groups, individuals, and organizations having a stake in the innovation” (p. 694). More recently, Tuomi (2002) has observed that the traditional model of a heroic inventor is ... losing some of its obviousness and descriptive value. The emergence of new innovations depends to a large extent on resources that are available to potential users, as well as on constraints that limit change in their current practices. Therefore, to understand innovation, we need to understand technologies in use. (p. 11).

With regards to Research, Kline and Rosenberg (1986) have argued that “the notion that innovation is initiated by research is wrong most of the time” (p. 288). Von Hippel (1988) has concurred:

[it] has long been assumed that product innovations are typically developed by product manufacturers. Because this assumption deals with the basic matter of who the innovator is, it has inevitably had a major impact on innovation-related research, on firms’ management of research and development, and on government innovation policy. However, it now appears that this basic assumption is often wrong. (p. 3).

Though Douthwaite has included Research as part of his Start-up phase, in the Learning Selection model researchers do not design finished products. Instead, researchers introduce their “best bet” into the field where users adapt the innovation according to local conditions. Research, I should also point out, can be characterized by a variety of different academic practices. These multiple conceptions of research may have contributed to its outlying factor grouping and why more than 50% of respondents rate it as Very Important to the process of innovation.

Because Secrecy and Research were outliers they were removed from the list of 15 characteristics and Factor Analysis was then re-run using Principal Axis Factoring as the extraction method and Promax with Kaiser Normalization as the rotation method. Results indicated three distinct factor groupings that converged in five iterations. For the purpose of conducting Reliability Analysis, I labeled the groupings Stimulation (characterized by Vision, Environment, and Intellect), Germination (characterized by Creativity, Imagination, Risk-taking, and Open-mindedness), and Fruition (characterized by Flexibility, Revision, Reflection, Patience, Collaboration, and Critique). Reliability Analysis results showed that the three groupings correlated well together: Stimulation $\alpha = 0.756$; Germination $\alpha = 0.688$; Fruition $\alpha = 0.747$. Pearson Correlation results indicated the need for Multivariate Analyses (MANOVA). The correlation between Stimulation and Germination was $0.283 \ (p = 0.001)$; between Stimulation and Fruition was $0.293 \ (p = 0.001)$; and between Germination and Fruition was $0.441 \ (p < 0.001)$. MANOVA results indicated that there were no significant differences in how survey respondents grouped the innovation characteristics (Table 5). Results also suggest that there were no significant differences between how respondents rated the innovation variables and how they rated themselves as an innovative teacher ($F = 0.929, \ p = 0.431$).

Results from MANOVA analysis to determine the relationship between how respondents ranked the CETS proposal abstracts in relation to the how they view the innovative process show that there is no significant difference between how respondents ranked the abstracts and how they view the innovative process (Table 5). Responses to the innovation abstracts indicated that individual participants defined innovation differently. These results, however, suggest that regardless of how participants defined an innovative project, they were in agreement about how they defined the characteristics of an innovation process.

8. Reasons why faculty submitted grant proposals

Faculty who had submitted a CETS courseware development grant proposal were asked to respond to six statements (see Table 6) reporting possible reasons why they might have submitted the proposal according to a five point Likert scale ranging from Strongly Disagree to Strongly Agree. The goal of this section of the survey was to begin to gain a preliminary understanding of the reasons why faculty submitted proposals, which would aid in the creation of follow-up interview and focus group questions. Results suggest that a perceived

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\[ \text{Germination} \; \alpha = 0.688 \; \text{and If Item Deleted for Risk-taking} \; \alpha = 0.711 \; \text{and Collaboration} \; \alpha = 0.769 \] are borderline but within margins.
ne need for the project in their academic unit, enhancing student learning, enhancing their teaching, and adding to their development as a teacher were significantly more important to faculty for deciding to submit a proposal than the possibility of grant funding aiding them in the tenure or promotion process (Table 7). These results build on Knutel’s (1988) study of the facilitators and inhibitors of faculty decisions to use instructional technology in the classroom.

9. A local learning process of innovation

The consistent grouping of innovation characteristics across survey populations suggests that faculty and graduate students in the college conceive of a distinct, three-phase innovation process: Stimulation, Germination, and Fruition.

Stimulation. Characterized by innovation concepts Vision, Environment, and Intellect, during this phase a teacher recognizes the need for a new courseware tool. An important feature of this phase is Environment, which suggests that faculty consider innovations to be context-specific, arising out of their local circumstances. This is consistent with the most recent theories of the origination of innovations (Douthwaite, 2002; Tuomi, 2002).

Table 5
Multivariate tests for Stimulation, Germination, and Fruition across respondent populations and innovation scenarios

<table>
<thead>
<tr>
<th>Variable</th>
<th>Wilk’s Lambda</th>
<th>F</th>
<th>Hypothesis df</th>
<th>Error df</th>
<th>p</th>
<th>Observed power</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>0.855</td>
<td>1.738</td>
<td>9.000</td>
<td>304.368</td>
<td>0.080</td>
<td>0.674*</td>
</tr>
<tr>
<td>Gender</td>
<td>0.959*</td>
<td>1.641</td>
<td>3.000</td>
<td>116.000</td>
<td>0.184</td>
<td>0.421</td>
</tr>
<tr>
<td>Age</td>
<td>0.992*</td>
<td>0.156</td>
<td>6.000</td>
<td>228.000</td>
<td>0.998</td>
<td>0.089</td>
</tr>
<tr>
<td>Title</td>
<td>0.828</td>
<td>1.693</td>
<td>12.000</td>
<td>275.450</td>
<td>0.068</td>
<td>0.796</td>
</tr>
<tr>
<td>Abstract 1</td>
<td>0.955</td>
<td>0.484</td>
<td>12</td>
<td>328</td>
<td>0.923</td>
<td>0.244</td>
</tr>
<tr>
<td>Abstract 2</td>
<td>0.900</td>
<td>1.109</td>
<td>12</td>
<td>328</td>
<td>0.351</td>
<td>0.571</td>
</tr>
<tr>
<td>Abstract 3</td>
<td>0.920</td>
<td>0.869</td>
<td>12</td>
<td>326</td>
<td>0.580</td>
<td>0.448</td>
</tr>
<tr>
<td>Abstract 4</td>
<td>0.932</td>
<td>0.717</td>
<td>12</td>
<td>320</td>
<td>0.735</td>
<td>0.366</td>
</tr>
<tr>
<td>Abstract 5</td>
<td>0.905</td>
<td>1.034</td>
<td>12</td>
<td>323</td>
<td>0.417</td>
<td>0.534</td>
</tr>
</tbody>
</table>

* Exact statistic.

Table 6
Frequency results (%) for statements about possible reasons why faculty submitted proposals for courseware development projects

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I saw the need for it in my Academic Unit</td>
<td>9.8</td>
<td>4.9</td>
<td>31.7</td>
<td>53.7</td>
<td></td>
</tr>
<tr>
<td>I thought it would help me when I am up for promotion or tenure</td>
<td>26.8</td>
<td>29.3</td>
<td>17.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought it would help students learn</td>
<td>34.1</td>
<td>65.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought it would help my teaching</td>
<td>41.5</td>
<td>58.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought it would make my course more dynamic</td>
<td>2.4</td>
<td>36.6</td>
<td>61.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I thought it would aid my development as an instructor</td>
<td>2.5</td>
<td>12.5</td>
<td>40.0</td>
<td>45.0</td>
<td></td>
</tr>
</tbody>
</table>

Table 7
Chi square results for statements about possible reasons why faculty submitted proposals for courseware development projects

<table>
<thead>
<tr>
<th>Statement</th>
<th>N</th>
<th>df</th>
<th>$\chi^2$</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>I saw the need for it in my Academic Unit</td>
<td>41</td>
<td>3</td>
<td>24.659</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>I thought it would help me when I am up for promotion or tenure</td>
<td>41</td>
<td>3</td>
<td>1.439</td>
<td>0.696</td>
</tr>
<tr>
<td>I thought it would help students learn</td>
<td>41</td>
<td>1</td>
<td>4.122</td>
<td>0.042</td>
</tr>
<tr>
<td>I thought it would help my teaching</td>
<td>41</td>
<td>1</td>
<td>1.195</td>
<td>0.274</td>
</tr>
<tr>
<td>I thought it would make my course more dynamic</td>
<td>41</td>
<td>2</td>
<td>21.268</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>I thought it would aid my development as an instructor</td>
<td>40</td>
<td>3</td>
<td>20.600</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Germination. Characterized by innovation concepts Creativity, Imagination, Open-mindedness, and Risk-taking, during this phase a faculty member develops the idea for the new courseware tool, typically on paper or in theory, but not yet in practice. The Risk-taking that is a part of this phase maps onto the action faculty members take when submitting a project proposal, which is a risk because they are exposing their ideas to a committee of peers.

Fruition. Characterized by innovation concepts Flexibility, Revision, Reflection, Patience, Collaboration, and Critique, during this phase a faculty member, in collaboration with others (CETS staff, UDAs, and so forth), engages in the process of designing the innovation and assimilating it into practice. With Revision and Reflection included in this phase, faculty members have the potential to engage in a learning process over time.

10. On Collaboration

Though response patterns indicated a relationship among how respondents ranked Collaboration and other variables in the Fruition stage, many of those who had submitted a CETS grant proposal indicated that they had engaged in a collaborative activity (discussion) during the Germination phase of their projects. A significant number of respondents who had submitted CETS grant proposals reported that they discussed their proposal with their colleagues in their academic unit ($N = 46$, $df = 1$, $\chi^2 = 22.261$, $p < 0.001$) and that they discussed their proposal with members of CETS ($N = 46$, $df = 2$, $\chi^2 = 30.435$, $p < 0.001$). An expected number of respondents reported that they discussed their proposal with colleagues outside their academic unit ($N = 46$, $df = 1$, $\chi^2 = 0.783$, $p = 0.376$). These results suggest that though response patterns located Collaboration within the Fruition stage, those who submitted proposals collaborated with their colleagues prior to submitting their proposals—during the Stimulation and Germination phases. This may account for Collaboration’s borderline Reliability Analysis results. It may also suggest a discrepancy between how respondents think about the concept of collaboration and the real-world collaborative practices of those who submitted CETS courseware development proposals. Recall that one Professor placed “collaboration” alongside “innovation” in the comments section at the end of the survey, calling them a “chimera of sorts.” Yet, the faculty member also reported that they discussed their project with academic unit colleagues and CETS staff. Hall and Hord (2001) have observed that as “people plan … change processes, they tend to be preoccupied with the innovation and its use. They often do not think about the various actions and events that they and others take to influence the process, which are known as interventions” (p. 9). Conversations between the innovator and colleagues and/or administrators are one of the more important examples of collaborative activities that can have profound effects on the direction of an innovation.

11. Conclusions and challenges for educational technology support organizations

Study results suggest that survey respondents’ conceptions of innovative projects and innovation processes are consistent with contemporary models of distributed innovation and innovation processes. Such processes, however, have yet to be shown in an academic setting. A review of the current CETS grant program suggests that by going through the processes of identifying a need for a specific project, submitting the project description for evaluation, and then designing the actual tool, faculty have the potential to be engaged in learning processes. Because CETS is dedicated to developing both technology-related projects and educated faculty, they have created structures (in particular, the UDA program) designed to aid faculty once they have been awarded grant funding. Faculty whose projects have not been awarded funding (or a UDA) however, have few learning-centered options in the college other than a two-week summer workshop or walk-in assistance at CETS facilities. The dynamics and implications (social, political, pedagogical, and so forth) of “faculty training” or “faculty development” have been considered extensively (Johnson, 2000; Krauthamer, 2002; Moore, Moore, & Fowler, 2005; Owen & Demb, 2004; Smith, 1997; Zhao & Cziko, 2001). CIOs representing nearly 600 institutions who have responded to Educause Current Issues surveys rated “Faculty, Development, Support, and Training” in the top 6 of instructional technology issues that “are most important for your campus to resolve for its strategic success” every year between 2000 and 2007. However, when queried as to which
issues their campus is spending the most human and/or financial resources on, “Faculty Development, Support, and Training” has not appeared in the top ten since 2002 (Educause Current Issues Committee, 2007). This, for anyone who has spent time teaching on college and university campuses, is not likely to be a surprise. A review of the findings of this study, however, raises significant challenges for administrators of educational technology support organizations like CETS that build on questions already considered in the literature: how closely do local practices for soliciting and funding courseware development projects complement local faculty reasons for developing courseware tools, conceptions of innovative projects, and innovation processes? How can educational technology organization administrators cultivate environments that encourage all interested faculty—regardless of their educational technology adoption rates—to engage in a learning process when developing new courseware tools?

The first issue to be addressed is both practical and rhetorical: reconceiving faculty members as (and encouraging faculty to be) active learners rather than individuals who can be trained. Wenger (1998) has argued that “our perspectives on learning matter: what we think about learning influences where we recognize learning, as well as what we do when we decide that we must do something about it—as individuals, as communities, and as organizations” (p. 9). The term “training” evokes images of faculty members collected in workshop rooms, seated in front of an expert, being told how to use a certain software application. They are then expected to be able to regurgitate what they have been taught when, for example, they have to design a course web site days, weeks, or months later. Wildman, Hable, Preston, and Magliaro (2000) and Hall and Hord (2001), however, have made strong cases against the workshop model that are consistent with contemporary learning practices (Bransford, Brown, & Cocking, 1999; Brown, 2005; Freire, 2005).

The processes of innovation as conceived by members of this local community of faculty and graduate students were not merely the pragmatic developments of products from idea to completion. Rather, they were conceived as a reflective socio-cognitive learning process grounded in organizational environments and practices. Nor did the processes reinforce the traditional heroic model of innovation, which, due “to the increasingly knowledge-intensive and networked nature of innovation processes ... is being replaced by a social model of innovation” (Tuomi, 2002, p. 220). In this new, social model, “innovations emerge and become articulated when they are taken into meaningful use in social practice.... As a result, innovation and technological change can be studied as phenomena that occur within an ecology of such communities” (Tuomi, 2002, pp. 4–5). Tuomi’s practice-related communities recall Wenger’s (1998) community of practice. Wenger, McDermott, and Snyder (2002) have suggested that “a community of practice [is] an ideal knowledge structure—a social structure that can assume responsibility for developing and sharing knowledge” (p. 29). Brown and Duguid (1991) have argued that from a “process-based standpoint ... learning [is] the bridge between working and innovating” and observed that “communities of practice are significant sites of innovating” (p. 41). The shift to community means a shift from individualistic views of the enterprise to the view of a larger, shared enterprise: faculty teaching and learning with technology—together. A challenge for administrators of educational technology support organizations is to cultivate environments and structures from which emerge authentic learning among faculty of all skill levels (see, for example, Wildman et al., 2000).

Building an environment that cultivates communities of practice “entails integrating communities into the organization—giving them a voice in decisions and legitimacy in influencing operating units, and developing internal processes for managing the value they create” (Wenger et al., 2002, p. 12). The current CETS model for funding the development of courseware innovations does not yet provide all faculty with the ability to actively engage in such communities of learning. Indeed, the process focuses on the success of individual projects rather than the continued development of all interested faculty as learners. This is a significant side-effect of using a competitive system to help determine which faculty projects will receive funding, and therefore, which faculty will have an opportunity to learn more about educational technology courseware and its development. Kohn (1999) has argued that in competitive systems the central message that is taught ... is that everyone else is a potential obstacle to one’s own success. If the reward system sets people up as one another’s rivals, the predictable result is that each will view others with suspicion and hostility and, depending on their relative status, perhaps contempt or envy as well. (p. 55)
Furthermore, Kohn (1999) has observed that “those who believe they don’t have a chance of winning are discouraged to apply themselves except to defeat their peers, and convinced that they cannot do so, these people are almost by definition demotivated” (p. 56). Kohn’s observations are not merely hypothetical; one Professor who responded to the survey stated: “After [being] rejected for my two proposals ... I just refuse[d] to submit any more proposals.” Though there are numerous reasons why a project may not be funded, the Professor’s frustration and resentment are palpable.

Further research is needed to learn more about local faculty conceptions about innovative projects and the processes they use to development courseware tools. Qualitative follow-up interviews and focus groups would be a logical next step, as would ethnographic studies of faculty collaborating with colleagues on the development of their project. Results would have the potential to map more accurately the processes faculty use when developing courseware tools.

Research is also needed to determine how significant local environments are for faculty conceptions of innovation. This study could be replicated at varied institutions of higher education (including two and four-year). A large-scale study would provide administrators of educational technology support organizations with greater insight into how faculty conceive of the processes of developing innovative courseware tools.

Administrators of programs like the CETS grant program should recognize the potential danger such programs can pose to the development of a community of learners. Administrators should then identify ways to ensure that all interested members of the community are engaged in conversations about teaching and learning with technology regardless of their individual outcomes in a competitive process. By creating structures that reinforce locally conceived models of innovation processes, administrations have the potential to aid in demystifying the nebulous rhetoric of innovation and change that has overwhelmed higher education, and address the very real concerns of faculty innovation fatigue and change exhaustion.

Acknowledgements

I am indebted to Margaret A. Syverson, Diane Penrod, Nancy Heger, Daniel Updegrove, Linda Ferreira-Buckley, John Slatin, and Shanna Smith, each of whom offered their time, expertise, and suggestions during the preparation of this article and the study that informed it. I am deeply grateful for the support and cooperation of the students, staff, and administrators of CETS, without whom this study would not been possible.

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