Towards Improving Dissemination and Building Community for Course, Curriculum and Laboratory Innovations using the NSDL

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Introduction

The National Science Foundation (NSF) Course Curriculum and Laboratory Improvement (CCLI) program[1] fosters innovation nationwide and works to improve the "quality of science, technology, engineering, and mathematics (STEM) education for all undergraduate students." [2] Since 1999, the program supported a multitude of individual projects, some that have gone on to be widely disseminated, such as the Python Robotic programming language (developed under a CCLI grant), while many have remained local to the individual investigator or campus.

This study was undertaken to understand how to "*foster better dissemination of CCLI-developed educational innovations".* The research focused on understanding how CCLI principal investigators currently view dissemination of their educational innovations and what barriers might exist to broader dissemination. The expected product of the study is the issuance of a set of recommendations to improve the diffusion of CCLI innovations into a broader array of educational venues.

This report summarizes: preliminary findings from a survey of CCLI Principal Investigators (PIs) and NSF's Cognizant Program Directors (PDs), and results of panel discussions held during a meeting of invited experts in the area of STEM education as well as the results from the general discussions held at that meeting.

The findings include:

1. The most frequently used methods of dissemination do not lead to desired outcomes.
2. NSF PDs and CCLI PIs hold differing opinions about what constitutes effective dissemination practice, which leads to overuse or over reliance on ineffective dissemination venues and vehicles.
3. NSF PDs and CCLI PIs hold different definitions, and possibly have different expectations, about what constitutes successful dissemination.

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[1] In 2010, the name of this program was changed to: TUES – Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics. The overall purpose of the program remains similar: to encourage projects that have the potential to transform undergraduate STEM education.

[2] Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics (TUES), program, http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=574

This report recommends:

1. In order to provide effective educational innovations and methods to the undergraduate teachers, funding agencies must increase the emphasis on active dissemination which builds communities of practice around specific resources and shares the knowledge of how to adapt them to varied learning environments.
2. Developers must be encouraged and supported to go beyond traditional methods of dissemination. Potential adopters must also find value in investing their time to incorporate new innovations into their teaching practices. University rewards systems can go a long way to provide the necessary incentives.
3. Adopters and developers must be brought together using computing and communication technology combined with social networking processes to provide the best propagation mechanisms and continuing communal support.

Evolution of the Program

The National Science Foundation (NSF) Course Curriculum and Laboratory Improvement (CCLI) Program has produced a vast number of educational products and processes since its inception. The CCLI Program has fostered innovation nationwide and has worked to improve "quality of science, technology, engineering, and mathematics (STEM) education for all undergraduate students." More often than not these innovations remain local, in that they are only developed and used by the initiating investigator(s) and are tied to the funding. Once the initial funding ends the investigators move on. Since 2004, the CCLI Program has included a multi-stage plan to encourage scale up of these innovations—extending the reach from small test-beds to national dissemination. However, this process typically recognizes and disseminates only fairly large-scale innovation; the result is that most innovations developed through the CCLI Program continue to 'stop where they started.' Relatively few CCLI projects, or their results, are integrated into daily use by the larger set of teachers and learners who might benefit from these innovations, and who should take advantage of existing projects thereby eliminating the need to regularly re-invent these works.

> *The central question for this study is how to foster better dissemination of CCLI-developed educational innovations?*

Our experience and anecdotal evidence suggests that effective dissemination is limited by the energy and knowhow of the developer. Adoption and adaptation of the materials by the broader science, technology, engineering, and mathematics (STEM) education community appears to be constricted by the way in which materials are made available and/or by the lack of available places that allow user communities to easily exchange best practices.

Current Dissemination Practices

For the initial purposes of this study, *dissemination* was defined to be the diffusion of innovation into the everyday practices of teaching/learning community members who are interested in specific subject matter. Effective dissemination goes beyond broadcasting

information on the existence of an innovation, but rather it additionally involves making the innovation available, supporting the adoption of the innovation by others, and finally facilitating or scaffolding the adaptation of the innovation to the large variety of educational environments. The statement of this definition was modified once all of the information collected in the study was processed, but the intended meaning stayed basically the same.

To determine the types of dissemination practices CCLI Principal Investigators (PIs) use and believe to be most effective, we surveyed the 2,463 CCLI PIs who had received funding since 2000. The response rate was 55% with 1,285 filling out the survey either completely or partially. In addition to the survey we also convened a panel of 35 experts and practitioners [1] to consider the problem, typical dissemination practices and potential solutions, The preliminary survey results were used as a starting point for the discussion.

In the survey we asked CCLI PIs to rate a set of 'traditional' dissemination activities (i.e., activities perceived as more academic such as writing and presenting papers or workshops) in terms of their success as dissemination vehicles. We also asked them to rate a set of online dissemination activities. In parallel, we surveyed NSF Program Directors (PDs), asking them similar questions with regards to their perceptions of the success of these methods for disseminating innovations. We also asked both sets of respondents the open-ended question:

> *Briefly describe what successful dissemination of your educational innovation means to you?*

We asked respondents to be as specific as possible, avoiding generalities such as 'lots of students' so that in our coding we could quantify or qualify the outcomes.

The scope of this work only allowed for a high level, descriptive summary of the data, which included a first pass at content analysis of the open-ended questions. No in-depth or predictive statistical analyses were performed because of the limited project funding. At this first pass on the data analysis, we focused on looking for any discrepancies between how the PIs and PDs described effective dissemination in response to open ended questions, how the PIs view effective dissemination and their practices (what they say is effective and what they reported doing to accomplish it), and differences between the PI's and PD's ratings on the successfulness of 'traditional' and online/social networking dissemination methods.

'Traditional' Dissemination Methods

The following sections focuses on the survey question: "*Some of the ways that the NSF has recommended disseminating educational innovations are listed below. Please rate the success of using these methods in terms of disseminating your educational innovation.*" For the purposes of this report, we describe the set of dissemination methods described in Tables 1 and 2 as 'Traditional' methods, that is, those methods that tend to be more familiar and historically recognized ways of sharing academic or scholarly knowledge.

Table 1 lists the percentage of all CCLI PIs who reported using a particular dissemination method. As illustrated by the table, the most popular methods are those that have undergone peer review, e.g., journal (65%) or conference (87%) papers or posters (73%) at conferences. Workshops, be they local, regional or presented at a conference, are less popular with reported usage ranging from 45% to 58%. More 'informal' methods such as posting or writing a white paper, or using promotional materials were used the least.

Table 1: Percent of Respondents Who Reported Using a 'Traditional' Dissemination Method

	% All CCLI PIs (n = 1,209)
Paper for publication in peer reviewed journal	65
White paper	22
Paper/presentation at professional conference	87
Workshop/seminar held on home campus	58
Invited workshop/seminar at another campus	45
Workshop/seminar at professional conference	54
Poster at professional conference	73
Booth at professional conference	20
Paper/presentation posted to website	56
Promotional materials, e.g., book mark, flyer, etc.	31

While the CCLI PIs identified the particular dissemination mechanisms they used, why these PIs chose to use or reject a particular dissemination method was not explored in this survey but was discussed at the 2010 study group meeting as discussed below. At this level of analysis it is also unclear what impact, if any, the stage of the development project has on dissemination. Only 6.5% of the PIs were in the planning stages of the project and only 2% reported that the project was not as successful as anticipated so they did not disseminate it. The low numbers of these respondents suggest that they did not affect the overall finding significantly.

In addition to telling us which methods were used most frequently by PIs, the question also asked respondents to rate how successful they felt each method is as a dissemination mechanism. Table 2 summarizes the 'top box score' (the 'top box score' is the percentage of those who chose either of the two highest responses – successful or extremely successful) for the question.

In analyzing these data we compared the responses from only those PIs who are currently disseminating their innovation or who have already disseminated their results at the completion of their project, to responses from all CCLI PIs to determine how experience might impact responses, if at all. Based on this level of analysis, it appears that they do differ. Experienced disseminators, in contrast to their counterparts, see peer reviewed methods as being more successful. One possible explanation for this difference might be in the acceptance rate of papers and presentations for there is a tendency for peer reviewed journals and conferences to favor papers/presentations based on results, meaning reports made at the completion of a project over those in progress. Opinions about workshops also differed, especially those conducted off campus. While there appears to be good agreement

about workshops held on one's home campus, once they move off campus it appears that PIs experienced in disseminating their innovation find them to be more successful. It also appears that this group tends to believe that posting papers and presentations to a website is successful. It is important to note that the type of grant, in other words Type 1, 2 or 3, may have impacted these results, for those who did not indicate they were actively disseminating their innovation may be predominantly newly funded or have received a Type 2 grant, and therefore do not yet have access or opinions about some of the dissemination mechanisms.

Table 2. Top Box Score* for Success of 'Traditional' Dissemination Methods

	% All CCLI PIs (n = 1,209)	% CCLI PIs Actively Disseminating Innovations (n = 638)	% NSF PDs (n = 14)
Paper for publication in peer reviewed journal	46	54	71
White paper	10	10	7
Paper/presentation at professional conference	75	82	71
Workshop/seminar held on home campus	55	52	64
Invited workshop/seminar at another campus	38	45	100
Workshop/seminar at professional conference	47	52	100
Poster at professional conference	54	60	50
Booth at professional conference	12	15	43
Paper/presentation posted to website	36	43	29
Promotional materials, e.g., book mark, flyer, etc.	20	24	50

Scale: 1 = not at all successful – 5 = Extremely Successful
* Top Box Score: total results of top two ratings on five-point scale

More striking perhaps, are the differences between the NSF PD's and the CCLI PI's beliefs about successful dissemination methods (regardless of their dissemination effort). Although one must take into account the small response rate (20%) for the PDs, the results do suggest that the PDs see workshops as being highly successful (based on these results one could argue they see them as essential) dissemination efforts. PDs also see more marketing style dissemination techniques such as booths at professional conferences (43%) and promotional materials (50%) as being effective. In contrast, CCLI PI's tended to view these as not particularly successful with ratings ranging from 12% to 24%. And more than the PIs, PDs see peer reviewed publications as being much more successful.

In the study group discussion of the survey results, some members of the presentation panels as well as meeting participants observed that the most 'successful' dissemination activities reflected the reward system for faculty members. (CCLI PIs are for the most part faculty members at two and four year institutions of higher education). So, the high support for publication among the PDs might reflect their desire to support faculty members' efforts to gain tenure or receive promotion. Members of the panel and meeting participants, especially those who are or were PIs, noted that they were unaware of how to

disseminate by doing anything other than following the more 'academic' pathways, e.g., papers or presentations.

Based on other research and the experience of this project's leaders, there may be several reasons the PIs do not view workshops as positively as the PDs. They are time and resource intensive, and require that the participants already know about or are interested in learning about an innovation in-depth. Usually, this means that the project is well beyond the Type 2 funding available from the program. Workshops may also be hampered by the complicated relationship between adoption of innovation and dissemination, meaning that if a faculty member is not interested in adopting something, no dissemination strategy will be effective.

The reliance upon more 'passive' methods of dissemination (i.e., the non-marketing style efforts) is also interesting given that the PIs tended to define the outcomes of effective dissemination as being adoption by others. This opinion was shared by the PDs. Both PDs and those PIs who were active disseminators felt that use of their innovation as a building block to the secondary innovation built by others was a desirable outcome. These kinds of disconnects between belief and action about dissemination methods deserves more attention both in terms of analyzing the existing data set and in terms of future research.

Online/Social Networking Dissemination Methods

The Web has made available new dissemination vehicles that extend and are different from those we have described as 'traditional'. We were particularly interested in learning more about the use of these methods by CCLI PIs. Tables 3 and 4 summarize responses to the question: *Please rate the success of your use of the Web as a dissemination vehicle*. In this question we listed a number of options, focusing mainly on digital libraries, repositories and social networking tools.

Table 3 shows that by far the most popular online method used by CCLI PIs was hosting a website at the campus level with information about the innovation. While recommended as a dissemination method in the CCLI request for proposals since 2004, contributing to a digital collection of some sort is not regularly used. Its reported use ranged from 17% to 29%. Even lower usage was reported for those methods often associated with social networking tools such as blogs, or community sites such as Facebook.

Newer methods, emerging from the use of the Web as a dissemination vehicle, are in sharp contrast to the more 'traditional' methods described above. At this point in time, the results from the survey do not give us specifics about why this is so. Hosting a website seems to be becoming a normal activity for many of the PIs. This may be because there is adequate campus technology support for this kind of activity or because the materials are posted on a learning management system for the students. Regardless, this type of activity seems to be more integrated into an instructor's work habits. The results also may be affected by time. Almost half (52%) of the respondents reported that their project was complete. We do not have the data for when these projects were completed, but it is likely that a number of the projects were completed before use of the Web for dissemination purposes became possible or popular. Lack of the use of social networking sites might be explained by the relatively new and untried nature of the resource. Lack of use by PIs in this case might be

consistent with the tendency on the part of all faculty members to regard these tools with suspicion. However, Wikipedia has been a well-known site with many users since 2001 and used widely in a number of disciplines such as math, as a repository for content, though it received the lowest use of any option suggested to the survey respondents.

Table 3: Level to Which Online/Social Networking Dissemination Methods Used

	% All CCLI PIs (n = 1,209)
Hosting a website on your campus with information about the educational innovation	70
Contributing to a digital library collection in your discipline	29
Contributing to a digital library collection or institutional repository on your campus	20
Contributing to a digital library collection such as the NSDL	22
Contributing to an opencourseware collection	17
Posting a video to YouTube or similar site describing the educational innovation	13
Posting to Wikipedia about the educational innovation	9
Using a asocial network site, e.g., Facebook or MySpace, to promote the educational innovation	11
Hosting a blog about the educational innovation	12
Posting to a blog about the educational innovation	14

Of note in the Table 3 data is the fact that few PIs indicated that they contribute (use) information to digital library collections such as the NSDL. The study group suggested two likely reasons for this result; the first relatively easy to remedy, the second more difficult. First suggested is that PIs simply do not know of the NSDL and its subsidiary collections referred to as pathways. The NSF has taken steps to remedy the lack of knowledge of the existence of the digital library by incorporating into the CCLI RFP the recommendation that PIs use the NSDL as a dissemination mechanism. Secondly, it was suggested that the NSDL lacks proven success which causes low usage. While each of the NSDL pathways publishes the rate of activity on the sites as an indication of success, activity rate is not truly an indication of adoption but rather an indication of someone taking the first step towards possible adoption – discovery. Further, for those who gauge success based on the traditional faculty rewards system, which generally does not include measures related to digital library activity, using the NSDL for dissemination produces no tangible benefit.

Table 4, which summarizes the CCLI PIs' and NSF PDs' opinions regarding the success of these web services as dissemination vehicles, provides some insight into beliefs about the effectiveness of this mode of dissemination. It appears that NSF PDs tend to believe that online and social networking tools are effective dissemination mechanisms. Few PIs believe that anything other than posting information about the innovation on their campus websites is successful. In general, contributing to a digital collection be it a library, repository, opencourseware collection or Wikipedia is not viewed as successful by this group, regardless of the type of collection. It is interesting to note however, the difference between ratings of Wikipedia, where all PIs rated its success much higher than those who are actively disseminating their project.

Table 4. Top Box Score for Success of Online/Social Networking Dissemination Methods

	% All CCLI PIs (n = 1,209)	% CCLI PIs Actively Disseminating Innovations (n = 638)	% NSF PDs (n = 14)
Hosting a website on your campus with information about the educational innovation	48	54	21
Contributing to a digital library collection in your discipline	19	20	50
Contributing to a digital library collection or institutional repository on your campus	10	10	7
Contribute to NSDL	12	12	43
Contributing to an opencourseware collection	10	10	50
Posting a video to YouTube or similar site describing the educational innovation	7	6	36
Posting to Wikipedia about the educational innovation	12	2	21
Using a social network site, e.g., Facebook or MySpace, to promote the educational innovation	4	3	29
Hosting a blog about the educational innovation	4	4	14
Posting to a blog about the educational innovation	4	4	14

Scale: 1 = not at all successful – 5 = Extremely Successful

* Top Box Score: total results of top two ratings on five-point scale

Why the survey respondents believe these methods are not effective remains an open question. When discussing these results, the panels and meeting participants observed that lack of knowledge on the part of the PIs about digital libraries, collections and repositories was a primary reason for which they are not rated as successful. This was particularly true about the options associated with the NSDL. Like other online methods, use of the NSDL may also be a result that it has not shown how effective it is in its own dissemination efforts. As a result, potential contributors such as these PIs may hesitate to contribute their materials. Unfortunately, this becomes a circular problem: the method is not used because it is not shown to be successful – to understand whether the method is successful a number of people need to be using it. Compounding this hesitation in using online methods may be the work or perceived work it takes to ready materials for contribution or for cataloging. A barrier may be for example, not having a resource website that can be cataloged in a broader vehicle like the NSDL or opencourseware collection.

Defining Effective Dissemination

We felt it important to ask both the PIs and the PDs to tell us in their own words how they measured successful dissemination. To that end, we included the open-ended question: *Briefly describe what successful dissemination of your educational innovation means to you?* The question for the PDs was slightly different in that it did not focus on a particular innovation but on all innovations funded by NSF. Responses to these questions would allow us to determine if there were significantly different expectations about what 'successful' dissemination means and how PIs should go about it.

Three themes emerged during the content analysis for this part of the survey. Respondents described successful dissemination in terms of the:

- number of users,
- vehicle for dissemination, and
- outcomes of dissemination.

The vehicles for dissemination tended to reflect the forced choice responses to the forced choice survey questions. PIs tended to describe success around the number of users more than the PDs. Approximately 20% of the PIs, regardless of their experience with dissemination, defined its success in terms of large numbers of instructor or student use. Only 7% of the PDs mentioned this metric with regards to students and 14% with regards to instructors. The two groups were, however, consistent with regards to listing the number of institutions as adopters of an innovation.

PIs and PDs differed in their descriptions of the outcomes of successful dissemination. The majority of the PDs focused on outcomes associated the wide dissemination to a professional community (50%) or adoption by others (71%) with some interest in there being sufficient growth to support continued development (by others) of the innovation (21%). In contrast, PIs focused on adoption by others (approximately 27%) with less than 10% describing dissemination to a professional community, making real changes in the quality of teaching or learning or supplemental use of innovation by others. So, adoption by others stands as the primary measure of success, PIs and PDs differing mainly along the dimension of the number of adopters. This finding as supported by the panelists and meeting participants; it highlights that <u>'successful' dissemination is not simply telling others about it, but instead dissemination must focus on encouraging its use by others.</u>

Workshop

A panel of 35 experts and practitioners was convened in February 2010 to consider the question:

> *"How can NSF and successful CCLI grantees foster better dissemination of CCLI-developed educational innovations?"*

Workshop participants were presented:

- The initial analysis of the survey results from CCLI PIs and NSF PDs
- Presentations providing perspectives on dissemination, including how the individual/organization approaches dissemination, what do they do that's successful and what are the major issues from their perspectives. NSDL, professional societies, commercial publishers, and others.
- Practical experiences of the participants.

Meeting discussions were posted to workshop website [2]. Outcomes included a list of informal recommendations for individual PIs, professional societies, publishers, campuses and administrators, and NSDL. The agenda and participants list are in Appendix I.

Emergent Themes

How is "dissemination" defined, and are PIs and PDs sharing an understanding of what it means to disseminate?

Panel participants spent quite a bit of time discussing what is meant by dissemination, probably more than they spent discussing effective dissemination. This highlights the challenge that most PIs and perhaps PDs face in clearly articulating what dissemination means to them, and what how they plan to conduct effective dissemination.

The results from the CCLI PI and NSF PM surveys, along with the review and vetting of the results by our panel, suggest that there are multiple definitions and understandings about:

- what dissemination means
- what should be disseminated
- how it should be disseminated, and
- what constitutes effective dissemination, i.e., what are the appropriate outcomes for dissemination?

For the purposes of this report, we turned to the NSF RFPs to get a better sense of what the definition has been. A quick content analysis of the CCLI RFPs since 2000 shows that while there is increasing interest in and support for dissemination there are differing descriptions and outcomes suggested. For example, the 2009 RFP makes no specific reference to dissemination outcomes, merely suggesting that Type 2 proposals should go beyond a single institution while the examples for Type 3 suggest a national audience, no mention is made about the outcomes for dissemination of Type 1 projects. This description is in sharp contrast to the 2002 RFP that lays out specific dissemination outcomes for each of three tracks, moving from dissemination of information about the prototype (track 1) to a professional community in the other tracks to the requirement of a plan for self-sustained distribution of the innovation.

It is no surprise then that CCLI PIs might hold differing opinions about what constitutes a good dissemination plan and the kinds of dissemination activities that are preferred by NSF. The lack of clarity is exacerbated by the fact that the PIs, while experts in their content domain, and possibly in terms of pedagogy, are not expert or knowledgeable about dissemination. As we have found, they rely mainly upon traditional academic tools, i.e., peer reviewed papers and conference presentations, for their main dissemination efforts.

Panelists and meeting participants suggested that dissemination is more than the "diffusion of innovation" view promoted in Everett Rogers's work, which has guided much of the dissemination efforts to date. Instead it is a set of activities that revolve around and

include a number of activities associated with adaptation and adoption of an innovation. They suggested that perhaps the notion of "theories of change" might be helpful in both defining dissemination, as well as in describing the project's goals for effective dissemination. Similarly, an understanding of the research and resulting strategies from "how people learn" might be effective in developing effective dissemination strategies.

Perhaps one of the most striking observations emerging from our research and the meeting is that effective dissemination is hampered without a coherent understanding of the meaning, models and practices associated with dissemination by the STEM community. The survey results and the discussion by the panelists and meeting participants indicate that we should undertake an effort to look at and understand dissemination differently. As we now know, PIs engage in dissemination activities that are about making information concerning an innovation available primarily through academic and scholarly venues, which can be considered relatively passive in their approach. NSF PDs, while supporting this approach also look to more active approaches and those supported by online knowledge (and community) building tools and resources. Regardless of method, both sets of people see actual adoption as a critical measure of successful dissemination. This combination of factors suggests that we might consider some of the new work being done primarily in the public health realm that looks at the overlaps among knowledge utilization, diffusion, implementation, transfer and translation (Ottoson & Hawe, 2010).

Dissemination as an organizational commitment

Panelists and meeting participants reiterated that dissemination takes a community: a community that supports both the disseminator and the adopter/adapter.

Dissemination has not been valued or focused on during the full life-cycle of the development of an educational innovation. Dissemination, partially because of the funding methods supported by NSF, has been seen as an "after-the-fact" sort of activity. First, I'll develop and test my educational innovation and then I'll concern myself with disseminating it if it's successful. But it's still primarily an individual activity. Whether for lack of external grant funding to support dissemination specialists ("I need more money for graduate students, technical staff, or summer salary") or (perceived?) lack of organizational support ("There's nobody on my campus who can help me to package and distribute my innovation."), or ("Having someone from another campus adopt my work is not valued by my chair")

Educational innovation has been individual investigator driven, taking it beyond the individual sustaining it. Dissemination, and more importantly local sustainability, has relied on individual faculty member's getting good at networking, both locally on their campus and with peers at other campuses. By seeking out the departments, and organizations (like teaching and learning centers or local faculty development institutes) that can help out, some success has been achieved. So if dissemination is important, there needs to be specialists and organizations prepared to help faculty. If dissemination=sustainability then this becomes important to administrators at campuses—if their faculty participate in educational research, then the campus is by default investing it's time and effort, and it's in the institution's best interest to see a return on that investment (and not just let the idea drop).

Conclusions and Recommendations

1. The most frequently used methods of dissemination do not lead to desired outcomes.

CCLI PIs see the outcome of adoption by faculty and students as the main result of their dissemination practices. Unfortunately, the practices that most PIs use to disseminate their innovations (conference presentations, papers or posters and peer reviewed journal articles) are not particularly effective means for encouraging adoption of an innovation. These forms of dissemination do not typically include kinds of information necessary for another instructor to adopt or adapt their innovation. Instead, these forms of dissemination tend to focus on the research side of the project, leaving out the stories of "how" and "why" certain choices were made in the design and development. These "sanitized" histories tend to say what worked, not what didn't work and more importantly why didn't it work, which is critical information for the potential adopter.

Recommendation:

> Developers must be encouraged and supported to go beyond traditional methods of dissemination. Presenting papers at conferences or in journals has a limited effect and does not produce the desired broad diffusion of an innovation. Potential adopters must find value in investing their time to incorporate new innovations into their teaching practices. New innovations must be sufficiently well-proven to permit others to justify the work they must commit to in going through an adoption process. University rewards systems can go a long way to provide the necessary incentives. While it is still desirable to continue to base rewards on peer reviews, it may be time to examine the definition of peer review as it relates to pedagogical practices and resources.

2. NSF PDs and CCLI PIs hold differing opinions about what constitutes effective dissemination practice, which lead to overuse or over reliance on ineffective dissemination venues and vehicles.

There are striking differences between what the NSF PDs and CCLI PIs see are successful dissemination methods. Many of the PIs steer away from the workshop approaches. Only around half of the PIs have implemented workshops whether on campus, regional or associated with a professional conference. And, only about half of the PIs see workshops as a successful dissemination method. This is in sharp contrast to the 100% belief on the part of the NSF PDs that workshops are a very successful means of dissemination. NSF PDs also see more potential for success with online dissemination methods. In particular they see contributing materials to digital libraries that are not a part of the PI's institution as successful. And, about a third of PDs viewed the use of online social networking sites such as YouTube or Facebook as successful methods. These beliefs contrast fairly sharply with those held by the PIs who indicate a 10% to 20% range of agreement with posting materials to digital libraries and the 5% or so who reported they thought online social networks were successful.

Recommendation:

> Adopters and developers must be brought together using computing and communication technology combined with social networking processes to provide the best propagation mechanisms and continuing communal support.

3. NSF PDs and CCLI PIs hold different definitions, and possibly have different expectations, about what constitutes successful dissemination.

Differences between the way PIs and NSF PDs view dissemination suggest that CCLI PIs do not understand dissemination in the same way as NSF PDs even though there is general agreement that the primary outcome of dissemination should be adoption by others. The PIs view seems to be that innovation needs to be disseminated directly to instructors or students, while the NSF PDs see dissemination landscape more broadly including professional communities, other developers, and anyone who may use the resources in practice. . So while PIs are mainly concerning themselves with showing adoption of the innovation in terms of numbers of users, NSF PDs seem to be equally interested in finding effective practices for disseminating innovation as well as actual adoption numbers.

PIs however, are STEM faculty and most are not experts in propagating good teaching practices, let alone knowing how to get their peers to actually adopt an innovation. Clearly, some PIs are expert at this or willing to take on the challenge in that they pursued Type 3 funding. But, these PIs seem to be the exception rather than the rule. Our panelists agreed that perhaps it is unreasonable to expect every Type 1 grantee to disseminate the innovation to the same level as Type 2 and 3 PIs do, suggesting that expectations should be more clearly defined by grant type.

Recommendation:

> In order to provide effective educational innovations and methods to the undergraduate teachers across the country, funding agencies and faculty members must increase the emphasis on active dissemination which builds communities of practice around specific resources and shares the knowledge of how to adapt them to varied learning environments. Both developers as well as adopters must be supported in their processes by a central resource service that has sufficient expertise to identify effective resources, increase community awareness of resource existence and efficacy, build community around individual resources to provide support as they are integrated into practice, and provide feedback and guidelines to developers as to best practices that make resources disseminatable.

Summary Dissemination is a multi-layered activity and needs to be better understood

The survey data and the discussions, by the panelists and meeting participants, of the problems associated with dissemination revealed a multi-layered and rocky landscape in which CCLI PIs' attempt to disseminate CCLI sponsored educational innovations. CCLI PIs and NSF PDs hold differing opinions about effective dissemination strategies even though for the most part they have similar ideas about what should be the outcome of dissemination. PIs struggle to balance NSF expectations about dissemination that may or may not be realistic depending on the Type of funding received; this is especially true for Type 1 projects. The differences are enough to raise the following questions:

- What is appropriate dissemination for the Type of project and for what audience?
- What about each project should be disseminated?
- How do we know when dissemination has been successful?

References

[1] Dissemination of CCLI Educational Innovations Study Group, February 18 - 19, 2010, FDIC L. William Seidman Center, 3501 Fairfax Ave. Arlington, VA 22226

[2] http://einnovations.org/nsdl-ccli-dissemination/

[3] "The complexities of transforming engineering higher education: Report on characterizing the impact and diffusion of transformative engineering education adoptions", Lichtenstein, G, (2011).. NAE. URL: http://www.nae.edu/File.aspx?id=53724

[4] "The role of collaborative reflection on shaping engineering faculty teaching approaches", *Journal of Engineering Education*, McKenna, A., Yalvac, B., & Light G. (2009). 98 (1), 17-26.

Additional references are found in Appendix II: Reading list for Study Participants.

Appendix I

DisseminatIon of CCLI Educational Innovations

Study Group
February 18 - 19, 2010
FDIC L. William Seidman Center
3501 Fairfax Ave. Arlington, VA 22226

AGENDA

Meeting Purpose

This study group has been convened to consider the question: H*ow can NSF and successful CCLI grantees foster better dissemination of CCLI-developed educational innovations?* The study group participants range from PIs of small focused grants to large dissemination efforts. Expert guests represent publishing in both the profit and non-profit sectors, researchers concerned with dissemination of STEM educational innovations, the NSDL and NSF program staff.

The charge of this group is to review the status of what we know about dissemination of STEM educational innovation. This review will include reviewing and discussing:

- results of the recently completed survey of CCLI PIs regarding their dissemination efforts
- results of survey of NSF CCLI program officers (past and present) regarding their impressions of dissemination
- results from researchers who study educational innovation dissemination
- and of course practical experiences of the participants in study group.

Meeting Outcomes

1. Identification of critical issues and barriers to effective dissemination
2. Identification of methods for overcoming impediments to dissemination
3. Identification of effective models for dissemination
4. Identification of processes, mechanisms and bridges to connect CCLI PIs with dissemination collaborators, e.g., NSDL, publishers, or OER
5. Identification of effective practices for developing adopter communities
6. Identification of mechanisms for disseminating effective practices to all CCLI PIs

The ultimate outcome of the meeting will be the development of a dissemination guide for CCLI PIs. The format of the guide will be generated in part, based on the deliberations of the group and feedback from participants.

<u>Wednesday, February 17, 2010</u>

Participants who arrive early enough will meet in the lobby of the hotel at 6:30 pm

for informal evening dinner.

Thursday, February 18, 2010

8:00 am **Continental Breakfast**

8:30 am **Opening Session – Welcome, Introductions and Review of Agenda**

- Framing the workshop and review of agenda , Joe Tront, Flora McMartin, Brandon Muramatsu
- Russ Pimmell – opening remarks
- Participant introductions

9:15 am **What we know about CCLI PI Dissemination Efforts**: Report on Survey Results led by Flora McMartin

10:30 am **Break**

10:45 am **Setting the Context for Study Group** moderated by Brandon Muramatsu
Panel discussion: Steve Ehrmann, Melissa Dancy, Elaine Seymour, Norman Fortenberry

12:00 pm **Lunch - working lunch – Group Discussion**

1:00 pm **Report back from small groups -** facilitated by Flora McMartin

2:00 pm **Break**

2:15 pm **Industry Panel – How do the Professional Approach Dissemination -** moderated by Joe Tront
Publisher (Sayre, Wiley), Professional Society (Pearson, MAA), NSDL (Howe, UCAR/NSDL) How do these organizations differ in approach to dissemination; what do they do that's successful; what do they see as major issues they are facing?

3:15 pm **Discussion and break into small groups -** facilitated by Flora McMartin

4:30 pm **Summary of the day** –Jeanne Narum and Robert Beichner

6:00 pm **Dinner** -- meet in the hotel lobby

Friday, February 19, 2010

8:00 am **Continental Breakfast**

8:30 am **Overview of where we are now** – Facilitated by Brandon Muramatsu

9:00 am **What can we recommend to Funders, PIs and Publishers with respect to dissemination? -** Moderated by Brandon Muramatsu
Small working groups focus on recommendations

10:00 am **Participants shift** to new groups - and discussion continues - facilitators/recorders stay the same.

11:00 am **Break**

11:15 am **Report out by groups** - facilitated by Flora McMartin

12:00 pm **Working Lunch – Prioritize Recommendations**
Small group discussion

1:00 pm **Merge Priorities** facilitated by Joe Tront

2:00 **Workshop Summary and Path Forward**

2:30 pm **Afternoon Departures** -car pools?

Participants

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Attendees		

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Susan Hixson		
Victor Piotrowski		
Scott Grissom		
Linda Slakey		
Connie Della-Piana		

Appendix II

NSDL-CCLI Dissemination Study Group - References/Bibliography

- Stephen C. Ehrmann, Steven W. Gilbert, and Flora McMartin. 2006. Factors Affecting the Adoption of Faculty-Developed Academic Software: A Study of Five iCampus Projects. TLT Group.
  Read Executive Summary:
  http://icampus.mit.edu/projects/Publications/TLT/exec_sum_icampus_assessment.pdf
  (Optional) Full Report:http://icampus.mit.edu/projects/Publications/TLT/iCampus_Assessment_Full.pdf

- Roberta M. Spalter-Roth, Norman Fortenberry, and Barbara Lovitts. 2006. "Acceptance and Diffusion of Innovation: A Cross Curricular Perspective on Instructional and Curricular Change in Engineering". American Sociological Association and the Center for the Advancement of Scholarship on Engineering Education of the National Academy of Engineering.

Read Executive Summary: PDF extract
(Optional): http://www.nae.edu/File.aspx?id=11552

- Melissa Dancy and Charles Henderson. 2008. Barriers and Promises in STEM Reform. Workshop on Promising Practices—Innovations in Undergraduate STEM Education, National Academies Board on Science Education, October 13-14, 2008.

Read:
http://www7.nationalacademies.org/bose/Dancy_Henderson_CommissionedPaper.pdf

- P. Uri Treisman. 1993. What Works - A PKAL Essay on Leadership in STEM. Appears in Project Kaleidoscope Volume IV: What works, what matters, what lasts. **Read**:
  http://www.pkal.org/documents/UriTreismanPresentationLeadershipInSTEM.cfm

- James Fairweather. 2008. Linking Evidence and Promising Practices in Science, Technology, Engineering, andMathematics (STEM) Undergraduate Education. Workshop on Promising Practices—Innovations in Undergraduate STEM Education, National Academies Board on Science Education, October 13-14, 2008.

(Optional):
http://www7.nationalacademies.org/bose/Fairweather_CommissionedPaper.pdf

- Brenda J. Turnbull. 2009. Dissemination in STEM Education R&D: Perspectives on Knowledge Use. Prepared by Policy Studies Associates for Community for Advancing Discovery Research in Education.

Read Highlights:
http://cse.edc.org/dr%2Dk12/Docs/CADRE%20highlights%20of%20dissem%20white%20paper.pdf

(Optional): http://cse.edc.org/dr-k12/Docs/CADRE%20dissemination%20white%20paper%20Nov2009.pdf

Others

- Excellent paper: Pedagogical Practices and Instructional Change of Physics Faculty. By Melissa Dancy and Charles Henderson - they did a large survey about if knowledge about an innovation causes faculty to change their practices. It's sort of the next step. One finding: knowing about something counts, but it alone is not quite enough to make change. Also, people rarely adopt, meaning that they take pieces of something - and usually that is not the piece that research shows is the most effective at affecting student change. http://www7.nationalacademies.org/bose/Dancy_Henderson_CommissionedPaper.pdf

- RELEVANT??? "Creating a Culture for Scholarly and Systematic Innovation in Engineering Education: Ensuring U.S. engineering has the right people with the right talent for a global society," Phase 1 Report, Jamieson and Lohman, ASEE, 2009. Partially funded by NSF EEC-0743223
  Read:
  http://www.asee.org/about/board/committees/EEGE/upload/CCSSIEE_Phase1Report_June2009.pdf

- RELEVANT??? "Change in Engineering Education: Where Does Research Fit?" 2009. Karan Watson, Journal of Engineering Education, 98(1): 3-4.

- "Useful Sharing" 2009. Sally Fincher, Journal of Engineering Education, 98(2):109-110.

- "Valleys of Death and Darwinian Seas: Financing the Invention to Innovation Transition in the United States," 2003, Philip E. Auerswald and Lewis M. Branscomb, Journal of Technology Transfer, 28, 227-239 Kluwer Academic Publishers.

- "A Valley of Death in the Innovation Sequence: An Economic Investigation," 2007, George S. Ford, Thomas M. Koutsky, and Lawrence J. Spiwak, Phoenix Center for Advanced Legal and Economic Public Policy Studies. http://ssrn.com/abstract=1093006.
  Read:
  http://papers.ssrn.com/sol3/Delivery.cfm/SSRN_ID1093006_code339992.pdf?abstractid=1093006&mirid=5

Why reusing/remixing and Open Educational Resource?
Read: http://olnet.org/node/68

- What are the barriers to reusing/remixing OERs
  Read: http://olnet.org/node/119

- ???http://www.col.org/news/Connections/2009oct/Pages/InFocus.aspx

- http://learn.creativecommons.org/productions
- Such as: http://learn.creativecommons.org/wp-content/uploads/2009/04/cclearn-explanations-oer-and-cc-licenses-05-apr-09.pdf

- PIDL?
- Reusable Learning Slides and Notebook
- Collection Development Policies of Pathways
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