

Dissemination: A Key Element of the ATE Program

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Executive Summary

For the National Science Foundation (NSF) to derive maximum benefit from its investment in technology education and workforce development, it is essential that research findings, newly developed curricula, and innovative instructional strategies developed at Advanced Technological Education (ATE) centers and projects (i.e., *projects*) be effectively disseminated and used by others. This paper: (1) highlights key findings from previous studies of dissemination, (2) reports findings related to dissemination from the WMU evaluation project's 2000 and 2001 surveys and site visits to selected ATE *projects*, (3) describes comprehensive dissemination examples, (4) shares findings from a dissemination survey of ATE center directors and from an analysis of ATE centers' Web sites, (5) proposes a new paradigm for dissemination, and (6) presents recommendations for strengthening NSF proposal requirements for dissemination, improving practices at ATE *projects*, sharing effective practices, and evaluating the impact of dissemination. The findings from this paper should be especially useful to NSF and ATE staff but also helpful to other educators and researchers looking for new ideas regarding dissemination.

A useful definition of dissemination was developed by Hutchinson and Huberman (1993) who defined it as "the transfer of knowledge with and across settings, with the expectation that the knowledge will be 'used' conceptually or instrumentally."

Several theories or frameworks were reviewed that add insight into dissemination by ATE *projects*. The Dissemination Analysis Group (Klein, 1992) identified four functions of dissemination and appropriate strategies for achieving each.

1. Spread – the one-way broadcasting of information, in order to increase awareness
2. Choice – the provision of information on options intended to help users compare alternative resources
3. Exchange – interaction of information, materials or perspectives
4. Implementation – technical assistance, training or other forms of support to change attitudes or behaviors and to institutionalize changes over time

The ATE *projects* may find that all four functions are appropriate for their use at different times depending on the specific needs of individual clients.

Prior studies have found that successful dissemination systems have some common elements:

- Shows understanding of user characteristics
- Uses preferred language styles of users
- Is timely
- Is comprehensive
- Is accessible

- Uses validated materials/practices
- Has materials that meet user needs and concerns
- Includes electronic, print, and person-to-person communications
- Is interactive
- Is integrated with other R&D functions
- Has ongoing interactions with users
- Uses networks to help with dissemination
- Has training and technical assistance to match user needs

Federal guidelines related to dissemination also contain insight into factors that contribute to successful dissemination. This paper cites relevant guidelines from the Fund for the Improvement of Postsecondary Education and the Dissemination Partnership Program. It also describes and gives examples of items from the *Dissemination Self-Inventory* used by the National Institute on Disability and Rehabilitation Research.

As an example of a comprehensive dissemination approach, this paper describes dissemination strategies being used by the National Dissemination Center for Career and Technical Education and strategies used at ATE centers.

The WMU evaluation project 2000 and 2001 surveys included some aspects of curriculum dissemination. The researchers found that less than half of the materials developed by the *projects* surveyed were used at sites other than the one that developed them. The site visits indicated that dissemination was included as a specific objective in 5 of the 13 sites visited. Dissemination was usually discussed by the visitation teams under the category of materials development or in relation to sustainability.

While some dissemination activities can be expected at all NSF-funded ATE *projects*, this paper proposes different levels of dissemination that might be expected of smaller projects (funded for under \$100,000), of larger projects, and of multiyear ATE centers. Since the centers have the largest resources for dissemination, this author focused most heavily at this level with some additional data collection used to identify practices that could also be used less intensely with smaller projects. Thus, ATE center directors were surveyed and center Web sites analyzed to supplement the limited information about dissemination practices from the WMU evaluation project surveys and site visits. The ATE center survey included findings regarding what dissemination strategies the center directors thought worked especially well, suggested changes or additions to NSF dissemination guidelines and ideas for sharing “best practices” in effective dissemination.

Since the concept of dissemination is changing, this paper next describes a new paradigm that may be especially appropriate for ATE center dissemination that includes two concepts recently borrowed from e-commerce—*integrated solutions providers* and *customer relationship management*. Combining ideas from these two concepts with the roles that ATE centers have been playing in dissemination can lead to a newer definition of dissemination. In this new paradigm, dissemination is “the process of knowing your clients and systematically providing them, either directly or in partnership with other

organizations, with knowledge, strategies, products and support that can enable them to better solve their problems and enhance their delivery of effective technical education.” The benefits and dangers of borrowing from a business model to examine educational dissemination are addressed.

Finally, the paper makes recommendations regarding four areas: strengthening ATE proposal requirements for dissemination, implementing dissemination practices at ATE *projects*, developing strategies for sharing effective dissemination practices, and evaluating dissemination impact.

Dissemination: A Key Element of the ATE Program

Introduction

While the history of innovation in American education is rich with new ideas and projects that have benefited local communities, there has not been a continued systematic effort to disseminate most of these ideas and practices to educators in other parts of the country. There is even less success in helping other educators and communities to adapt these ideas and practices to meet their local needs. Because federal agencies such as the National Science Foundation (NSF) have invested billions of dollars in programs and projects to help improve education, there is a need to give greater attention to disseminating the policies, practices, and materials that have already been developed and to assisting others in adapting them to improve education in their communities.

Literature Review Highlights

Definitions and conceptualizations of dissemination. This brief literature review focuses on ideas considered especially relevant to the NSF ATE staff and those in the ATE *projects* (i.e., centers and projects)³. Emphasis here is given to factors found to facilitate effective dissemination. The review does not include the history of dissemination nor the philosophical underpinnings for dissemination. These have been covered well elsewhere (see Louis and Jones, 2001; Hutchinson and Huberman, 1993).

The term *dissemination* has different meanings to different people. According to Hutchinson and Huberman (1993), “Its most common definition is the transfer of knowledge within and across settings, with the expectation that the knowledge will be ‘used’ conceptually (as learning, enlightenment, or the acquisition of new perspectives or attitudes) or instrumentally, (in the form of modified or new practices)” (p. 2).

Another definition is that “Dissemination consists of purposive, goal-oriented communication of information or knowledge that is specific and potentially useable, from one social system to another” (Louis & van Velzen, 1988, p. 262).

Several theories or frameworks were reviewed that add insight into dissemination by ATE *projects*. One of these is the work of the Dissemination Analysis Group done at a conference of dissemination professionals (Klein, 1992). This group identified four functions of dissemination and appropriate strategies for achieving each.

1. Spread – the one-way broadcasting of information, in order to increase awareness
2. Choice – the provision of information on options intended to help users compare alternative resources
3. Exchange – interaction of information, materials or perspectives

³ Please see the attached overview document (*The ATE Program: Issues for Consideration*) accompanying this paper for a detailed description of this program and its evaluation.

4. Implementation – technical assistance, training or other forms of support to change attitudes or behaviors and to institutionalize changes over time.

Hutchinson and Huberman (1993) show how different activities are appropriate for each function of dissemination. For example, publications, presentations, and telecommunications may be appropriate for spread. Choice is facilitated when a person responds to a client request or query that can lead to the client understanding the advantages and disadvantages of an option. Exchange is helped by individual meetings, workshops, and seminars. Implementation is fostered through direct assistance, training, and sustained support for change. The ATE *projects* may find that all four functions are appropriate for their use depending on the specific needs of individual clients at the time.

Factors considered facilitating or hindering to effective dissemination. A review of the literature on dissemination reveals five areas in which there are practices that either facilitate or hinder effective dissemination: (1) the information users, (2) quality of the information, (3) adaptability of the information, (4) diverse modes of communicating the information, and (5) support for utilization. Table 1 lists practices that have been identified in the literature as having facilitated or hindered dissemination.

Table 1
Factors Found to Facilitate or Hinder Effective Dissemination

AREAS	FACILITATORS	BARRIERS
1. Information users	Understand characteristics of the users	Poorly targeted groups
	Use preferred language style of the users	Inadequate information about the users
2. Information	Timely	Insufficient evaluation of the materials to be disseminated
	Comprehensive	Low quality materials/practices
	Accessible	
	Validated materials/practices	
3. Adaptability	Users can easily adapt materials to their needs	Lack of attention to the need for users to want to adapt materials/practices to their local settings
	Materials are seen as meeting the users' needs and concerns	

4. Diverse modes	Includes electronic, print, and person-to-person communications	Only one mode used
	Interactive	Reliance on one-way communication
5. Support for utilization	Ongoing interactions with users	Limited local development and training
	Dissemination is integrated with other R&D functions	
	Uses networks for dissemination	Inadequate structure for between-group sharing
	Has training and technical assistance to match user needs	

As part of its theoretical framework, the National Center for the Dissemination of Disability Research (NCDDR) has identified eight premises based upon the findings of research and experience. Their premises support the common factors listed above. In addition, they stress that

- Dissemination and distribution are not the same.
- Effective dissemination is not an “end activity” that occurs after research is completed.
- Recipients of government-funded research funds have a responsibility to effectively disseminate their results (NCDDR, 1997).

A comprehensive review of the literature in knowledge dissemination and use in science and mathematics education was done by Hutchinson and Huberman (1993) for the Directorate of Education and Human Resources, Division of Research, Evaluation and Dissemination within NSF. Their experience and review of earlier research in various disciplines call attention to seven factors that facilitate dissemination:

1. **Accessibility, availability, and adaptability** – easy access to information that can be locally adapted.
2. **Relevance and compatibility** – the information being disseminated is seen by practitioners as fitting their world and concerns.
3. **Quality** – materials have been evaluated or validated.
4. **Redundancy of the messages** – repeated messages over time and through diverse dissemination modes.
5. **Linkage among users** – interpersonal interactions among users.
6. **Engagement** – opportunities for users to engage with the new materials or ideas.
7. **Sustained interactivity** – frequent contact between information users and providers.

Westbrook and Boethel (1997) found that successful dissemination systems have the characteristics identified in Table 1 as common. In addition, they indicate that successful dissemination systems

- Include both proactive and reactive dissemination channels—that is, they include information that users have identified as important, and they include information that users may not know to request, but that they are likely to need. Clear channels are established for users to make their needs and priorities known to the disseminating agency.
- Recognize and provide for the "natural flow" of the four levels of dissemination that have been identified as leading to utilization: spread, exchange, choice, and implementation.
- Draw upon existing resources, relationships, and networks to the maximum extent possible while building new resources as needed by users.

In the 1960s, Havelock and other members of the Institute for Social Research at the University of Michigan proposed a RDDE cycle consisting of Research, Development of prototypes, Diffusion of the amended prototypes, and Evaluation of the product (Havelock, 1969). This model was important in the creation of the educational laboratories and centers created by the U.S. Department of Education. During the 1970s, other researchers identified problems with the RDDE model. Later, others disagreed with the flow of knowledge as a one-way process that did not take into account the motivations, contexts, and realities of the intended users.

Hutchinson and Huberman (1993) described the shift from the one-way flow models to a constructivist perspective in which “the user acts upon information by relating it to existing knowledge, imposing meaning and organization on experience and, in many cases, monitoring understanding throughout the process. This casts the user as an active problem-solver” (p. 2).

The most frequently cited reason for the gaps between research and its use center on the lack of communication and cooperation between researchers and their intended audiences (Leung, 1992).

Smink reviewed a series of federal dissemination studies. He found that there were many operational problems with dissemination. Each of these was already included in the common barriers in Table 1. He also found weak incentives for use among practitioners (Smink, 1985).

Dissemination guidelines and tools. Federal guidelines related to dissemination also contain insight into factors that contribute to successful dissemination. For example, The Fund for the Improvement of Postsecondary Education (FIPSE) emphasizes that dissemination must be adapted to the particular circumstances of the new environment and that it is important to establish that those wishing to adapt the reforms are ready to

take action. It also stresses the importance of providing training and ongoing implementation assistance, having a period long enough to permit extensive coaching, and being proactive in communicating regularly with adapting sites to sustain and support progress (FIPSE, 2000).

The NSF Dissemination Partnership Program involves an institution-to institution mentoring approach. Its guidelines state that “Disseminators have learned that their efforts yield the strongest and most lasting results when the project includes some of the following:

- A good product with proven or promising results
- A match between the experience and knowledge of the grantee and the needs of the partner institutions and/or agencies
- A mutual understanding that the promising practice or component will be adapted to at the particular circumstances of the partner institutions and/or agencies
- Substantial involvement of the partner institutions and/or agencies in the developing of the application
- A readiness on behalf of the partner institutions and/or agencies to take action
- An action plan which includes on-site technical assistance
- Systematic contact and communications between the grantee and the partner institutions and/or agencies, including face to face contact
- Clear roles and responsibilities between the project and the partner institutions and/or agencies
- Well defined objectives for the project
- A strong evaluation plan that will document the effectiveness of the practice (or program component) at the adapting sites (U.S. Department of Education, Office of Postsecondary Education, 2000)

In addition to the factors associated with effective dissemination identified above, some strategies and tools developed through federal funds have facilitated effective dissemination. One of these is the *Dissemination Self-Inventory*. This self-inventory was developed to assist National Institute on Disability and Rehabilitation Research (NIDRR)-funded project staff in reviewing their dissemination practices and is available on line at www.ncddr.org/du/products/dsi/index.html. It was designed to help guide the planning and implementation of dissemination by busy staff with limited time and resources (NIDRR, 2000).

The self-inventory contains rating scales for items grouped into five categories as shown below with a sample item from each:

User group – (user group(s) or potential users of the information or product to be disseminated). Example: Does your research design clearly define the intended groups of “users” or beneficiaries of your project's results?

Information source – (your project/organization as an information source, that is, the agency, organization, or individual responsible for creating new knowledge or products, and/or for conducting dissemination activities). Example: Are your

project staff regarded by users as highly knowledgeable resources in the project's topical area?

Content of message – (message content that is disseminated, such as, the new knowledge or product itself, and any supporting information or materials).

Example: Does your project information contain examples or demonstrations of how to use, and the implications of use, of the information?

Medium of the message – (the ways in which the knowledge or product is described, “packaged,” and transmitted). Example: Does your project make information available in any alternate format requested by individual users?

Contextual consideration for implementation – (context for use of the message, that is, the environmental, personal, and other supports needed to use the information or product). Example: Does your project develop a written plan with objectives as a guide in delivering technical assistance to user groups?

The *Dissemination Self-Inventory* is based on the research literature on dissemination, knowledge utilization, and the change process. In addition to scoring directions, the instrument contains a useful set of references organized around the five categories. These items could easily be adapted for ATE *projects*.

Findings From the WMU Evaluation Project Surveys and Site Visits

The WMU evaluation project 2000 and 2001 surveys (Gullickson, Lawrenz, & Keiser, 2000; 2001) addressed dissemination through one question in the PI overview section, which asked for product dissemination methods. There was also reference to one aspect of it under materials development.

In each year of the survey, more than 1,000 of the materials developed were reported in use at least locally. If one presumed that all developed materials were used at least on a local basis, then in each year at least 35 percent of this total were used at sites other than the *projects*, and 11 percent were commercially published. It should be noted that some of these materials were modules versus course development or course adaptation. Thus, *projects* may have reported modules both separately and as part of course development or adaptation materials. Despite the potential this raises for over-reporting, this author suspects that the figures overall are an understatement of use of materials since many *projects* may be unaware of some sites that may use their materials.

The site visits to 13 selected ATE *projects* conducted by the WMU evaluation project did not systematically address the issue of dissemination as a specific topic, but it was imbedded within materials development or grouped with sustainability and transportability. A review of the 13 reports indicated that dissemination was mentioned as a *project* objective at 5 of the 13 sites. It must be noted that it does not mean that dissemination was not important just because it was not mentioned during the site visit.

The most frequent mention of dissemination was in regard to presentations made by *project* staff at professional conferences. Several sites combined the Internet with the use of CDs as a platform for their curriculum. One site mentioned use of networking groups

with educators and business members to communicate the importance of their curriculum emphasis. Other dissemination activities mentioned included a pending article in the *Journal of SMET Education*, development of PowerPoint presentations, arrangements with a commercial publisher to disseminate modules, the dissemination of emerging technology trends, the adoption of one curriculum by 15 colleges, and a clearinghouse and network for continuing collaboration of partners regarding their *project's* area of focus.

Comprehensive Dissemination Examples

While it is useful to review prior dissemination studies and findings from national surveys and site visits, it may also be useful to have a few examples of comprehensive dissemination approaches. Two examples are presented here that suggest individual strategies or sets of strategies that could be used by ATE projects (especially the larger projects) or ATE centers. The first comes from the new National Dissemination Center for Career and Technical Education (NDCCTE), and the second is an example of comprehensive dissemination activities at one of the ATE centers.

NDCCTE. Perhaps the largest dissemination contract in vocational technical education in the U.S. was awarded in 1999 to NDCCTE as a five-year contract for implementation between 2000 and 2004. The national dissemination is being implemented by a consortium of primary partners (The Ohio State University – Prime, University of Minnesota, University of Illinois, The Pennsylvania State University, and Oregon State University with assistance from Johns Hopkins University and the Academy for Educational Development) (McKinney et al; 1999).

The dissemination strategies being used by NDCCTE include those listed below:

“Web site available for all users

All documents and publications available in electronic format on the Web site

Print documents available for those with limited or no access to the Internet

Information that is easy to use, featuring short summaries, well-designed graphs and charts

Information made available through a variety of channels, including person-to-person communication through the Web, teleconferencing, and interactive dialogue between current users of an idea and potential users of an idea

Information presented in varying depth and length, depending on the nature of the target audience

Information presented using videos and electronic media to reach those more favorably inclined to receive information through a visual medium

Provision for access to information at a time when it is relevant to the user via the Web site and the Question-and-Answer Service

Information made available through multiple channels, including print, audiovisual, electronic, and person-to-person

Presentations at significant conferences and institutes” (McKinney et al., 1999, p. 214).

Some principles used in the planned external evaluation of NDCCTE also have relevance for the evaluation of ATE centers and larger projects. A logic model guides the assessment of dissemination impact. The logic model is organized around six questions each supported by indicators/criteria, standards, and procedures.

1. Is the center establishing the preconditions for impact?
2. Is the center reaching its intended audiences?
3. Is the center maintaining national visibility?
4. How do the clients and the field perceive the outputs of the center?
5. Have the knowledge, skills, and/or behaviors of clients changed as a result of center activities?
6. Have center products and services had an effect on policies and/or practice in the field?

(Altschuld, 1999)

Procedures planned in the NDCCTE evaluation include analysis of records and database, an annual survey of a sample of center clients, requests for center products, evaluation of specific products and services, case studies and tracer studies, staff surveys, and a survey of specially constituted expert panels. The ATE centers and larger projects may want to adapt the above six questions and include them at various times during their operations.

In applying the 14 factors considered facilitating for effective dissemination as shown in Table 1, the NDCCTE model addresses 12 factors. The 2 that are not clearly addressed are the check on validated materials/practices and the available training and technical assistance to match user needs.

NWCET. At the National Workforce Center for Emerging Technologies, the new name for the NorthWest Center for Emerging Technologies (an ATE center for information technology at Bellevue Community College), dissemination is an essential ingredient in providing national leadership.

What are a few examples of some dissemination strategies they are using? Illustrations are drawn from its latest NSF report (NWCET, 2001). First, the center listened closely to its customers before acting. This included partnering with the American Electronics Association to do industry-expert reviews nationwide that served as the basis for validating and updating the *Millennium Edition of the NWCET IT Skill Standards*. They also worked with the external evaluator to conduct studies of educators and businesspeople who used the earlier version of the Skills Standards to determine how they used the standards and ways they felt the document could be improved.

To help address the question of what it would take to attract middle and high school youth, especially women and minorities to the IT field, NWCET contracted with a marketing firm to do focus groups in various parts of the country. These consisted of panels of students, parents, and educators and were used to establish the research foundation for producing the Cyber Careers for a Net Generation video and classroom materials.

Recognizing that there are many developers of IT Skill Standards-based products and services, NWCET established a compliance review process that helps ensure that developers across the country produce valid, quality courseware, assessments, and related products.

In addition to regular presentations about the center and its best practices to local, state, and national conferences of educators and industry leaders, it also organized a Partners Summit to bring together top executives and leaders in education, business, and technology to discuss trends impacting IT education and workforce issues and to learn about NWCET initiatives. Recognizing that the largest bottleneck in the IT workforce shortage is the supply of qualified IT instructors, the center launched the Educator-to-Educator Institutes across the U.S. with instructors who are certified by NWCET. And, finally, center staff are willing to reach out to influence and assist other groups. For example, the center’s director testified before the U.S. House of Representatives Committee on Science on behalf of NSF funding requests. The associate director advises the Information Technology Association of America, serves on the National Academy of Sciences National Research Council, and is coauthor of their report to the U.S. Congress on IT workforce shortage issues.

In applying the 14 factors considered as facilitating effective dissemination as shown in Table 1, the NWCET model addresses all 14 factors. How have they done it? Table 2 shows examples of the 14 elements.

Table 2
NWCET Examples of Factors Facilitating Effective Dissemination

AREAS	FACILITATORS	EXAMPLES
1.Information users	Understand characteristics of the users	NWCET identified four specific audiences: educators, students, employers, and government staff. Its Web page, for example, is geared for quick access to information of special interest to each of these audiences.
	Use preferred language style of the users	The Cybercareers for a Net Generation, a video and support materials to interest young people in Information Technology (IT) careers, was based on a prior careful study of young people’s attitudes toward and misinformation regarding IT. It then videotaped young people of color discussing issues related to IT.
2. Information	Timely	The IT skill standards are updated every several years, and information on the Web site is updated widely.

2. Information continued	Comprehensive	Information and materials have been developed that address all areas of IT workforce training including IT standards, curriculum, training of educators, orientation of young people to IT, and even addressing the need to recruit and retrain more IT educators.
	Accessible	Many of the materials are immediately available on the Web site as well as in print.
	Validated materials/practices	Materials are based on IT standards that were recently validated nationally.
3. Adaptability	Users can easily adapt materials to their needs	The NWCET staff adapted their materials for special groups such as the Job Corps and have provided a model and technical assistance to others in adapting materials to their state or local needs.
	Materials are seen as meeting the users' needs and concerns	Evaluation surveys of educators and industry people who have used the IT skill standards have indicated how the standards are meeting their needs.
4. Diverse modes	Includes electronic, print, and person-to-person communications	NWCET used its Web site, printed materials, training sessions, testimony to congressional committees, and many conference presentations.
	Interactive	The center staff use continuous contact with their clients to obtain feedback regarding their products, services, and training.
5. Support for utilization	Ongoing interactions with users	The quarterly meetings with the National Advisory Board have been examples of interactive exchanges among the staff and advisory board members representing education, business, and government.
	Dissemination is integrated with other R&D functions	Dissemination is closely coordinated with staff training, curriculum development, research, and evaluation.

AREAS	FACILITATORS	EXAMPLES
5. Support for utilization continued	Uses networks for dissemination	The center uses its contacts with other community colleges to help expand curriculum development and training. A contract with AACC is used to disseminate the IT skill standards. Educators and business leaders on the NAB have been active in disseminating information about the center to their institutions and colleagues.
	Has training and technical assistance to match user needs	Under separate contracts, NWCET trained staff from all the other community colleges in Washington. Through support from the Microsoft Corp, NWCET is setting up training centers throughout the U. S. to help train IT educators.

Findings From an ATE Center Director Survey and Web Site Analysis

ATE center director survey. To supplement information from the literature review, annual reports, and site visits to ATE *projects*, the author conducted an e-mail survey of the ATE center directors about their dissemination practices. A draft instrument was sent to an ATE center director and associate director for their feedback. Following the feedback, in May 2001, the survey was sent as an e-mail attachment to the directors of the 11 centers. Responses were received from 9 of the 11 directors (1 director had retired and another center was not currently functioning). A summary analysis of the responses was prepared by this author and is shown below.

The ATE center director survey consisted of eight questions listed below. Responses to this survey are shown here, and highlights are integrated into other sections of this paper. NSF could use these eight questions as part of their site visits to ATE centers or large projects. They may not be relevant to small projects.

1. What have been your major strategies for disseminating policies, strategies, and materials (such as curricula) developed by your ATE center?
2. Which dissemination strategies do you feel have worked especially well? Why?
3. Have you used any strategic partnerships to help with dissemination? If yes, which groups? How effective do you feel these partnerships have been? Why?
4. What are the primary types of evidence you have to support the impact of your center's dissemination efforts?
5. Which dissemination strategies do you feel have not worked too well? Why?
6. Based on your experiences with dissemination, what new strategies might be tried by your ATE center in the future?

7. What changes or additions would you support for the NSF guidelines regarding dissemination?
8. What ways could NSF or the ATE centers use for sharing “best practices” in effective dissemination?

1. What have been your major strategies for disseminating policies, strategies, and materials (such as curricula) developed by your ATE center?

ATE center directors most frequently mentioned using their ATE Web sites, exhibits, presentations at national conferences, word of mouth, and partnerships with other organizations. Other strategies used included providing Congressional testimony, use of state or regional partners, partner meetings, serving on other ATE national visiting committees, serving on education or industry advisory boards, brochures, career days/fairs, student competitions, preparation of best practices, faculty development workshops, special topic publications such as on student retention, using informed college students and employers as spokespersons, online or printed newsletters, electronic mailings lists, journal articles, and production of videotapes especially for students.

2. Which dissemination strategies do you feel have worked especially well? Why?

The most successful strategies were targeted dissemination efforts including faculty development workshops because there is more opportunity for one-on-one attention and interest from recipients. This allows center staff more opportunities to work with faculty to ensure effective use of the new curricula or other strategies. Some specific curriculum adopter workshops were co-hosted by partner schools with live interactive practice.

Use of Web sites was found to be less effective as a stand-alone strategy but helpful when employed in actual contact with users. The Web sites were also found to be particularly useful when organized for easy access by targeted audiences such as educators, students, business, and government. Cross-referencing of ATE center Web site information from other education and industry leading organizations also added credibility.

Using knowledgeable industry leaders and current or recent community college students who had engaged in the technology programs was also found persuasive with many audiences.

Although print and electronic newsletters may not lead to specific documented changes, they were found effective in reaching larger audiences for awareness purposes.

One center recently experienced success when curricula and materials were delivered via a hybrid web and CD-ROM system that allowed updating through the Web but provided high bandwidth items via the CD.

State and regional partnerships were also noted as effective in helping to share information and tailoring it to local needs.

Several directors mentioned the effectiveness of mentoring projects where they work with other community/technical colleges in developing and/or adapting instructional materials and models for use in their targeted area of technology.

3. Have you used any strategic partnerships to help with dissemination? If yes, which groups? How effective do you feel these partnerships have been? Why?

Use of business and education partners to assist with dissemination was common among ATE centers. Regional centers and state departments or organizations were especially effective in connecting to high schools, colleges, universities, and industries in the local areas. State Departments of Education and Commerce were mentioned as partners. Technology alliances and industry associations were also mentioned, as were commercial publishers who assist with curriculum dissemination.

Involvement with professional societies and groups like the League of Innovation were also found helpful, as were contacts initiated by the NSF staff.

4. What are the primary types of evidence you have to support the impact of your center's dissemination efforts?

A variety of evidence was cited to support the impact of dissemination including (1) the types and numbers of requests from the field for information, curriculum, materials, training, and proposal development; (2) number of students enrolled in ATE classes, graduating, receiving ATE scholarships, being hired as technicians, and promoted in their technical fields; (3) number of colleges offering the new ATE center courses, using curriculum and marketing/recruiting materials, and expressing interest in adapting ATE approaches; (4) follow-up evaluations of faculty, students, and industries using products or services of the centers; (5) regular Web site usage reports; and (6) reports from partners.

5. Which dissemination strategies do you feel have not worked too well? Why?

In the words of one center director, "Just placing materials on a Web site is not working. Other strategies must be use to create a 'need to know' to grow a Web site audience." Another said, "Simply telling people about our materials and delivery system is inadequate. They need to see the system demonstrated to appreciate the multimedia features and ease of use."

Other barriers mentioned included faculty concern regarding intellectual property ownership of instructional material they develop that get placed on the Internet.

Mass mail-outs were found to be of limited usefulness by some center directors.

It was also mentioned that most colleges are reluctant to use newer student recruiting strategies (e.g., career fairs, news articles, and newspaper advertising) and to hire contract help to spearhead recruiting efforts.

6. Based on your experiences with dissemination, what new strategies might be tried by your ATE center in the future?

Responses mentioned included development of general interest videos for students, focusing more on ATE outcomes, a cost/benefit analysis, more targeted marketing, more on-line dissemination, use of Web-based surveys of faculty and industry, identifying and presenting at new conferences such as those that attract high school teachers, grants to fund other community/technical colleges to develop or adapt new technology curricula, setting up a clearinghouse for other information and curricula in the respective technology area, use of streaming audio and video CDs, and experimenting with PDF files and user passwords to allow follow-up and prevent pirating of materials placed on the Internet. The overlap of these techniques with ones that have been unsuccessful in other settings (e.g., use of the Web) points out the need for careful targeting of the dissemination strategy.

7. What changes or additions would you support for the NSF guidelines regarding dissemination?

Although the suggestions might be more appropriate for a guidebook than the NSF Program Announcement, suggestions included NSF identifying some effective dissemination strategies, suggesting what to avoid, stressing that integrated strategies must be considered that include professional development, utilizing ATE centers as hubs for disseminating ATE project materials and findings, and establishing a NSF distribution and marketing center for ATE center and project products so proposal writers could borrow from what is working.

8. What ways could NSF or the ATE centers use for sharing “best practices” in effective dissemination?

Several directors suggested cross-training PIs and some professional staff of ATE centers and large projects to speak about not only their own materials but also other centers' outstanding materials and strategies. Other suggestions included using centers as clearinghouses for information on projects addressing specific topics where best practices are being developed, better use of technology to share “best practices,” more sophisticated cataloging of work being done with search engines that would take the use of the type of data provided to the current FastLane to a new and more helpful level, sharing best practices at the annual NSF and PI conference and have them posted on a Web site bulletin board maintained by the centers, coupling best practices with professional development needed to help others learn how they can do it, and holding a facilitated discussion of NSF staff and center PIs on specific dissemination outcomes expected.

ATE centers Web site analysis. In addition to the literature review, data from the WMU evaluation project's 2000 and 2001 surveys, and survey of ATE center directors, this author reviewed each of the available 10 ATE center Web sites to identify types of information disseminated there. There was no attempt to judge the technical quality of these sites or their impact but merely to describe the types of information they were disseminating. On the home page, information was available specifically for students (at 5 sites), educators (at 9 sites), business/industry (at 4 sites), and for government (at 2 sites). Table 3 shows the number of ATE centers displaying various types of information.

Table 3
Types of Information Displayed on ATE Center Web Pages

TYPE OF INFORMATION	NUMBER OF ATE CENTERS
Information about the Center	10
Coming events/calendar	7
Curriculum	6
Job listings	5
Current news in the technical field	5
References/publications	5
Partner site information	4
Clearinghouse searches	3
Newsletters	1

As shown in Table 3, all 10 ATE centers' Web sites contained information about their center, half included job openings in their technical field, and one included an electronic newsletter.

A New Paradigm for Dissemination

The prior review of the literature and survey of ATE center directors makes clear that some of the past ideas of dissemination need to be updated to accommodate future needs of educators, industry, and the public. No longer can dissemination be viewed as a one-shot activity, flowing only from the centers to users, or separated from other components of successful ATE *projects*. It must be ongoing, planned, and implemented in continuous dialog with the information/product/service users and comprehensive enough to address the variety of interrelated needs of the customer. Professional development of clients in the form of training and technical assistance is an essential component of the newer view of dissemination. It must also help anticipate the future needs of users in solving their problems or creating new opportunities for them. These elements have been supported by the literature review as shown in Table 1.

Two concepts from business and e-commerce have applicability as we contemplate a new paradigm for dissemination at ATE centers—**integrated solutions provider** and **customer relationship management**. Each is described here, followed by a new definition of dissemination that incorporates implications from these two business concepts.

The Director and Associate Director of the National Workforce Center for Emerging Technologies (NWCET) (called the NorthWest Center for Emerging Technologies before June 2001) shared a concept emerging from e-commerce that has relevance—an **integrated solutions provider (ISP)**.

As Dr. Peter Saflund, Associate Director of NWCET has told me recently, in regard to an integrated solutions provider:

It's sort of like Wal Mart. The more you can put under one roof, the more likely your products and services are to synergize. As an Information Technology example: if I design Web pages, but also procure graphics, host the site for my clients, offer shopping cart and transaction processing, offer to help my clients design and implement web marketing services, and possibly integrate suppliers or complimentary goods I'm an integrated solutions provider.

Conceptually, it's the difference between merely 'selling cell phones' and offering services to 'keep people connected.' The latter concept includes family discounts, flexible calling plans, voice and text messaging, and maybe other services to help the client get the most out of his/her phone.

So, listening to how your clients are using your products and services—figuring out what problems they have that your products and services are solving for them, and being aggressive about how to help them use your products or services more effectively and productively—that's the essence of solutions-oriented marketing.

In our case, we know almost nobody uses the Information Technology Skill Standards just as they are—there is almost always some interpretation, adaptation, application to existing curricula, needed. Rather than simply be reactive to these needs, we will do more to anticipate them and offer the solution package at the time of 'sale' (Personal e-mail communication, May 7, 2001).

For NWCET, the needs of the field have included a better understanding of the Information Technology (IT) workforce shortage and its causes, identification of occupational areas in the IT field (including those requiring less than a baccalaureate degree), nationally agreed-upon IT skill standards that are acceptable to industry and education, new IT curricula at the high school and college levels, adaptation of the IT curricula for special populations such as the Job Corps members, ways to help educators adapt existing IT curricula and certify IT programs as being IT skills standards compliant, processes for authentically assessing IT competencies in students and employees, ways to articulate community college and university programs for some areas of IT, strategies to interest middle school and high school students in IT, ways to attract more women and minorities into the IT workforce, ways to attract and retain IT faculty and upgrade their IT skills, strategies to effectively work with a national advisory board and other partners, and mechanisms for effectively sharing what was being learned and developed with educators and industry leaders across the U. S. and in other countries. NWCET has addressed each of these areas through its basic NSF center grant and augmented this with

additional grants from NSF, Microsoft, and other sources including the Department of Labor.

Given the above set of needs, how does NWCET plan its dissemination? This ATE center announced that it “strives to be the premier National IT Education Solutions Provider and E-Portal Dissemination Point.” The E-Portal to IT Education and Careers will be a new NSF-ATE dissemination focal point grant that will become a primary source for IT information, trends, programs, and best practices. It will be interactive, adaptive, and service oriented. NWCET will use the League for Learning Network and E-Portal to IT as marketing vehicles to extend the NWCET image and brand awareness.

Solutions to the problems listed above were not undertaken in isolation but in an integrated way that included work with numerous education and business partners with expertise in one or more of the above areas. In this sense, dissemination is an integral part of the entire research and development agenda of NWCET.

In industry, integrated solutions providers are becoming more common. For example, the United States Automobile Association (USAA) incorporated some of the above principles into what industry is now calling **customer relationship management** (CRM) and is using sophisticated software techniques such as data mining to extract a large volume of information about their clients. Kathleen Khirallah, a senior consultant with Tower Group, defines CRM as “a sales and service business strategy where the organization wraps itself around the customer, so that whenever there is interaction, the message exchanged is appropriate for that customer. That means knowing all about that customer and what the profitability of that customer is going to be” (Curley, 1999).

USAA, one of the world’s largest insurance companies, has a single technology company within the company to provide cross-cutting solutions to its 16 business units. The firm is moving forward with plans to create huge data warehouses where customer information can be mined for service and sales opportunities (Curley, 1999).

The implications of CRM as a tool for educational institutions such as the ATE centers are clear. The centers can no longer get by with broad scattering of information. They must know well their clients and their needs and find ways to anticipate and meet these needs. This will necessitate keeping accurate records on ATE center customers and sharing new information with them as new products and services are introduced that might interest them.

Combining ideas from the above two concepts with the dissemination roles that ATE centers have been playing can lead to a newer definition of dissemination. In this new paradigm, dissemination is “the process of knowing your clients and systematically providing them, either directly or in partnership with other organizations, with knowledge, strategies, products and support that can enable them to better solve their problems and enhance their delivery of effective technical education.”

Borrowing business models to apply to public education has its benefits as well as dangers. On the plus side, it can more closely integrate dissemination with other R&D functions, encourage customer-driven planning, be interactive, and support the sustainability of ATE centers. Some dangers to be aware of include making educational decisions based primarily on profitability, creating the image of centers as businesses, disseminating only the products of the center and not those generated elsewhere, invasion of privacy in order to create profitable databases of customers, and selling customer databases.

Thomas Bailey, in reviewing a draft of this paper suggested that we “examine the dissemination activities of ATE *projects* from two perspectives: public good and private good. Policies, practices and materials on STEM (formerly SMET) education disseminated by ATE *projects* are public good since these efforts raise the STEM competency of the community of the nation’s people. For some *projects*, however, materials disseminated are often private goods as well as public. Dissemination in this case could be seen as more akin to marketing, generating net revenue, and enabling recipients to be self-sufficient in their ATE operations.” It is possible that both public and private “goods” would be addressed.

Recommendations

Strengthening the ATE proposal requirements for dissemination. At the present time, the NSF guidelines on dissemination are rather vague and simply require a dissemination plan. NSF specifies that dissemination needs to be more than maintaining a Web site. The NSF Program Announcement for National Centers of Excellence mentions the expectation that centers “disseminate their products through commercial publishers, journals, conferences, workshops, electronic networks and other means”; but suggestions are not given regarding promising practices to develop and maintain an effective ongoing dissemination presence. An adaptation of the dissemination self-inventory by the National Institute on Disability and Rehabilitation Research should be considered as a tool to guide the thinking of NSF proposal writers.

NSF should also consider the advice of one ATE center director who suggested that “Encouraging the integration of dissemination with mentoring, faculty development, and other project activities, rather than treating it as a stand-alone activity, would strengthen dissemination efforts and encourage the spread of best practices and useful curriculum developments.” The idea of centers being “integrated solutions providers,” as described in this paper, might guide the thinking of new and existing ATE centers.

If dissemination is to be perceived as an important part of future *projects*, there may also be a NSF requirement that, in addition to providing simple statistics such as the number of faculty and students served, centers and major projects should report impact data on at least one major product or service they provide.

NSF may also want to establish a best practices in dissemination section on its Web site and request that grant writers refer to these practices and consider using or adapting some of them in their own proposals.

While it may be true that all knowledge, materials, and practices developed under NSF funding should be effectively communicated to other potential users, limited resources dictate that there be various levels of dissemination expected depending on whether those receiving funds are small projects (under \$100,000), large projects, or multiyear ATE centers. For small projects, a minimal expectation may be that staff at the local institution share the findings, materials, or practices with others at their institution and that in their reports to NSF they provide sufficient information that will enable NSF to disseminate such information to others. Larger projects might also be expected to share their results through presentations to some local and national conferences and through participation at the annual NSF-sponsored principal investigator meetings. In addition, ATE centers could be expected to find suitable partners for their ongoing national dissemination efforts, provide a vehicle for training and technical assistance to support their dissemination, and help disseminate the results of other NSF-funded projects in areas that relate to their designated expertise.

Improving dissemination practices at ATE projects. Dissemination practices at ATE projects would improve if dissemination was (1) more targeted to specific audiences such as particular students, educators, business, and government; (2) focused on solving the interrelated problems of targeted users; (3) better integrated with other aspects of project activities such as faculty development and curriculum adaptations; (4) perceived as an ongoing strategy directly involving targeted audiences at every step and not just something that occurs after materials have been prepared; (5) a key focus of center activities with state, regional, and national partners; and (6) viewed as a joint activity with NSF and the other ATE centers.

ATE centers and major projects should examine the paradigm of their organization as an “integrated solution provider” as described in this paper. The concept of “customer relationship management” also described in this paper presents some challenging ideas for collecting and using a client database to better serve new and future clients. This would help centers/projects go beyond information sharing and lead to more concrete services and impacts on their targeted clients.

Dissemination practices are likely to improve if more attention is given to impact evaluations of what is occurring. In addition to providing simple statistics such as the number of faculty and students served, centers and major projects should report on impact or effectiveness. The dissemination perspective influences evaluation by asking for evidence of the quality of products or services to be disseminated as well as by asking about the impact on users of the products and services that are disseminated. Clearly, dissemination and evaluation cannot be treated independently. Feedback from the evaluation of dissemination efforts should be reviewed each year by the centers and NSF to allow a refocusing of efforts to better inform and improve practice in advanced technology education.

Ways for sharing effective practices in dissemination. Although some ATE centers are active in disseminating their own work, it is important for center and major project staff to share with each other and the field their best practices in this area. Panels

and small group discussions at the annual PI meeting in Washington, DC, should stress sharing of successful and unsuccessful dissemination strategies. In addition to sharing best practices at the annual NSF and PI conference, smaller projects may be able to post information on an e-portal for ATE projects.

Several ATE center directors suggested that they be cross-trained to speak effectively about the materials and strategies being developed by their sister centers so that educators and industry leaders with whom they associate can learn about successes at the other centers.

Centers should also be encouraged to serve as clearinghouses for information, new curricula, and best practices in the technology fields that are being developed by colleagues in other colleges or agencies across the country.

Strategies for evaluating dissemination impact. A frequent outcome of evaluation is often the increased sensitivity of educators as to what is expected in dissemination because they know that someone else is looking. What can be done to strengthen the evaluation of dissemination without producing an excessive burden on busy ATE project and center staff? There are three directions to go. One is to ask questions to help ATE staff better understand who their primary clients are for the dissemination and what information they know or could find out about their clients. Second, it would be helpful to ask evaluative questions that help ATE staff see the links between what they are doing in dissemination and other aspects of their work such as research, product development, and training. Third, to help keep a focus on dissemination impact, it would be useful to encourage ATE staff to include information regarding the user impact from at least a few of the most important products or services they provide in their evaluation follow-up studies.

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