

**A Learning Community Model of Graduate Student Professional Development for
Teaching Excellence in Higher Education**

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Caption:

A learning community model is presented as a demonstrated successful approach to teaching-related professional development for research-active future faculty.

Abstract:

A learning community model is presented as a successful approach to teaching-related professional development for research-active future faculty. Four core elements of learning communities are identified: shared discovery and learning, functional relationships, inclusive learning environments, and connections to other learning experiences. These four elements are used throughout learning community programming and activities to foster a sense of shared identity, belonging, ownership, responsibility, and contribution. We describe preliminary indicators of success as we prepare to further test the model.

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Introduction and Problem Statement

As the quality of undergraduate education receives greater attention at colleges and universities, the question of whether future faculty are receiving training that will enable them to function as excellent researchers *and* excellent teachers warrants consideration. Golde and Walker (2006) conceptualize doctoral education as preparing “stewards of the discipline” who can “imaginatively generate new knowledge, critically conserve valuable and useful ideas, and responsibly transform those understandings through writing, teaching, and application.” Unfortunately, the current research-centric focus of doctoral education and postdoctoral training insufficiently prepares future faculty to be effective teachers (Boyer Commission on Educating Undergraduates in the Research University, 1998, 2002).

In this paper, we describe how this problem is being addressed at the University of Wisconsin–Madison through the creation of a *learning community*. Learning communities, which bring people together in intentional ways to accomplish shared learning objectives, support the development of teaching ability in a way that coexists and integrates with research. At UW–Madison, the Delta Program in Research, Teaching and Learning (“Delta”)¹ brings together graduate students, postdocs, faculty and staff for teaching-related professional development that models the myriad of interactions that comprise a comprehensive and rewarding faculty life.

Although the literature on learning communities is relatively young and to date has primarily been applied to undergraduate education, it has provided a solid foundation for Delta’s

¹ For more information on the Delta Program, see <http://www.delta.wisc.edu/>.

creation and ongoing operation. In particular, our analysis of the learning community literature revealed four core elements—shared discovery and learning, functional relationships, inclusive learning environments, and connections to other learning experiences—and two key outcomes—changed identity and sense of ownership over the community. We hypothesize that if the four core elements are actively and continually maintained, a learning community that is characterized by a sense of belonging, as evidenced by identity change, and a sense of ownership will be observed.

A Connected Approach to Research, Teaching and Learning

A healthy literature has emerged describing programs that prepare future faculty for the many facets of their careers (Wulff and Austin, 2004). An even larger literature addresses how teaching and learning centers across institutions of higher education provide courses, workshops and experiences for graduate students and faculty.² Although these programs and centers have been considered essential to instruction in higher education, even a cursory review of the literature reveals a common yet significant limitation: training in teaching and learning is typically disconnected from training in conducting research. This limitation results in three key problems: it reinforces the view that learning to teach “distracts” students from the more important goal of conducting research; it fosters a desire among students to learn “quick fixes” or a “bag of tricks” for effective teaching in an effort to minimize time away from research; and it discourages the formation of communities for students—and faculty—to discuss, develop, and explore teaching practices. Ironically, opportunities to improve teaching abound on many campuses, but a community of supportive colleagues is often lacking.

² See http://www.hofstra.edu/faculty/ctsc/cte_links.cfm for a comprehensive directory of teaching and learning centers in the United States.

Given the perceived conflict between learning to teach and learning to conduct research—and with it the resultant imbalance between these two essential faculty functions—we seek ways to help graduate students leverage synergies between their teaching and research efforts. Importantly, these synergies must originate from departmental culture and students' interactions with their major professors. We have explored how learning community processes and principles can be applied to address this challenge.

Why Learning Communities?

What is a learning community? At its simplest, a learning community is a community of people intentionally brought together to jointly pursue and accomplish specific learning goals (Brower & Dettinger, 1998). A learning community is supportive of its members as they collectively strive towards common learning goals and objectives and encourages a diversity of viewpoints and opinions. Furthermore, learning communities are *intentional environments* in that each and every program, activity and interaction within the community is intended to further the primary learning goals (Brower & Dettinger, 1998; Smith, et al., 2004).

In the last twenty-five years, most of the literature on learning communities has focused on undergraduate education (Tinto, et al., 1994), ranging from residential learning communities (Inkelas, Brower, & Associates, 2004) to curricular learning communities (Gabelnick, et al., 1990; Smith et al., 2004). Research on learning communities finds benefits to students' academic and social lives in the form of better grades, more satisfaction with what is learned in class, greater ability to apply knowledge to novel situations, deeper academic connections to faculty and peers, increased satisfaction with academic and social environments, more healthy

personal choices, and even more giving from alumni (Brower, Golde, & Allen, 2003; Gabelnick, et al. 1990; Inkales, Brower, & Associates, 2004; Tinto, et al., 1994).

Learning communities are generally built upon mentoring relationships between “novices” (e.g., students) and “experts” (e.g., faculty), who help novices succeed in the face of competing pressures and expectations (Roberson et al., 1997). These mentoring relationships are characterized by rotating roles, where novices become experts who can provide peer support, guidance, and leadership, while experts revert to novices as they learn new skills and partake of new experiences (Shapiro & Levine, 1999). Learning communities have the added benefit of engendering strong feelings of *belonging* (Shapiro & Levine, 1999), feelings that can be so strong that members report changes in *identity* as a result of membership; their identities become aligned with the mission of the learning community and they feel a sense of responsibility towards the joint accomplishment of the mission (Tinto, et al., 1994).

Learning community elements and processes are ideally suited to the creation of future-faculty teaching training programs. In forming Delta, we specifically applied learning community principles to professional development in graduate education, resulting in a conceptually driven and intentionally designed community of doctoral students, postdoctoral researchers, faculty, and staff who work together to develop their teaching skills. That the Delta teaching and learning community was established at a research-intensive institution illustrates that not only do excellent teaching and excellent research go hand-in-hand, but that training for both can be complimentary. This paper describes our efforts to create a full-fledged learning community for graduate students, postdocs, staff and faculty and thereby provide a model for improving the teaching practices of current and future faculty at research-intensive universities.

The Four Core Elements of a Learning Community

Four core elements pervade descriptions of learning communities in the literature: (1) shared learning and discovery (Gabelnick et al, 1990; Zhao and Kuh, 2004), (2) functional relationships (Pascarella, et al., 2006), (3) inclusive learning environments (Lawrence, 2002), and (4) connections to broader learning across campus (Nelson, 2001). (See Table 1.)

In the development of the Delta Program at the University of Wisconsin–Madison, each of these elements was employed. Delta is a research, teaching and learning community for graduate students, faculty, academic staff, and post-docs. The program is designed to enhance undergraduate learning by helping current and future faculty change the landscape of higher education in the sciences, engineering, and math. It is the local implementation of the NSF-sponsored national Center for the Integration of Research, Teaching, and Learning (CIRTL), which aims to develop a national faculty in the sciences (biological, social, and physical), engineering, and mathematics who are committed to implementing and advancing effective teaching practices for diverse student audiences as part of their professional careers.³ All offerings of Delta and CIRTL are founded on three fundamental assumptions: (1) teaching and research activities can be complimentary, even synergistic; (2) high-caliber teaching in the sciences benefits all students; and (3) training can best be accomplished in the context of a learning community.

The Delta learning community fosters teacher training in doctoral education by creating opportunities for current and future faculty to engage in collaborative processes that are familiar to faculty and departments actively engaged in research. Our hypothesis is that by appealing to

³ For more information on CIRTL, see <http://cirtl.net/>

the same curiosity, challenges, and, in some cases, methods that excite Delta participants as researchers, we can encourage them to engage in new teaching-and-learning experiences, to access new resources, to develop new skills, and to connect with like-minded peers. Through this synergistic research and teaching enterprise, future faculty will thrive as members of the professoriate and become agents of change for future generations of faculty.

Delta is neither a residential learning community, as described in the National Study of Living/Learning Programs (Inkelas, Brower, and Associates, 2004), nor an exclusively curriculum-based learning community, as are the non-residential learning communities described by Smith and MacGregor (Smith, et al., 2004). And while the intent to provide peer support and professional development is similar to the faculty learning communities as described by Cox and Richlin (2004), our learning community program exists through a very rich array of programs and activities (e.g., courses, one-shot workshops, semester-and year-long internships, individual consulting and support, large- and small-group discussion groups—some of which are relatively short term and others lasting a full year) that provide a wide range of ways for people to interact and a variety of roles and paths for individuals to get involved. Participants can even earn a Delta Certificate in Research, Teaching, and Learning. In the richness of the available opportunities and experiences, Delta is similar to a full-featured residential learning community, without the residential component, of course.

In the sections that follow, we describe how Delta has implemented each of the core elements of a learning community. Specific evidence of successful outcomes related to changes in participant identity, belonging, ownership, responsibility, and commitment are drawn from externally driven evaluations (e.g., a longitudinal study and a participant database) and internally generated student and participant work in Delta courses and programs.

Core Element #1: Shared Learning and Discovery

Shared learning and discovery are an essential component of a learning community experience; without these, one simply has a collection of individuals who either do not share common learning objectives or learn without the benefit of a community experience. Shared learning and discovery can take many forms, but common to all is the de-centering of the teacher as the sole source of knowledge. The implicit assumption is that every person in the learning community has something to offer that will enhance the learning of others. The explicit implementation of this comes when the “teacher” recognizes and embraces his or her role as facilitator, and intentionally structures experiences that enable students to learn from and with one another. Collaborative learning activities help create a learning community where participants share responsibility for the learning that takes place, often doing so in ways that are unique to the particular learning community yet compatible with the learning community’s values, expectations and operations. For example, instructors may incorporate collaborative learning techniques to enable learners to see their contributions to the achievement of the learning goals, rather than relying on the traditional “expert-centered” lecture format.

Shared learning and discovery permeate Delta, from the way in which visioning and strategic development sessions are conducted to the way Delta course instructors conduct small group discussions in their classes. All Delta instructors and facilitators lead using collaborative learning techniques. For example, each Delta course is structured around teamwork and projects to facilitate shared learning and discovery, rather than relying purely on individual work. The size of groups is limited to enable better discussions and avoid the necessity for expert-driven and lecture-based formats. Each course is team-taught by two instructors to model

collaborative teaching as well as collaborative learning. Instructor teams share an understanding of a set of basic principles and a vocabulary related to effective teaching, as defined by the common learning objectives of the Delta community. This approach is also incorporated into staff meetings, training sessions, and steering committee meetings.

A graduate student who participated in several Delta offerings reflected on the role of shared learning and discovery as follows: “the atmosphere in the classroom or wherever we are still comes out to be more of a community atmosphere with people working together for a common cause, rather than everyone being competitive and doing it on their own.”

Core Element #2: Functional Relationships

Learning communities develop when the interactions among learners are meaningful, functional and necessary to accomplish the “work” of the learning community; interactions that merely serve as “window dressing” or consist of “feel good” activities are insufficient. Moreover, interactions should lead to meaningful connections that extend throughout the learning community and are not limited to specific cohorts or role-related peers. Thus in a successful learning community, members will continue to interact because their interactions produce something of value to them and the learning community itself.

We contrast these functional relationships with those that are all too common in organizations, where people are asked to participate in groups that either do not need their input or do not produce anything that furthers the organization; individual investment in groups such as these is marginal at best. Instead, relationships within learning communities are essential for the work of the organization to be completed; no products will be created and no learning will

take place if the members did not collaborate. Consequently, individual investment in learning communities is high, since individuals recognize the value of their contributions.

Intentionality, reciprocity, and functionality are crucial to the successful implementation of functional relationships. Reciprocal relationships between individuals and the learning community as a whole need to be developed to discourage a one-way, “consumerist” model where members participate for the sole purpose of individual gain. Functional roles for individuals that allow them to “give back” to the community need to be intentionally created and allowed to grow organically as the community matures. For example, in Delta, participants are encouraged to develop their own programming ideas for the community. This reciprocity takes many forms, including participants assuming a leading role in existing courses and programs, developing spin-off programs in their home departments, or joining Delta’s Leadership and Steering Committee.

Functional relationships are fostered and exist at all levels within Delta; indeed, all activities are accomplished through collaboration and group-based action. For example, the “Instructional Materials Development (IMD)” course is organized around partnerships between faculty and graduate students, allowing them to develop specific instructional materials for their home departments. Partnerships often start with a faculty member’s desire to improve his or her course and with a graduate student’s desire to try out new skills in order to gain real life experience. Delta’s role is thus to match faculty needs with graduate student skills, helping them develop their partnership and supporting them as they implement and evaluate their project. A representative experience is documented in the following reflection from a student: “[The IMD course] was a new experience for me in that graduate students and faculty enrolled in the course together and were essentially on equal footing as students in the class. Discussions of

teaching and learning issues were greatly enhanced by having both the perspectives of the ‘learners’ (graduate students) and the ‘teachers’ (faculty members). I believe such learning communities foster greater respect and understanding among individuals for the position (teacher or learner) opposite their own” (Statement from graduate student teaching portfolio, 2006).

Delta itself operates through collective decision-making and action. Internal operations model the types of learning community experiences we aim to create for the broader Delta membership. This reinforces the idea that “functional relationships” are necessary throughout Delta, from how paid staff interact with one another to how graduates through faculty members interact with each other and Delta staff. As an example, weekly “Delta Operations” meetings among paid staff are open meetings; the role of meeting facilitator rotates and the agenda is co-created. Faculty, academic staff, and students are included on our paid roster, and all have a voice at the table. Although staff members are hired with specific areas of specialization, the responsibility for the conception, development, leadership, and evaluation of Delta’s operations is shared across paid staff.

Core Element #3: Inclusive Learning Environment

Much research exists that demonstrates that groups produce higher quality output (along many dimensions) when diverse perspectives are represented (Cox, 1993; Mcleod, et al, 1996). We have incorporated these findings into our model of a learning community by holding to the principle that learning communities succeed when the diverse backgrounds and experiences of learners are welcomed in such a way that they enhance the group’s collective learning. Whenever possible, we create and facilitate activities that provide opportunities for participants to reach out and connect with people from backgrounds different from their own, recognizing

that such experiences can enhance the types of learning that occur and the relationships that develop.

Learning community leaders must continually monitor activities within the community to ensure a sufficient variety and quantity of opportunities to attract a diverse participant base. In Delta, we discuss not only who *is* participating, but also who is *not* participating. These discussions form the basis for creating new programs, modifying existing recruiting strategies, and refining marketing messages.

Reaching agreement on the definition of “diversity” is key to keeping work focused without being overly prescriptive or exclusive of other perspectives. Although Delta is inclusive, a few guiding parameters are followed to keep us grounded in our core mission. The primary parameters of inclusion are that Delta focuses on the sciences (biological, social, and physical), mathematics, and engineering, and on graduate students, postdocs, faculty, and instructional staff (as opposed to classified or support staff). In the case of the Delta internship program, this is expanded to include involvement from institutions who partner with Delta to provide graduate students with opportunities at diverse institutional settings.

Table 2 presents a frequency distribution that includes all people involved in all aspects of Delta (i.e., students, staff, faculty and postdocs, who are participants in programs, course instructions, and leadership and strategic planning members). The primary dimensions of diversity that are tracked are gender, race/ethnicity, academic status, and discipline.

The 54% participation rate for women is over-representative of the local population of women in STEM fields, where 38% of doctoral students and 30% of postdoctoral researchers were female, based on Fall 2004 local institutional records. It is difficult to draw any conclusions from the data on participants by race/ethnicity, as 48% of the participants were categorized as unknown;

however, of those we do know (519), more than 10% (52 of 519) were from underrepresented groups (Asians not included), which is above the institutional average of 7% of doctoral students and 2% of postdoctoral researchers in 2004. With regard to academic status, there were roughly equal percentages of faculty, academic staff, and postdocs, balanced by 52% participation by graduate students, our primary focus group.

Across disciplines, 43% of Delta participants are from the biological sciences and 18% come from engineering and the physical sciences. Delta only recently began to actively recruit in the social sciences, and we anticipate increased involvement over time. Greater participation from the mathematics department continues to be a challenge and reflects a national trend concerning the need for mathematics departments to become involved in campus teaching and learning efforts (Chronicle of Higher Education, 9/1/06).

Core Element #4: Connections to Other Learning Experiences

Learning communities flourish when implicit and explicit connections are made to experiences and activities outside the course or program in which one is participating. These connections help situate and embed one's learning in a larger context by solidifying one's place in the broader campus community of learners. These connections reduce curricular and personal isolation, increase diversity in people and programming, and programmatically create campus-wide "momentum" for educational and curricular reform. Connectivity is also cost-effective; from a campus standpoint, it is a vehicle for the sharing of resources, the delegation of responsibilities, and reduced redundancy of opportunities. By connecting experiences across an institution, gaps are filled without diluting the core mission of any one learning community.

Delta offers more opportunities than a single person can be involved in. Similarly, our campus has a rich array of diverse professional development opportunities related to teaching and learning. When practical, people participating in one part of Delta are connected with other Delta and non-Delta offerings. For example, at the programmatic level, we attempt to connect participants in Delta courses and weekly discussion groups with our monthly Roundtable dinners. Those who attend the dinners are then asked to take what they learned back to their discussions with the rest of the class the following week. An example of a cross-campus connection is the experience of students in our Summer course offering. As part of the course requirements, students attend a campus-wide, two-day Teaching and Learning Symposium that is comprised of Delta and non-Delta workshops and presentations (discussed further in the next section). Finally, Delta's Expeditions in Learning is devoted to a semester of discussions and "expeditions" to parts of campus that then become central to the weekly small group discussions within Delta.

Learning Community Outcomes

In addition to the core learning community elements described above, our synthesis of the literature revealed two primary outcomes common to the experiences of learning community participants: (1) *internalized individual transformations*, characterized by feelings of shared identity, a sense of belonging and a feeling of ownership and commitment to the learning community (McInnis et al, 2001; Zhao and Kuh, 2004); and (2) *externalized public expressions*, characterized by reciprocal "giving back" to the community in the form of shared responsibility and contributions (Gabelnick et al, 1990; McInnis et al, 2001; Lawrence, 2002). Both contain a mixture of individual-level and community-level indicators. For instance, one can observe

changes in the way individuals talk to one another through the language they use to describe their teaching and learning activities. At the same time, language can also serve as a “marker” of community membership in that “speaking the same language” enables individuals to recognize each other as having had similar training and experiences within the learning community.

Our working hypothesis is that if the four core learning community elements are actively and continually maintained, a learning community that is characterized by a sense of belonging and a sense of ownership will be observed.

Outcome #1: Internalized Individual Transformations (Shared Identity, Belonging, Ownership, and Commitment)

It may seem self-evident that learning communities exist when their members recognize themselves and others as being part of the community. Shared language and shared practices are one fundamental way of recognizing who belongs to a community. This is true for all types of communities (e.g., identifying an individual’s place of origin from his or her dialect), and is true for learning communities as well. Many Delta participants observe that Delta gives them the vocabulary to talk about teaching and learning. For example, one participant said that the language she learned from Delta enabled her to articulate what she knows about teaching in an intelligent way, a skill that proved immensely valuable at an interview for a position at a community college.

Development of a common language and practice does not happen by chance; leaders must intentionally “seed” common language and practices into activities. In Delta, regular meetings for program facilitators and course instructors are held to reinforce foundational concepts, language, and practices. In evaluations of Delta events and participation, we ask

about these same foundational concepts and practices. As a consequence, the guidebooks created to train instructors and facilitators, the syllabi created by course instructors, the projects that students generate, the facilitation techniques that instructors use and teach, and the participant data that is collected—all reflect the common language and practices of Delta.

We frequently hear from people who have participated in multiple Delta activities that they gradually become comfortable with activities they initially found uncomfortable. They also find themselves using common “Delta language” like “teaching-as-research,” or having discussions about diversity in ways they had not previously. For example, at Delta events, we encourage participants to go beyond the standard “name, department, years on campus” introduction and share something more personal, such as motivations, relevant personal experiences, or challenges. At first this approach feels foreign to many, but over time they become accustomed to it and recognize the value of incorporating a personal dimension into community development. A short excerpt from a graduate student’s teaching portfolio points to her sense of belonging: “Students who feel like they belong to an energizing and supportive academic society will persevere and learn better than students who see education as a solitary commitment ... Now I can hardly imagine teaching in isolation; I will always look for an active learning community to stimulate my teaching” (Statement from graduate student teaching portfolio, 2006).

Further evidence of a sense of belonging is continued participation in Delta activities. Of the 982 individuals who participated in at least one Delta activity through December 2005, 362 (37%) continued to be involved in Delta for multiple semesters (see Table 4). It can be argued that longevity and sustained involvement in non-mandated activities are signs of commitment and belonging.

Outcome #2: Externalized Public Expressions (Shared Responsibility and Contribution)

A second outcome that demonstrates the existence of a learning community is shared responsibility for and contribution to the products of the community. This is evidenced by members assuming roles that are important to the running of programs and activities or taking responsibility for the “care and feeding” of the community’s life, including helping new members acclimate and accomplish their learning goals. Such reciprocal relationships between a community and its members signify a mature learning community.

We see members sharing responsibility for Delta’s operations in many ways. Veteran student members have developed ways to “buddy up” with new members in classes and through monthly Roundtable dinners; faculty participants have become our “second generation” of course and program instructors; faculty and student partnerships have formed to create new guidebooks and internship projects; and those who have received support from Delta for their “broader impact” sections on NSF grants have become mentors for others as they make their own grant applications (http://www.nsf.gov/pubs/gpg/nsf04_23/3.jsp#IIIA2). A previous Delta internship participant, who graduated and found a teaching position at a local liberal arts college, now serves on the Delta Internship Committee, offering internships at her institution to Delta participants. She continues to work with Delta because “It’s a great program and I want to keep being a part of it. I think there’s a lot I can do to help teach and to help people get involved in the program.”

A sense of shared responsibility and shared contribution is evident in how Delta leadership groups and instructors have evolved over the years. What once consisted almost exclusively of individuals from the original development team now includes a balance of new

members from the community—past participants who want to contribute as leaders of initiatives, and original members mentoring their replacements as they rotate out of their leadership roles. Indeed, many Delta instructors and facilitators started as participants in the programs or courses they now lead (see Table 5). Nearly one-third (24 of 79) of Delta leadership comes from early participants who became leaders, and an additional one-third (25 of 79) comes from participants who were new to Delta when they took their leadership position. Similarly, many featured speakers at the monthly Roundtable Dinners are Delta participants who wish to share what they learned in Delta with a wider audience. This is indicative of the many entry points into the Delta learning community that were intentionally created to provide multiple opportunities for diverse individuals to get involved.

Another dimension of shared contribution is seen when members begin to generate their own activities, bring exercises back to their home departments, recruit new members, write papers, present at conferences, and therefore shape the future direction of the community through their input and initiatives. Several former participants have now graduated and begun to establish “Delta-like” programs on their campuses; one has even helped her campus create a new faculty training program modeled after Delta. A previous Delta postdoctoral participant, who found a faculty position at another university, is motivated to use Delta as a model for establishing a learning community at his new institution. He says, “the thing I really got excited about ... is the idea that most graduate students get positions as educators, not as researchers. What do Research One universities have to do to prepare students for that? It’s not working in the lab 24/7, so we really need to prepare our graduate students to do more than that.”

As another example of members generating their own activities that “feed back” and shape the entire community came through a pair of graduate students in geography who volunteered to take responsibility for their department’s TA training. Similarly, a graduate student in sociology took the initiative to develop a survey for her department to sensitize her peers and faculty to diversity-related teaching issues that were raised through one of her Delta courses.

Finally, Delta has become increasingly involved in the premier all-campus teaching and learning event on our campus, the all-day Spring Teaching and Learning Symposium. This event is a combination of keynote speakers, plenary sessions, and concurrent workshops. The number of sessions directly related to Delta activities or run by Delta participants has increased from 12% to 20% to 33% over the past three years. This is evidence of not only a growing number of Delta community members on our campus, but also increased visibility and impact on the campus-wide teaching and learning environment.

Conclusions

Doctoral students and postdoctoral fellows need better preparation for integrating teaching and research as faculty. We believe that participation in full-fledged learning communities founded on the shared goal of improving teaching practices at research-intensive universities can effectively serve this purpose. Successful implementation of learning communities such as Delta ultimately results in cohorts of peers that benefit from a shared identity and sense of belonging to a community for which they feel ownership and commitment. These internalized signs of membership manifest themselves externally as each individual shares in the contribution to, and responsibility for, the sustainability of the community. The end

result is a national faculty who view teaching as an integral part of their work, who take responsibility for improving teaching and learning, and who contribute to teaching, learning, and research communities to transform the national landscape of undergraduate and graduate education.

Delta provides social and professional support by going beyond mere pedagogical training, including learning community components such as shared learning and discovery, functional relationships, inclusive learning environments, and broader connections. To take our work to the next level, we need to follow our members and see whether we have accomplished the broader goal of better training for the full spectrum of faculty life. Data collection structures are in place, but since Delta is only three years old, it is too early to observe large scale impact, particularly as to whether future faculty are better trained through Delta with respect to teaching practices. We also need to continue to track the broader goal of sustained impact, national movement, and effect on student learning.

We are a long way from realizing our vision. The timeframe for seeing substantial change at a national level is at least a generation. We can say with confidence, however, that Delta exists as a learning community and that we have integrated the four core learning community elements throughout Delta sufficiently to begin seeing results at an individual and local level. It is our hope that graduate schools and academic departments will reflect on the learning community model presented in this paper and utilize the Delta learning community as an example for creating their own learning communities, supporting the integration of teaching and research for doctoral students and postdoctoral fellows at their institutions. Together, we can collectively advance the culture of science, technology, engineering, and mathematics education across the nation by better engaging and preparing faculty and students.

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Table 1: Core elements and critical points to consider for learning community development

<i>Core element</i>	<i>Critical points to consider for implementation</i>
Shared learning and discovery	The learning environment is not expert driven. Essential to this element is a de-centering of the expert to allow all members to contribute their own knowledge, learn from others, and contribute to others' learning.
Functional relationships	The learning environment is intentionally designed to cultivate meaningful, necessary, and reciprocal relationships. The content and process of the community's activities are structured to <i>require</i> group interactions and group solutions that are necessary for shared learning to occur.
Inclusive learning environment	The learning environment is inclusive for every individual involved. Learning goals are structured so that they are best achieved when a diversity of perspectives are incorporated; the process by which learning goals are achieved is intentionally inclusive to allow all individuals to bring their diverse backgrounds into the shared learning taking place.
Connections to other learning experiences	The learning environment exists within an interlocking community that is larger than any individual activity, class, program, or experience. Members are part of overlapping and interlocking networks with others beyond their immediate group who share common learning goals.

Table 2: Demographic distribution of Delta participants* (from 5/1/03 to 8/7/06)

<i>Demographic Characteristics</i>		<i>Total Number</i>	<i>Percent</i>
Gender	Female	540	54
	Male	433	43
	Unknown	29	3
	Total	1002	100
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Race/Ethnicity	American Indian or Alaskan Native	5	<1
	Asian	55	5
	Black or African- American	13	1
	Hispanic or Latino	18	2
	Multi-Racial	14	1
	Native Hawaiian or Pacific Islander	2	<1
	White	412	41
	Unknown	483	48
	Total	1002	100
<hr/>			
Academic Status	Faculty	143	14
	Graduate student	520	52
	Postdoc	153	15
	Staff	135	13
	Other	16	2
	Unknown	35	4
	Total	1002	100
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Field of Study	Biological Sciences	427	43
	Engineering	183	18
	Mathematics	20	2
	Physical Sciences	181	18
	Social Sciences	101	10
	Unknown	90	9
	Total	1002	100

*Data is from the Delta Participant Database

Table 3: Outcomes of a successful learning community (LC)

<i>Outcome</i>	<i>Explanation</i>	<i>Examples of programs and activities</i>
Internalized Individual Transformations (shared identity, belonging, ownership, commitment)	<p>LC members feel pride and recognition through shared identity, language and practices.</p> <p>LC members' relationships are maintained beyond the requirements of the activities in which they participate.</p> <p>LC members feel supported and comfortable among other members.</p>	<ul style="list-style-type: none"> • A shared language develops and is commonly used in and beyond learning community settings. • Core concepts of the learning community begin to be used regularly without the need to define and explain what they mean. • Practices and identifiable behaviors "mark" members of the LC. • Members can identify each other as belonging to the same community by their practices, behaviors, and actions, even if they didn't previously know each other as a community member.
Externalized Public Expressions (shared responsibility and contribution)	<p>LC members feel responsible for and commit to accomplishing the mission and goals of the community.</p> <p>LC members feel responsible for helping other members in their learning.</p> <p>LC members form reciprocal relationships, giving to and receiving from the LC.</p> <p>LC members contribute to the generation of community "products."</p> <p>The organization of the LC is non-hierarchical.</p>	<ul style="list-style-type: none"> • Rotating roles (i.e., voluntarily taking on roles that help to advance the learning community; members "rotate" through various roles and responsibilities within the LC). • Community "products" are developed and worked on together by a variety of members of the community. • Members develop new friendships, new work relationships, and mutual supports that extend beyond the requirements of the activity or course they are involved in. • Members socialize and engage in work-related activities with each other beyond LC-prescribed activities and environment. • The "work" of the LC (e.g., running activities, presentations to departments) is performed by members beyond the paid staff. • Roles within the LC evolve and new roles are initiated by members. • Activities and products develop and evolve over time based on lessons learned, member input, and member initiative.

Table 4: Indicator of “Sense of Belonging and Commitment” based on number of semesters participated

<i>Number of semesters an individual has participated in Delta</i>	<i>Number of individuals who have participated for multiple semesters*</i>	<i>Percent</i>
1	620	63
2	180	18
3	88	9
4	48	5
5	21	2
6	16	2
7 or more	9	1
Total	982	100

*Counts include all Delta Participants (graduate students, post-docs, faculty, staff, and “other”) through December 2005.

Table 5: Indicator of “Shared responsibility and contribution”

<i>Role within Delta</i>	<i>Original Delta developers</i>	<i>Delta participants transitioned to leadership position</i>	<i>New Delta members taking on leadership position</i>	<i>Total</i>
Steering Committee	6	12	7	25
Instructors/Facilitators	20	8	7	35
Roundtable Dinner Speakers	4	4	11	19
Total	30	24	25	79