# Out of the Box

**Elaine L. Craft**
**South Carolina Advanced Technological Education Center of Excellence**

How does a state-wide system of two-year technical colleges produce enough engineering technology graduates to meet the needs of high-tech employers?  South Carolinians are thinking "out of the box" in addressing this challenge.   The South Carolina Technical Education System's Advanced Technological Education (ATE) Initiative is taking an innovative, faculty-first approach to foster systemic reform in engineering technology education.

The SC ATE Initiative is being fueled by two significant grants from the National Science foundation (NSF): the SC ATE Exemplary Faculty Project and the SC ATE Center of Excellence.  Out of the Box addresses outcomes for the SC ATE Exemplary Faculty Project. Remarkable results are being achieved through the SC ATE Exemplary Project as science, mathematics, engineering technology  and communications faculty work together across the state in interdisciplinary teams for the purpose of increasing the quantity, quality and diversity of engineering technology graduates.  By removing the limits of distance, academic discipline and individual endeavor, systemic synergy has resulted.  Likewise, through strengthening collaboration and partnerships, the concept of how technical college faculty impact their students and local business communities is expanding.

Background

There is a profound need for systemic change throughout the educational system in order to become more sensitive to and consciously respond to the learning styles of students, the technological opportunities available to teachers, and the increased demand for better trained, more sophisticated employees.

> Industrial leaders continue to emphasize the change occurring in the workplace and the need for a better educated workforce for U.S. industry to be competitive in the world marketplace.  Employers need a pool of highly qualified, technically sophisticated, and versatile engineering technology graduates.  These new technicians must be team players who communicate well but are independent problem solvers who can integrate concepts from many disciplines.  When employers are asked to prioritize the competencies engineering technology graduates need, they place communication and teamwork at the top of the list.  Their message is clear: technicians must have interdisciplinary skills which include both technical and non-technical competencies that enable them to analyze, solve problems, communicate effectively, and learn continuously as the work place changes.[1]

In South Carolina, we are embracing this challenge and responding to these opportunities through the SC ATE Initiative, for which the SC ATE Exemplary Faculty Project is providing an absolutely essential foundation. The SC ATE Exemplary Faculty Project addresses the issue of restructuring the learning environment to prepare two-year technical college students to compete in today's high performance global marketplace. The major goal of the project has been to create a cadre of exemplary faculty teams for the express purpose of implementing innovative, research-based advanced technological education practices across the South Carolina Technical College System. As Fullan and Stiegelbauer stated in *The New Meaning of Educational Change,* "Educational reform depends upon what faculty do and think. It is as simple and as complex as that." [2]

The Exemplary Faculty Project is serving as the initial building block of the three integral components of the SC ATE Center of Excellence: Faculty Development, Curriculum Reform, and Program Improvement. The SC ATE project offers a valuable model for assisting faculty in restructuring the teaching-learning process in order to produce qualified and capable two-year technical college graduates.

The SC ATE Exemplary Faculty Project are to addresses faculty development needs in advanced technological education content, effective pedagogy, and assessment of student learning outcomes. Faculty from the four discipline areas of communication, engineering technology, mathematics, and science are participating in team-based professional development activities that stimulate development of an integrated curriculum and encourage:

- interdisciplinary teamwork

- application of technology (e.g., calculator-based laboratories)

- use of relevant classroom methodology (e.g., cooperative learning)

- applications of learning theory (e.g., multiple intelligences)

Through this nine-step process, which is outlined below, Exemplary Faculty Teams have become "reform ready" and are transforming classrooms and curricula to reflect the workplace.

I. Form a Management Team

The first step toward introducing systemic change is to select a leadership or management team of committed leaders to collaboratively build and implement your program. The SC ATE Management Team includes three principal investigators and a liaison with the State Board for Technical and Comprehensive Education. The management team launched the project and serves as a team model for all of the faculty teams created through the project. Thus, team-based decision-making and problem solving are actively practiced at all levels of project activity.

The challenges of systemic change in education demand the attention of more than one person and deserve the creativity that only a team can offer. A critical success factor is the careful selection of a leadership team that includes diverse talents and perspectives and enthusiastic,

committed players.  Project leaders and participants alike must understand that educational reform is a marathon, not a 100-yard dash.

II. Select Faculty

The SC ATE Management Team developed the initial Exemplary Faculty selection process. Posters and an information video for each college, information packets for potential applicants, and criteria for evaluation and selection were provided to facilitate building the strongest possible interdisciplinary faculty team on each campus.  SC ATE Exemplary Faculty Teams are made up of faculty from mathematics, engineering technology, communications (both English and Speech), science and a few related disciplines.

Following the initial Exemplary Faculty selection process, open enrollment periods have been offered annually for the purpose of adding new Exemplary Faculty or replacing campus team members who have changed employment or left the project for other reasons.

During open enrollment periods, campus teams are encouraged to follow the industrial practice of participating actively in the process of selecting new faculty to join the project.  Letting project participants play a role in selecting new faculty for the project is a critical success factor.

Any reform initiative needs a "critical mass" of well-prepared and reform-ready faculty to effect systemic change.  A well-defined, carefully-followed method of maintaining or expanding the base of project participants is a critical success factor.  The importance of having a core of faculty sharing a common vision cannot be over-emphasized.

III. Emphasize the Strengths of Diversity

Getting faculty out of their "boxes"--subject-area silos and other comfort zones of traditional academia--is a critical success factor.  Getting out of the box means not only learning to appreciate the contributions other teaching disciplines are making in the overall education of students, but also effectively dealing with ethnic and gender differences.  A richness of diversity in a project can be one of its strengths.   The success of the SC ATE Initiative has been attributed in part to having nearly equal numbers of faculty representing the four disciplines (mathematics, science, communications and engineering technology) and race and gender demographics which meet or exceed faculty percentages at participating colleges.

Once faculty discover the benefits of collaborating across disciplines, they find it difficult, if not impossible, to return to an isolated departmental or discipline approach to teaching.  Faculty enjoy being able to add relevance to student learning and to answer the inevitable student question, " Why am I learning this?"

Many SC ATE faculty experienced feelings of resistance to change at first.  Faculty frustrations and suggestions were carefully examined and impacted the design of faculty activities.  This strategy has proven to be effective in helping faculty go beyond just accepting change to actually becoming leaders of change on their campuses.

IV. Promote Teamwork

> As individual skills are integrated into a group, the collective capacity to innovate becomes something greater than the sum of its parts. Over time, as group members work through various problems and approaches, they learn about one another's abilities. They learn how they can help one another perform better, what each can contribute to a particular project, how they can best take advantage of one another's experience. Each participant is constantly on the lookout for small adjustments that will speed and smooth the evolution of the whole. The net result of many such small-scale adaptations, effected throughout the organization, is to propel the enterprise forward.[2]

The objective for implementing teams for this project has been two-fold: first, to teach the principles and practices of high performance teamwork; and second, to provide an opportunity for the teams to apply these concepts while they work toward accomplishing project objectives. Providing faculty with an opportunity to practice teamwork throughout the project will, in turn, help students learn this valuable skill. The use of teaming principles is essential for effective and productive problem solving with interdisciplinary faculty.

Professional development activities have specifically been designed to teach and reinforce teamwork, and resources have been provided to support team activities at the campus level. A primary guide has been *Teams in Education*[3] and Jerome Acaro's key elements of a quality team:

- Commitment: Administrators, supervisors, and staff support the team's mission.

- Mission: Team members understand what they are expected to achieve.

- Objectives: Team members work on tasks that are consistent with the mission.

- Trust: Team members trust and respect each other and are willing to invest in one another.

- Meetings: Team meetings are efficient and produce results.

- Shared responsibility: Team members recognize the interdependency for success that exists within the team.

- Conflict: Conflict is anticipated and eliminated before it becomes divisive.

- Roles and responsibilities: Team members know what is expected of them.

- Participation: Everyone on the team participates in all activities.

- Communication: Information is shared with all members and team activities are communicated to all staff.

Guided by the project's team facilitator, SC ATE faculty have learned the power of teaming. The team facilitator conducts regular team leader meetings for the sixteen campus team leaders and provides workshops, coaching and training materials for team leaders and the management team. This guidance has proven valuable in helping teams grow and improve their ability to use

effective team principles. Building effective teams in the workplace is a slow process, but one well worth the effort. For SC ATE, having a team facilitator with considerable experience working with teams in industry has been a critical success factor. Continued use of a good facilitator over time helps prevent teams from backsliding into committee behavior.

V. Let Faculty Communicate Freely

A common communications infrastructure and the faculty's ability to effectively use available technology to work with one another is a critical success factor. Fortunately, S.C. Technical College System faculty have access to a wide range of communications technology including state-wide computer connections for electronic message and data transfer and a compressed video telecommunications network. This technology facilitates communications among all sixteen technical colleges and the State Board Office as well as with external partners. Much of this technology, however, is new and therefore several project activities have been designed to increase faculty "know how" and to stimulate use of available technology.

Because the level of technical capability and faculty experience with distance communications devices varies from campus to campus, it is a critical success factor to have someone facilitate electronic communications among participants. It helps considerably if this person is not only technically capable but also a good teacher who can work effectively with faculty who are less comfortable with the technology. Also to help faculty, a team of Exemplary Faculty has prepared a handbook on distance communications which has been shared with all project participants. Effective use of distance communications technology can dissolve walls between building and miles between colleges.

The project web page (http://scate.org/scate) works well as a basic resource site for interested parties seeking information about the project. Establishing an intranet for use as an "in-house" bulletin board is also a good idea.

To facilitate project communications, listservs have been established. There is a general listserv for all project participants and a listserv for each discipline peer group. The dialogue and sharing on the general listserv have helped faculty review project threads and issues. Faculty who attend project-sponsored conferences and workshops are required to submit reflections and summaries of their activities on the general listserv. Discipline listservs were established at faculty request to promote the sharing of ideas among faculty working in the same academic discipline at the different colleges. Faculty appreciate having a forum for the free exchange of ideas, and moderated listservs are serving this purpose well.

The compressed video television network is used by participants both for ATE work and for teaching classes. ATE meetings are routinely held over the network with many being scheduled by ATE faculty. It is important that all faculty receive training on effectively using a compressed video network, and practice is necessary. Providing "how to" information is only a first step. Faculty have found it important not only to have access to the network for teleconferencing, but also to have an awareness of scheduling procedures and priorities, and available technical support as they practice using this technology.

VI. Emphasize Professional Development

To effect systemic change, professional development is needed not only for the Exemplary Faculty, but for project and system leadership as well. Thus, the first ATE Exemplary Faculty retreat began with a Leadership Conference. This half-day event included Technical College Presidents, Chief Instructional Officers, and business and industry guests in addition to Exemplary Faculty.

Even so, as the SC ATE project began, the greatest fear faculty expressed was that their college administrators would not be supportive as they experimented with new teaching techniques and transformed their classrooms to model the workplace. Thus, keeping college administrators informed and helping them understand the levels of progress to be expected at each stage of the project has proven to be a critical success factor for the SC ATE Initiative. Strategies for accomplishing system-wide buy-in and support have included:

- regular meetings with Chief Instructional Officer's Peer Group.

- e-mail updates to Chief Instructional Officers.

- periodic meetings with the State Board, Technical College President's Council, Chief Student Services Officers Peer Group, and Chief Development Officers Peer Group.

- special programs for college "middle managers"--those who supervise ATE faculty and/or direct engineering technology programs.

A key message to college administrators is that transforming the learning environment takes time, and allowing for sufficient development of faculty early in the project is a critical success factor. It is critical to success that faculty not be rushed toward curriculum work too fast. To broaden the impact of curriculum-specific work later on, the faculty development process should be slow enough to allow creative thinking and team building exercises to occur outside of the context of daily curriculum demands.

Professional development activities carried out over a three-year period have included (A)Chautauqua Workshops, (B) Special Summer Activities and Fall Retreats, and (C) Train-the-trainer Workshops.

(A) Chautauqua Workshops

Chautauqua Workshops for SC ATE faculty are intense, multi-day learning and sharing experiences characterized by the recurrence of the themes of the SC ATE Exemplary Faculty Project and follow-up activities for faculty participants. The SC ATE Chautauqua workshops have been designed to:

- prepare faculty to lead curriculum reform,

- provide tools/strategies for curriculum reform,

- allow faculty to practice teamwork and problem solving,

- allow faculty to explore research-based classroom strategies and technology to enhance student learning, and

- provide faculty with ideas and information to stimulate further research to accomplish project objectives.

All workshop presenters have been required to incorporate appropriate methodologies into their presentations and to take into consideration the interdisciplinary faculty in the audience. Modeling the best ATE practices in every activity is a critical success factor.

As faculty from across the system have come to understand the vision of the SC ATE Center of Excellence and have come to know one another better, the Chautauqua workshops have increased systemic synergy and enhanced interdisciplinary team-building and problem-solving skills among faculty.

It is interesting to note that participants requested that the Chautauqua events be held at the technical colleges around the state rather than at other possible meeting sites. Faculty quickly realized that visiting different institutions broadens their sense of community and gives them an opportunity to pick up ideas from their peers. Also, ATE campus teams invariably experience a new level of "buy in" to the project when they host a Chautauqua workshop on their campus.

(B) Special Summer Activities and Fall Retreats

During the first summer of the project, SC ATE Exemplary Faculty were allowed to choose one of three types of summer activities: an integrated curriculum exploration classroom/laboratory project, a conference/train-the-trainer professional development activity, or a site visit. During the second and third summers, faculty participated in a workplace research project and/or worked on an assignment for the SC ATE Center of Excellence. Just as Chautauqua Workshops have provided the major forum for learning throughout the project, summer experiences and fall retreats have provided a unique opportunity for teams to bond and mature.

During the annual fall retreat, ATE faculty share their summer work with other ATE faculty. This accomplishes two things. First, it helps spread the benefits of the summer activities among all participants. Second, it provides an opportunity for these faculty to practice team-based instruction, which is one of the goals of the Exemplary Faculty Project.

(C) Train-the Trainer Workshops

It cannot be assumed that faculty who are effective in the classroom will also be effective workshop presenters for their peers. Teaching others about teaching, or sharing ATE project experiences with college administrators and peers, is a very different experience than teaching in one's subject area.

To assist faculty in becoming effective workshop presenters, a team-based collaborative learning workshop on conducting workshops was provided. The facilitators for this workshop were selected based on faculty recommendations, and teams who participated gained valuable experience in putting together the framework of an effective workshop for adults. Participants

are now prepared to serve as catalysts, enthusiastically spreading knowledge about systemic change to their peers in the technical college system and beyond. As a result, SC ATE teams are routinely providing workshops on topics such as team building, collaborative learning, and multiple intelligences.

Early in the project, a survey of faculty revealed a large variation in individual computer capability among project participants. The survey made it clear that faculty needs should be addressed individually. There could be no "one size fits all" technology workshop. One project activity designed to address this issue was an optional, individualized training on PowerPoint for all teams to enable faculty to prepare graphics for both teaching and presentations.

VII. Support Discipline Peer Group Activities

Faculty consistently request time at project events for discipline peer groups to meet. This request has been granted, but it was a good decision to add these meetings gradually as the project progressed.

It is important to resist the temptation to allow discipline peer groups to convene too early in the process. Discipline peer groups represent a "comfort zone" for faculty and, if allowed too early in an interdisciplinary project, peer groups can interrupt the chemistry of the multi-discipline team building process.

Discipline peer group meetings at Chautauqua workshops and other project events have facilitated faculty-to-faculty sharing and identified recommendations for future professional development activities. At one workshop, faculty members in each peer group gave individual demonstrations and shared classroom strategies fostered by participation in the ATE Project.

VIII. Encourage Faculty to Spread the SC ATE Vision

Providing support for on-campus workshops and offering presentations at local, regional and national conferences are excellent means of spreading the SC ATE vision, and Exemplary Faculty enthusiasm for change. With regard to faculty dissemination of ATE knowledge and products, one critical success factor is the SC ATE's motto "don't go solo," and another is to "practice what you preach."

Teamwork is the key to all that SC ATE has accomplished, and ATE faculty are expected to demonstrate teamwork when making presentations about, or on behalf of, the project. At least two ATE faculty are required to co-present to receive grant support, and presentations are expected to incorporate excellent teaching methodologies.

Attending professional development events or conferences outside their teaching field broadens faculty horizons and develops a new level of trust and understanding among different disciplines. For example, an English instructor attended the American Society of Engineering Educators Conference and an engineering technology instructor attended a writing conference. Such "cross-fertilization" is a critical success factor for faculty to be able to successfully author a truly integrated curriculum.

IX. Continually Evaluate Performance

As with any project of this magnitude, both formative and summative formal evaluation activities have been initiated. Feedback from short surveys, plus/delta notes (positive comments and suggestions for improvement), and other informal evaluation techniques are also being used by the Project's Leadership Team in planning each successive event.

Perhaps most helpful have been the short, simple and immediate feedback comments the management team has collected, analyzed and reacted to following each activity. Simple plus/delta notes are used at almost every event and meeting. Participants write one or more comments on a small yellow "sticky" notes and attach them on the door as they leave. Many project improvements have been made in response to these quick exit thoughts by participants, and thoroughly assessing all project activities is part of "practicing what you preach" when working with faculty who are being asked to continually review and improve their performance.

The project's external evaluators work closely with the management team by reviewing and evaluating project activities. In addition, evaluators provide regular feedback and project management support. A critical success factor is selecting an external evaluator who is a true partner in the project. An evaluation partnership involves not only documenting progress and identifying strengths and weaknesses, but also stimulating and assisting with continuous improvement.

Curriculum reform and program improvement, which includes recruitment and retention activities, are flowing naturally now from a reform-ready cadre of faculty. All ATE faculty rotate on and off special-purpose teams assigned to accomplish a finite objective within project goals. Teams are formed for a two-semester period, and each faculty member gets at least a one semester break between assignments.

Reform efforts are being enhanced by the commitment of the System's Chief Instructional Officers peer group who have recently agreed to take an organizational change approach to integrating and sustaining the work being done through the SC ATE Initiative. Using this reform of engineering technology as a model, South Carolina's technical colleges will identify and implement essential organizational changes to support efficient and effective learning for the twenty-first century.

Conclusion

SC ATE Exemplary Faculty and have indeed moved out of their boxes. Project participants recognize and embrace techniques and strategies that help them become leaders of a comprehensive, system-wide reform initiative dedicated to increasing the quantity, quality and diversity of engineering technology graduates.

These faculty are using technology effectively to bridge the communication and problem-solving gap from institution to institution. They are also participating in professional development Chautauqua workshops to help them learn about and apply the most effective teaching techniques and strategies.

At the same time, SC ATE Exemplary Faculty are perfecting their workshop design and presentation skills to better deliver effective ATE workshops and classroom lessons. Finally, they are using team building skills and technological tools to more effectively learn, and teach, in a way that models the workplace and adds relevance for students.

Teamwork can make a difference in educational reform even without grant-funded activities and faculty support. It will take longer, but the results are worth the effort. The key is synergy that comes from mutual trust and appreciation coupled with excellent teaming skills.

Administrators, too, are grasping the vision and moving the SC ATE Initiative forward. By using engineering technology as a model, systematic organizational change can be implemented to aid the interface between the old and new for the new millennium.

The project management team and all SC ATE Exemplary Faculty are making a conscious commitment to follow an honest model that practices what it preaches by virtue of its team management concept, strong embrace of technology, open-minded approach toward developing each learning activity, and commitment to continuous reflection and improvement.

1   Wood, J.C. and Mack, L.G., "The Image of Interdisciplinary Faculty Teams on Engineering Technology Curricula" (paper presented at the ASEE Annual Conference Proceedings, 1997).

2   Michael Fullan and Suzanne Stiegelbauer, *The New Meaning of Educational Change*, (Ontario Institute for Studies in Education: NY, NY, Second Edition., 1991).

3   Robert B. Reich, 1987, "Entrepreneurship Reconsidered: The Team as a Hero," *Harvard Business Review*, May-June 82.

ELAINE L. CRAFT is Director and Principal Investigator for the SC ATE Center of Excellence as well as Co-Principal Investigator for the SC ATE Exemplary Faculty Project, both National Science Foundation grants awarded to the South Carolina State Board for Technical and Comprehensive Education. She holds a BS in Chemical Engineering and an Masters in Business Administration. She has more than 20 years of experience as a professional educator.