

Part V. Impact Report of the Quality Enhancement Plan

Section 1. Title and Brief Description

Title: Improving students' critical thinking/real-world problem solving skills through the use of active learning strategies.

Description: The QEP's primary focus is on improving students' critical thinking and real-world problem solving skills through the use of exemplary and innovative active learning strategies that contribute to their life-long success. To help achieve success in this area and encourage the broadest possible campus participation in this endeavor, we have also identified three areas of emphasis that units may pursue to help improve critical thinking and real-world problem solving skills. These areas of emphasis within the broader topic include the following:

- Improving students' critical thinking/real-world problem solving skills with emphasis on communication skills.
- Improving students' critical thinking/real-world problem solving skills with emphasis on teamwork skills.
- Improving students' critical thinking/real-world problem solving skills with emphasis on creative thinking.

The selection of the QEP topic and the areas of emphasis described above were based on thorough analyses of TTU strengths and weaknesses in our IDEA teaching evaluations, senior exit exams, enrolled student surveys, alumni surveys, employer surveys, and faculty observations. We also examined available research and other published employer surveys to identify factors that would positively impact students' lifelong success since this is the focus of our strategic plan and vision. Finally, the selection of the QEP topic and the areas of emphasis were guided by faculty, student, and alumni input so that we could get the broadest campus involvement.

Section 2. Initial Goals and Intended Outcomes

Initial goals: Successful efforts to improve students' critical thinking/real-world problem solving skills should result in several measurable changes. Therefore, we established the following list of goals:

- Campus projects aimed at QEP-related objectives will be financially supported and will show increasing levels of success across the implementation plan.
- Faculty will pursue QEP-related objectives in their courses with greater frequency.
- Students will report greater progress on QEP-related objectives in their courses.
- Students will report greater involvement in and institutional emphasis on QEP-related activities in the National Survey of Student Engagement (NSSE).
- Students will improve their performance on direct measures of critical thinking/real-world problem solving (i.e., Critical Thinking Assessment Test, California Critical Thinking Skills Test).
- Alumni will report an increase in QEP-related activities during their time at TTU.
- Employers will report higher levels of skills in the areas of critical thinking, problem solving, teamwork, and communication.

Intended outcomes: With respect to the intended goals, we also predicted specific outcomes for each goal across the five-year implementation schedule. We expected to see progress on the most proximal goals (i.e., QEP-specific projects) early in the implementation. We expected campus-wide goals (i.e., IDEA objectives, critical thinking tests, NSSE responses) to be met somewhat later. We hoped to see progress on the most distal goals (i.e., employer and alumni reports) by the end of the five-year implementation period. The anticipated outcomes are outlined in Table 1.

Table 1: Initial Intended Outcomes

Area	Year 1 2006-2007	Year 2 2007-2008	Year 3 2008-2009	Year 4 2009-2010	Year 5 2010-2011
Implementation	Director Appointed \$35,000 in Grants Awarded	\$35,000 in Grants Awarded	\$35,000 in Grants Awarded	\$35,000 in Grants Awarded	\$35,000 in Grants Awarded
Individual Project Assessments	50% Successful	55% Successful	60% Successful	65% Successful	70% Successful
Frequency of Relevant Objectives Selected by Faculty on IDEA		5% Increase over baseline*	10% Increase over baseline	15% Increase over baseline	20% Increase over baseline
Student Progress on Relevant IDEA Objectives		5% Increase over baseline*	10% Increase over baseline	15% Increase over baseline	20% Increase over baseline
National Survey of Student Engagement Responses on Relevant Items			5% increase over baseline** or above national average		10% increase over baseline** and above national average
California Critical Thinking Skills Test			5% increase over baseline** or above national average	10% increase over baseline** or above national average	15% increase over baseline** or above national average
Critical Thinking Assessment Test			5% increase over baseline** or above national average	10% increase over baseline** or above national average	15% increase over baseline** or above national average
Alumni Survey Responses on Relevant Items				5% increase over baseline***	
Employer Survey Responses on Relevant Items					5% increase over baseline****

* Baseline established over 2001-2006 time period.

** Baseline established in 2006

*** Baseline established in 2005

**** Baseline established in 2008 (2006 graduates)

Section 3. Significant Changes

The central topic has remained unchanged, but some changes were made with respect to the implementation and assessment of the QEP. The major changes are described below.

Year 1: To insure a consistent method for evaluating QEP projects, the QEP Director developed a survey instrument that could be used to evaluate the success of projects funded through the QEP budget. A staff member from Student Services was also added to the QEP Committee to insure that QEP projects might extend beyond the classroom into other areas of student life. Both of these changes were in response to suggestions from the SACS Visiting Committee that reviewed our original QEP proposal.

Year 2: Awards for QEP-funded projects were announced in May (rather than August). This additional time provides faculty with greater opportunities to recruit students and implement projects in fall classes. QEP workshops were held to disseminate best practices related to active learning. This change was introduced so that faculty could serve as role models to encourage other interested faculty to apply for QEP awards and adopt active learning strategies. After further consideration, one assessment measure (i.e., student-reported progress on relevant IDEA objectives) was judged to be inappropriate and dropped from the list of goals. This measure asked students to compare a class to other classes. Net gains across the University would therefore be impossible to achieve.

Year 3: The QEP survey for evaluating class projects was made available online after we experienced an increase in the number of projects conducted off campus or outside of traditional classrooms. The QEP survey for evaluating class projects was also made available to faculty beyond their funded activities. Some faculty members are interested in refining their QEP-related interventions beyond the semester in which they receive funding. We also began holding QEP workshops to help faculty/staff prepare good proposals because the quality of QEP proposals was not increasing as expected. The California Critical Thinking Skills Test (CCTST) was dropped from our assessment plan. Extensive research supported by an NSF grant to evaluate the Critical Thinking Assessment Test (CAT) led us to question the construct validity of the CCTST. The CAT was determined to be a significantly better indicator of critical thinking as defined in our QEP.

Year 4: QEP workshops were jointly sponsored with other campus entities (e.g., STEM Center) to attract targeted audiences with content tailored to specific disciplines. We also changed the NSSE goal to match or exceed scores from Tennessee Higher Education Commission (THEC) peer institutions instead of the national average. The THEC peer group provides a better comparison group because it is composed of institutions with similar resources and students.

Year 5: Dr. Thomas Timmerman assumed the role of QEP Director. Dr. Timmerman served on the QEP Committee since its inception and was an active participant in all QEP-related activities. The University discontinued the use of the CAT as a widespread exit exam measuring critical thinking. We learned that QEP dissemination was not widespread enough to impact the entire sample of graduating seniors. The CAT continued to be used in a pre/post fashion to

measure improvement within specific classes/projects. The QEP Committee decided to hold two rounds of proposals each year instead of one. The second round provides more opportunities and more visibility for the QEP.

Year 5 also coincided with the first year of a new set of Performance Funding Standards used by the Tennessee Higher Education Commission to stimulate instructional improvement and student learning. Because of the success and infrastructure of our QEP, we are maintaining our critical thinking initiatives through 2015 to satisfy the new THEC requirements. This coincidental timing also provided us with an opportunity to revisit our goals and establish new goals for the maintenance of our critical thinking efforts. We had learned, for example, that continuous percentage increases were not realistic or sustainable. We also decided that future progress should be benchmarked against our own previous gains instead of against national norms or other peer comparisons. Thus, our Year 5 goals were modified in the ways described in Table 2.

Table 2: Changes to Year 5 Goals

Objective	New Goal for Year 5
Frequency of Relevant Objectives Selected by Faculty on IDEA	Faculty will select relevant objectives at an average rate equal to or greater than the average rate of the previous three years.
National Survey of Student Engagement Responses on Relevant Items	Average scores on relevant items of the Spring 2011 administration will match or exceed scores from Spring 2009.
Employer Survey Responses on Relevant Items	A new employer survey is under development and scheduled for Spring 2013 implementation.
Individual Project Assessments	The percentage of successful projects will meet or exceed the percentage over the previous three years.

Section 4. Quality Enhancement Plan Impact

Goal 1: Campus projects aimed at QEP-related objectives will be financially supported and will show increasing levels of success across the implementation plan.

Perhaps the most specific and intensive efforts to implement our QEP occurred within focused individual projects proposed by faculty/staff and supported financially by the University. Over the five-year implementation cycle, 75 projects involving 99 faculty/staff were funded by the University (see Table 3). These grants were awarded through a competitive process and attracted participation from every college within the University. We developed an assessment instrument to evaluate each project. Students were asked at the beginning of each semester to complete a survey describing their typical previous classroom experience. At the end of the semester, they completed a similar survey asking them about their QEP-related experiences in that particular class. Projects were deemed “successful” if students reported that the QEP project improved their critical thinking and real-world problem solving more than a typical classroom experience. Our initial goal was a 50% success rate in the first year with a 5% increase each year thereafter. Across the five-year span, 85% of the projects were successful. In 2010-2011, the percentage of successful projects (92%) exceeded the new goal described above (i.e., matching or exceeding the success rate of the previous three years). We also awarded 17 individuals with Excellence Awards for their outstanding contributions to the QEP effort. The

decline in the number of grants in 2010-2011 might be attributable to the transition to a new QEP director or our requirement that each funded project be something new to the instructor. Over time it might be more difficult to generate ideas for new projects. As budgetary support for the QEP continues, 15 unique projects have been funded for 2011-2012 and more than \$40,000 has been awarded.

Table 3: QEP-Related Campus Projects

Year	Number of Grants	Faculty/Staff Involved	Successful	Unsuccessful	Awards	Faculty Excellence Award Recipients
2010-2011	12	20	11 (92%)*	1	\$22,740	1
2009-2010	17	22	14 (82%)*	3	\$38,900*	3
2008-2009	15	24	12 (80%)*	3	\$35,000*	4
2007-2008	17	19	15 (88%)*	2	\$35,735*	6
2006-2007	14	14	12 (86%)*	2	\$35,000*	3
Total	75	99	64 (85%)	11	\$167,375	17

* Goal was achieved

Goal 2: Faculty Selection of Course Objectives

Tennessee Tech has used the IDEA Student Ratings of Instruction System to evaluate courses for many years. The IDEA System allows faculty to choose the most important course objectives and then asks students to report perceived progress on those objectives. Evidence of a successful campus-wide QEP should be observed in the frequency with which faculty choose QEP-relevant objectives. The IDEA System includes seven objectives that are particularly relevant to our QEP:

- Learning to apply course material
- Acquiring teamwork skills
- Developing creative capacities
- Developing skill in expressing oneself
- Learning how to find and use resources
- Learning how to analyze and critically evaluate ideas
- Acquiring an interest in learning more

We expected to see 5% increases in the percentage of faculty choosing QEP-relevant objectives (relative to the baseline) beginning in 2007. Table 4 shows year-by-year changes in each QEP-relevant objective. In the first year we observed large increases in 6 of the 7 objectives. The average increase in 2007 (15.0%) far surpassed our goal for the year (5.0%). Our goal in 2008 was also achieved in 4 of the 7 objectives. In 2009, our goal of a 15% increase was achieved in 2 objectives (i.e., Finding and Using Resources and Critical Thinking). In 2010, our new goal of matching or exceeding the previous three years was achieved in 3 objectives (i.e., Teamwork, Self-Directed Learning, and Finding and Using Resources).

Overall, there is evidence that faculty are choosing QEP-relevant objectives with greater frequency than they were before the QEP began. Most notably, faculty are much more likely to emphasize Teamwork and Finding and Using Resources. Critical Thinking and Self-Directed Learning are also much more likely to be endorsed by faculty than before the QEP began. The objective showing the least amount of change (i.e., Learning to apply course material) was

already being chosen at a relatively high rate before the QEP began. By 2010, that particular objective was chosen in 69.0% of our classes, much more than any other objective. Other objectives (i.e., Creativity and Communication) seemed to show short-term increases in selection followed by subsequent decreases. There are at least two explanations for these decreases and small increases. First, there was obviously a large increase at the beginning of the QEP when there was campus-wide excitement and involvement in the development of the plan. Efforts to increase Creativity and Communication in classes may be particularly more difficult to sustain and may have been abandoned after initial attempts to improve them. Secondly, new faculty are introduced to the QEP during their orientation, but this short introduction may be insufficient. As we get further away from the QEP launch, we need to make sure that new faculty are introduced to all aspects of the QEP, perhaps through a stand-alone workshop in addition to the orientation.

Table 4: Percentage of Faculty Choosing QEP-Relevant Course Objectives

	Baseline (2001- 2006)	2007	Percentage Increase Over Baseline (Goal 5%)	2008	Percentage Increase Over Baseline (Goal 10%)	2009	Percentage Increase Over Baseline (Goal 15%)	2010	Average of Previous 3 Years (Goal: Match or Exceed)
Application	66.3	67.1	1.3	71.4	7.8	69.6	5.0	69.0	69.4
Teamwork	32.0	38.2	19.4*	38.3	19.7*	35.4	10.6	39.5	37.3*
Creativity	23.6	26.9	14.0*	25.8	9.3	27.1	14.8	24.4	26.6
Communication	39.2	43.1	9.9*	40.9	4.3	42.4	8.2	41.2	42.1
Finding & Using Resources	36.6	44.9	22.7*	43.8	19.7*	43.3	18.3*	44.5	44.0*
Critical Thinking	36.2	42.7	18.0*	43.9	21.3*	43.9	21.3*	42.4	43.5
Self-Directed Learning	33.7	40.3	19.6*	39.1	16.0*	37.5	11.3	40.3	39.0*
Average			15.0*		14.0*		12.8	43.0	43.1

* Goal was achieved

Goal 3: Students will report greater involvement in and institutional emphasis on QEP-related activities in the National Survey of Student Engagement (NSSE).

The National Survey of Student Engagement (NSSE) was administered to TTU freshmen and seniors in Spring 2006, Spring 2009 and Spring 2011. Five of the items ask students to report the types of mental activities required in their coursework. Over the course of the QEP, we expected students to report less memorizing and more analyzing ideas, synthesizing ideas, evaluating information, and applying theories to practical problems. Six of the items ask students to report the extent to which the institution contributed to their skill in writing, speaking, critical thinking, teamwork, independent learning, and complex problem solving. By 2009, we hoped to see either a 5% increase over the 2006 baseline scores or scores that matched or exceeded the relevant THEC means. The revised goal for 2011 was to match or exceed the THEC means.

In 2009, we observed 5% increases in the extent to which freshmen synthesized ideas in class and the extent to which self-directed learning was encouraged by the institution (see Table 5). Five of the TTU institutional means matched or exceeded the THEC means. By 2011, 14 of the TTU institutional means matched or exceeded the TTU means from the 2009 administration.

Table 5: Changes in QEP-Related NSSE Responses

NSSE Item	Class	2006 Baseline	2009	Percentage Change (5% Goal)	2011
Memorizing facts, ideas to repeat in rote form (Expected decrease or less than average)	Freshmen	2.91	3.01†	3.44	3.03‡
	Seniors	2.85	2.84	-0.35	2.83
Analyzing ideas, experiences, or theories	Freshmen	2.98	3.00	0.67	3.05‡
	Seniors	3.18	3.22	1.26	3.25‡
Synthesizing and organizing ideas into new more complex relationships	Freshmen	2.67	2.82	5.62*	2.81
	Seniors	2.91	2.98	2.41	3.03‡
Making judgments about the value of information, arguments, methods	Freshmen	2.74	2.82	2.92	2.87‡
	Seniors	2.88	3.01	4.51	3.01‡
Applying theories or concepts to practical problems	Freshmen	2.93	2.99	2.05	3.04‡
	Seniors	3.24	3.28†	1.23	3.29‡
Institution contributed to skills in writing clearly and effectively	Freshmen	2.82	2.84	0.71	2.94‡
	Seniors	2.92	3.01	3.08	2.93
Institution contributed to skills in speaking clearly and effectively	Freshmen	2.73	2.77	1.47	2.79‡
	Seniors	2.90	3.00	3.45	2.97
Institution contributed to skills in thinking critically and analytically	Freshmen	3.05	3.15	3.28	3.19‡
	Seniors	3.35	3.37†	0.60	3.36
Institution contributed to skills in working effectively with others	Freshmen	2.94	2.94	0.00	2.94‡
	Seniors	3.28	3.24†	-1.22	3.23
Institution contributed to skills in learning effectively on your own	Freshmen	2.78	2.94	5.76*	2.93
	Seniors	3.09	3.05	-1.29	3.09‡
Institution contributed to skills in solving complex real-world problems	Freshmen	2.54	2.61	2.76	2.67‡
	Seniors	2.81	2.89†	2.85	2.87

† TTU mean matched or exceeded mean for THEC peers

* Percentage increase goal was achieved

‡ TTU mean matched or exceeded TTU mean from 2009

Goal 4: Students will improve their performance on direct measures of critical thinking/real-world problem solving (i.e., Critical Thinking Assessment Test).

The Critical Thinking Assessment Test (CAT) was administered to a stratified random sample of graduating seniors in 2005, 2008, and 2009. We expected to see an increase in scores across time with specific goals of 5% and 10% increases. We did not expect to see changes in the entire group of seniors until the QEP was widely disseminated throughout the campus. Scores on the CAT did show a substantial increase in 2008 (see Table 6). As the plan was more fully implemented, it became clear that QEP projects did not impact the magnitude of students required to affect the sample of graduating seniors. Assessment using the CAT was then implemented within specific QEP projects and performed in Spring 2009 and Spring 2010. Results from these projects showed that five out of nine projects assessed significantly improved critical thinking scores across a broad range of skills. Further course specific assessment using the CAT has been undertaken by individual departments on campus. This allows faculty to identify potentially high-impact courses and provide formative assessment about individual courses that may be improving students' critical thinking.

Table 6: Critical Thinking Assessment Test Results

	2005 Baseline	2008	Percentage Change (5% Goal)	2009	Percentage Change (10% Goal)
CAT Score	17.7	19.1	7.91*	17.9	1.13

* Goal was achieved

Goal 5: Alumni will report an increase in QEP-related activities during their time at TTU.

An alumni survey was conducted by our governing body (THEC) in 2007 and 2010. The survey targeted alumni who had graduated two years prior and asked them about several items related to our QEP. Specifically, alumni were asked if their college experience emphasized memorization, analyzing information, synthesizing information, making judgments, and applying information. They were also asked how well their college experience equipped them to write effectively, speak effectively, and learn independently. Results are shown in Table 7.

Table 7: Alumni Survey Results

	2007 Baseline	2010	Percentage Change (5% Goal)
Memorizing (decrease expected)	3.08	2.66	-13.6*
Analyzing	3.24	2.79	-13.9
Synthesizing	2.84	2.68	-5.6
Making Judgments	2.94	2.60	-11.6
Applying	3.23	3.25	0.7
Writing clearly and effectively	2.99	2.66	-11.0
Speaking clearly and effectively	2.90	2.71	-7.6
Learning on your own	3.31	2.98	-10.0

* Goal was achieved

We did observe a decrease in the amount of memorization reported by alumni, but we did not see significant increases in the other expected outcomes. The 2010 survey targeted those who graduated in 2008, so it is possible that the QEP had not been disseminated widely enough to have a significant impact across the campus.

Goal 6: Employers will report higher levels of skills in the areas of critical thinking, problem solving, teamwork, and communication.

Our baseline employer survey was conducted in 2008, but the subsequent survey has not yet been completed. We are currently designing an employer survey that will meet the needs of our QEP assessment as well as the requirements of our governing body (THEC). Implementation is currently scheduled for Spring 2013 and the survey is being designed to measure progress on our QEP goals.

Unanticipated outcomes: One unanticipated outcome concerned the path of change we observed. We expected gradual and progressive increases in our measures of success (e.g., selection of IDEA objectives, critical thinking test scores). Instead we observed a rather large initial increase in several outcomes. These initial increases were followed by sustained results or slight decreases.

Other unanticipated outcomes were very positive. Efforts to support service learning QEP projects led to the establishment and continued funding of the University Service Center. The Center has a full-time director whose responsibility is to support service learning initiatives across the campus. We also did not expect the powerful impact that the QEP would have on a few departments. Whereas the QEP has not been evenly implemented across campus, many departments have experienced a significant culture change. Many faculty members in the Department of Chemical Engineering, for example, have abandoned traditional lecture-based instruction and adopted active learning strategies as a direct result of the QEP.

Summary

After five years of implementing our Quality Enhancement Plan, we are quite proud of our successes and eager to continue weaving critical thinking and real-world problem solving skills into our campus fabric. Our QEP was developed with broad campus involvement and designed to build on our needs and potential for improvement. The plan was supported by the administration with financial resources and qualified staff. Students, faculty, and staff from across the campus were involved in innovative active-learning activities. Students in a French class traveled to Montreal to feed the hungry. Agriculture students collaborated with art students to create lifelike murals. Composition and theater students collaborated to produce a play. Engineering students worked with K-12 teachers to improve the science curriculum. Because of our success and the strategic importance of critical thinking and lifelong learning to the University, the structure of our QEP will remain in place. Our future emphasis on critical thinking will rely heavily on the most successful aspects of our QEP and the lessons we have learned.