Institutional Effectiveness Report

Department of Biology

The Department of Biology has three degree programs (B.S. in Biology, B.S. in Wildlife and Fisheries Science, and M.S. in Biology). Each degree program has a separate report. Program Goals and Student Learning Outcomes for the undergraduate programs are similar since Wildlife and Fisheries Science is applied Biology; however, assessment results differ for most goals and outcomes based on the assessment techniques used. The graduate program has a unique set of goals and learning outcomes. This report includes Program Goals and Student Learning Outcomes for Biology undergraduate majors.

Academic Year: 2017-2018
Department/Unit: Biology
College: Arts and Sciences
Submission Date: July 1, 2018
Contact: Dr. Robert E. Kissell, Jr.

I. Department Mission:

The primary mission of the Department of Biology at Tennessee Tech is to promote biological education in the region, state, and nation through teaching, research, and public service.

II. Program Goals and Student Learning Outcomes:

Program Goal 1: Cooperative programs ("co-ops") or experiential internships will be completed by at least 10% of BIOL students during their undergraduate years.

Program Goal 2: The Department of Biology will increase the incorporation of active-learning strategies in courses offered.

Program Goal 3: The Department of Biology will increase undergraduate retention.

Program Goal 4: The Department of Biology will make significant progress toward increasing diversity.

Student Learning Outcome 1: Undergraduate Biology majors will demonstrate improved critical thinking skills.

Student Learning Outcome 2: Biology majors will participate in extracurricular activities related to their discipline.

Student Learning Outcome 3: All students completing a degree in Biology at Tennessee Technological University will use scientific reasoning as codified by the structured process commonly known as the scientific method.

Student Learning Outcome 4: Biology majors will be able to demonstrate a command of general biology and the general principles in various specific areas of biology.

III. Assessments

- **Senior Questionnaire (Appendix 1)** (Program Goal 1 and Student Learning Outcome 2; Administered each Fall and Spring semester) – Graduating seniors are asked to complete a short questionnaire concerning extracurricular activities, including cooperative programs and internships, at the time they take their major field exam.

- **National Survey of Student Engagement** (Program Goals 1 and 4, and Student Learning Outcomes 1 and 2; Given Spring semesters 2006, 2009, 2011, 2014) – The National Survey of Student Engagement (NSSE) assesses students' abilities to work as a team, communicate, and critically think. These values will be compared to data from the senior questionnaire and results from IDEA evaluation reports.

- **Faculty Annual Report** (Program Goal 2; Conducted annually in Spring semester) – Each faculty member submits a Faculty Annual Effort report to the chairperson that discusses their efforts for the previous calendar year. The departmental chair tracks the number of faculty participating in active-learning training and mentoring, and the incorporation of active learning/critical thinking strategies by gleaning such information from these reports.

- **IDEA Evaluation Reports** (Program Goal 2 and Student Learning Outcome 1; Administered in each class during Fall and Spring semesters) – All faculty are asked to have IDEA Evaluation Forms completed for their respective classes at the end of each semester. Faculty are encouraged to integrate active learning/critical thinking techniques into course objectives.

- **California Critical Thinking Test (CCTST)** (Program Goal 2 and Student Learning Outcome 1; Administered during Fall and Spring semesters to graduating seniors) – The CCTST evaluates students' abilities to critically think based on skills that they have learned in their courses.

- **TECH TRENDS Institutional Research Reports** (Program Goals 3 and 4; Provided each Fall semester) – These reports provide institution-wide data concerning enrollment, demographics, and retention. The enrollment component of this goal is assessed by comparing enrollments from year to year. The retention component is assessed by comparing number of freshmen enrolled during fall and the following spring.

- **Scientific Method Exams (Appendix 2)** (Student Learning Outcome 3; Administered each Fall and Spring semester) – Exams developed by the Biology Department are administered to students in selected classes that determine the degree to which students have learned the scientific method and to determine if they agree that our classes are adequately teaching the scientific method.

- **ACAT Major Field Examination** (Student Learning Outcome 4; Administered each Fall and Spring semester) – The ACAT exam breaks subject matter into a number of biological categories. We can select which categories should be used in evaluating our majors. These categories include bacteriology, cellular biology, ecology, genetics,

botany, zoology, and evolution. This option is especially appealing because of the different focus of our program (i.e., organismal) from that of many other biology programs (i.e., molecular) in the state and nation.

IV. Rationale for Outcomes and Assessments (Process of Data Analysis):

- Graduating seniors are asked to complete a short **Senior Questionnaire** concerning extracurricular activities at the time they take their major field exam, including an assessment of how valuable they considered the experiences. Our goal is to have at least 25% of all Biology majors participate in extracurricular activities related to their discipline. One of the questions on the questionnaire is devoted specifically to internships and co-ops. The departmental chair tracks student internship participation rates through time. The goal is assessed by determining if 10% of Biology students complete cooperative programs ("co-ops") or experiential internships during their undergraduate years. The departmental Planning Committee, consisting of five departmental faculty members selected by the department chairperson, continually revises the senior questionnaire to provide more detailed information about activities that are most valuable to undergraduate students. Results from the Senior Questionnaire are compared with data from the **NSSE**.

- The department chair discusses each individual faculty member's progress as summarized in **Faculty Annual Reports**. Active-learning is assessed by determining the number of Department of Biology faculty that enhance their knowledge of active-learning teaching approaches by participating in on- or off-campus training and development workshops devoted to such approaches. All departmental faculty members are expected to receive such pedagogical training during their first 3 years of employment. In addition, 100% of new Department of Biology faculty are paired with a faculty mentor who has experience with active-learning techniques in the classroom during their first year of employment. On-going progress on active learning/critical thinking implementation is summarized and included in the Departmental Annual Report submitted by the chair to the Dean of the College of Arts and Sciences.

- **IDEA Evaluation Reports** are used institution-wide and provide a mechanism for faculty to evaluate if they have achieved specific objectives in their respective courses. When completing IDEA Evaluation Forms, departmental faculty are encouraged to increase their selection of critical thinking and active learning objectives. We would like at least 75% of Department of Biology faculty to incorporate active-learning/critical-thinking strategies into their individual courses to improve the reasoning ability of our students. Specifically, our goal is for departmental faculty to select as important or essential teamwork 25%, communication 50%, and critical thinking 50% of the time. The departmental chair and Planning Committee track these percentages from IDEA reports and provide feedback to the entire department at the start of each Fall Semester. In addition, the departmental chair and Planning Committee track percentages of students who responded with a "4" or "5" for items selected by faculty as important or essential in the "Progress Towards Goals" categories for teamwork, communication, and critical thinking. Results are compared with data from the **NSSE and the CCTST**. These results are also discussed at the Fall Semester faculty meeting.

- **TECH TRENDS Institutional Research Reports** are reviewed by the chair to acquire information on institution-wide enrollment, demographics, and retention. Enrollments are compared from year to year. Retention is assessed by comparing number of freshmen enrolled during fall and the following spring. Departmental retention is compared to the university-wide average. To assess progress increasing diversity, the departmental chair uses demographic information to compare minority and women enrollments from year to year. These data are summarized in the Departmental Annual Report submitted to the Dean of the College of Arts and Sciences.

- Biology majors enrolled in two courses (a freshman course and an upper-division course) are required to complete a **Scientific Method Exam (Appendix 2)** at the end of the semester during which they take the courses. Results are evaluated by the departmental chair and the course instructors to determine the degree to which students have learned the scientific method and to determine if they agree that our classes are adequately teaching the scientific method. Comparisons are made for scores achieved by students in the freshman course and those achieved in the upper-division course.

- All graduating senior Biology majors are asked to take the **ACAT Major Field Examination** during the semester in which they intend to graduate. Scores are compared to the national mid-point range for the areas of bacteriology, cellular biology, ecology, genetics, botany, zoology, and evolution. The departmental chair tabulates scores and reports the results to the departmental Planning Committee at the start of each Fall semester.

V. Results

All program goals and student learning outcomes are assessed and results are evaluated on an on-going and systematic annual basis.

Senior Questionnaire (Appendix1) (Program Goal 1 and Student Learning Outcome 2) Internships and cooperative programs usually are not as popular among Biology majors as Wildlife and Fisheries Science majors. (Program Goal 1). Until recently, the internship program in the Department of Biology has been directed towards field programs, and almost all of the students who took advantage of this opportunity have been Wildlife and Fisheries Science majors. During the last five years, a few Biology majors chose to pursue internships, especially in the health-related disciplines. During the last academic year, however, 2.1% of students participated in internships or co-op assignments; overall, we are not meeting our target goal of 10% (Table 1). We will continue to encourage students to pursue internships.

During the past 5 years, an average of 87.5% of graduating Biology majors indicated that they **participated in extracurricular activities** while at TTU (Student Learning Outcome 2), and more than 85% of them indicated that these experiences contributed positively to their education (Table 2). Among students who indicated the special activities did not contribute to their education, inappropriate seminar topics and club activities were the most common complaints. These complaints were understandable because most of our seminars were field-oriented, and the students who complained were primarily Health Sciences Biology majors. We provided additional seminars that were more pertinent to their interests last two years and there was a dramatic increase in participation.

Table 1. Percent of Biology graduates completing internship (BIOL 4900) or co-op assignment (n = number of students surveyed).

Academic Year	Sample Size (n)	Percent (%)
2013-2014	41	2.5
2014-2015	23	0.0
2015-2016	46	8.7
2016-2017	45	0.0
2017-2018	47	2.1

Table 2. Percent of graduating Biology majors participating in extracurricular activities related to their discipline by academic year.

	2013-2014 (N=40)	2014-2015 (N=23)	2015-2016 (N=46)	2016-2017 (N=68)	2017-2018 (N = 47)
Ext-Cur. Activities	92.5%	78.3%	80.4%	92.6%	93.6%
Clubs	57.5%	34.8%	32.6%	35.3%	38.3%
Internships	2.5%	0.0%	8.7%	0.0%	2.1%
Sp. Topics	30.0%	26.1%	19.6%	29.4%	25.5%
Sci. Mtg.	20.0%	30.4%	39.1%	26.5%	38.3%
Seminars	70.0%	65.2%	80.4%	76.5%	89.4%
Other	27.5%	26.1%	26.1%	20.6%	42.6%
Positive Contribution	75.0%	69.6%	76.1%	73.5%	85.1%

National Survey of Student Engagement (Program Goals 1 and 4, and Student Learning Outcomes 1 and 2) The NSSE report changed how data are categorized from 2014 to 2017. As a result, the results provided for 2017 combines Biology in with Biochemistry or biophysics, Biomedical science, Botany, Cell and molecular biology, Chemistry; Earth science (including geology), Marine science, Mathematics, Microbiology or bacteriology, Natural science, Other biological sciences, Physical sciences (general), Physics, and Zoology. Therefore, the comparisons are not necessarily representative of Biology alone.

When comparing participation by Biology majors in **internship programs** (Program Goal 1) with students University-wide, NSSE results from 2017 indicated 39.3% of Biology seniors indicated either they had or planned to participate in an internship, while 56.3% of Tennessee Tech seniors, regardless of major, indicated they either they had or planned to participate in an internship.

NSSE data from 2014 and 2017 indicated that **minority students** represented 2% to 11% of first

year Biology students (Program Goal 4), and 5% to 10% of Biology seniors, while **female students** represented 60% to 73% of first year Biology students, and 52% to 62% of Biology seniors. Our data are similar to the NSSE results; however, variation is due to the low sample size measured using the NSSE survey.

NSSE 2017 data indicate that for **communication and critical thinking** (Student Learning Outcome 1), our majors improved from their freshman year through their senior year (Mean values for written communication improved from 2.56 (± 0.2) to 2.89 (± 0.15). Mean values for oral communication improved from 2.69 (± 0.2) to 2.93 (± 0.13). Mean values for critical thinking improved from 3.13 (± 0.22) to 3.26 (± 0.13)). NSSE 2017 data for teamwork indicated slightly more autonomy between freshman and senior years for Biology majors: 2.44 (± 0.26) to 2.85 (± 0.15). While the means for each of the aforementioned metrics are typically increase in value from the freshman year to the senior year, there is no measureable difference given the effect size and sample size. The faculty observes distinct growth in students over their academic career in the department. This observation relative to the metrics used in the NSSE report raises questions about the use of these statistics given their low sample size and the effect size required to observe a difference.

NSSE data for 2017 seniors indicated that seniors in the Biological Sciences participated in **extracurricular activities** for an average of 6.06 hours each week (Student Learning Outcome 2). Our data indicate a high participation rate (i.e., 93.6%; (Table 2)).

Faculty Annual Report (Program Goal 2) During 2006, the Department of Biology determined through discussions at faculty meetings that it was essential that faculty develop and adopt **active learning techniques** into their courses (Program Goal 2). Three faculty members participated in workshops during 2012-2013 and 2013-2014. During 2014-2015, one faculty member attended "mEngage Leadership Academy" to mobilize emerging technology into the classroom. His experience promoted other faculty members to investigate how they might accomplish the same in their courses. During 2015-2016, faculty members participated in workshops such as a McGraw-Hill Higher Education Summit, AIMT Training for the Top 30 Classes, and the Flipped Classroom. During 2016-2017 five faculty members participated in workshops through the Center for Teaching and Learning. During 2017-2018 faculty members participated in several programs provided by the CITL (formerly the CTLE) and the Academic Learning Community program.

Table 3. Number of tenured or tenure-track faculty in the Department of Biology that reported that they had participated in active-learning workshops during the last five years.

Academic Year	Sample Size (n)	Participants
2013-2014	16	3
2014-2015	17	1
2015-2016	21	3
2016-2017	17	5
2017-2018	17	5

Since 2013, **at least 75% of departmental faculty incorporated active-learning/critical-thinking strategies into their individual courses** [Program Goal 2 (Table 4)]. The most commonly listed approaches were analysis and interpretation of independently gathered data in lab exercises and reviews of peer-reviewed articles. Several courses required students to work in

teams to gather data that could not be collected as individuals, and they were required to provide a team report at the end of these exercises. Many lab exercises attempted to simulate real-world problems, and students were required to develop solutions to these problems. Many upper division labs are designed to be "on-going", and each week's exercise builds on techniques or information learned during the previous week. All of our majors must complete an independent research project as part of the BIOL 3920 course and present their findings and interpretations in a written and oral format. Thus, we feel that we are doing an admirable job of incorporating critical thinking and active learning in our courses, but we will continue to develop additional approaches in these areas.

Table 4. Percent of Department of Biology faculty incorporating active-learning/critical- thinking strategies in their courses during the last five years.

Academic Year	Sample Size (n)	Percent (%)
2013-2014	16	79
2014-2015	18	83
2015-2016	21*	95
2016-2017	21*	95
2017-2018	20	95

*A total of 21 faculty members (tenure-track, tenured, and non-tenure-track) belong to the Department of Biology, but one did not receive IDEA evaluations during at least one semester during this academic year.

IDEA Evaluation Reports (Program Goal 2 and Student Learning Outcome 1) Departmental faculty members are incorporating active-learning/critical thinking strategies in their courses; however, **objectives incorporating teamwork, communication, and critical thinking** are incorporated at varying levels (Program Goal 2). We have not met our goal (25%) for teamwork in the last five years (Table 5). This was the first year we met our goal (25%) for communication in the last four years. In the last five years, our critical-thinking goal (50%) was met only in 2016-2017. The five year averages for Biology in these categories were 15.0% for teamwork, 22.3% for communication, and 43.1% for critical thinking. Consistency among years indicates that our departmental goals for critical thinking and teamwork are realistic and consistent with what faculty believe are important in their courses.

IDEA Reports now provide the percentages of students who respond with a "4" or "5" for items selected by faculty as important or essential. This allows a means of evaluating if students are learning the **goals of teamwork, communication, or critical thinking** in classes in which faculty consider these learning outcomes important by ranking the class as a "4" or "5" (Student Learning Outcome 1). To provide a more meaningful understanding of how students perceive if the goals are being met, the number of courses that students rated at least 50% of the time with a "4" or "5" was calculated. Based on these results (Table 6) it appears that during this last academic year, the percent of sections that were rated by students where substantial or exceptional progress was made declined across all three categories. This was the first academic year in which all evaluations were conducted on-line. Metric reporting was much improved. In a few instances, faculty listed all 12 items as important; student assessment of these courses tended to be lower than average. Similarly, some faculty listed an item as being important while the instructor of a different section of the same class listed it as being of minor or no importance; such classes also generally received poor marks from students. Consequently, faculty should be more selective of these three items and only select them if they will be emphasized in the course.

In reviewing results, it was clear that faculty and students sometimes differ in opinion as to the importance of teamwork, communication, and critical thinking in specific classes.

Table 5. Percent of sections from IDEA evaluation forms where Department of Biology faculty selected teamwork, communication, and critical thinking objectives as essential or important during the last five years.

YEAR	TEAMWORK	COMMUNICATION	CRITICAL-THINKING
2013-2014	11.5%	29.5%	44.3%
2014-2015	10.7%	16.7%	32.1%
2015-2016	16.7%	21.4%	40.5%
2016-2017	22.2%	18.9%	66.7%
2017-2018	14.0%	25.0%	32.0%

California Critical Thinking Test (CCTST) (Program Goal 2 and Student Learning Outcome 1) CCTST results for Tennessee Tech Biology majors averaged 16.7 for 2017-2018. The Tennessee Tech average for this timeframe was 16.2 and the national average was 16.2. Based on these results, our students are learning critical thinking techniques as well as other students at Tennessee Tech and better than those at other universities administering the CCTST.

Table 6. Percent of Unit courses that undergraduate Department of Biology students rate more than 50% of the time with a "4" or "5" in the "Progress Towards Goals" categories for teamwork, communication, and critical-thinking over the last five years.

YEAR	TEAMWORK	COMMUNICATION	CRITICAL-THINKING
2013-2014	59.5%	57.7%	67.8%
2014-2015	100%	82.4%	96.6%
2015-2016	100%	66.7%	88.2%
2016-2017	75.0%	82.4%	95.0%
2017-2018	48.0%	40.2%	63.1%

TECH TRENDS Institutional Research Reports (Program Goals 3 and 4) The Department of Biology has monitored **enrollment trends** for several years and used these trends to develop strategies to meet this goal [Program Goal 3 (Table 7)]. Although enrollment was not viewed as a concern by the department in 2017, in order to maintain a perspective on retention, enrollment data are included. In Fall 2014 and 2015, enrollment reached a high of 345 and declined to 285 in the fall of 2017. Health Sciences Biology is still the most popular concentration in the department, representing approximately 27% of all Biology majors. However, the decline represents 14 percentage points in one year. We are unsure of the root of the decline.

Retention efforts were intensified during the past eight academic years when the BIOL 1000

freshmen and transfer student orientation class was modified (Program Goal 3). During the past eight years, this course was taught in small sections of less than 25 students, and it included exercises designed to improve retention. Departmental retention (mean = 86.5%) from fall to spring has been slightly below the university average (mean = 91.3%; Table 7) and annually slightly below during all but one of the last five years; we will continue to monitor the trend.

Table 7. Number of students enrolled as Biology majors and freshman fall-to-spring retention rates (percent) for undergraduates within the Department of Biology and Tennessee Tech University.

Year	Enrollment – Biology	Retention – Biology	Retention – TTU
2013	338	91.8	91.5
2014	345	87.8	90.6
2015	345	82.1	91.9
2016	316	86.3	92.4
2017	285	84.7	90.3

On-going evaluation of **departmental efforts towards meeting diversity objectives** indicated that relatively consistent percentage of minority students pursued the B.S. Biology degree program over the last five years [Program Goal 4 (Table 8)]. Most of these students are enrolled in the Health Sciences concentration, and the establishment of this program in 2001 probably is the major factor influencing this increase. Over the last five years, over 50% of all undergraduate Biology majors have been females. Currently, 179 of 285 Biology majors are female. Attractiveness of certain programs to females (e.g., health-related biology and microbiology), as compared to others (e.g., applied field biology), probably provides the best explanation for this difference in gender balance among programs.

Table 8. Percent of Biology majors as minorities and females during the last five years.

Year	Minorities (%)	Females (%)
2013	15.4	61.2
2014	15.3	58.3
2015	13.3	60.9
2016	14.9	59.2
2017	14.4	62.8

Scientific Method Exams (Appendix 2) (Student Learning Outcome 3) Student understanding of the scientific method, as assessed using the Department of Biology Scientific Method Exam (Appendix 2), was evident [Student Learning Outcome 3 (Table 9)]. Results are consistent with long-term trends in the BIOL 1000 class that indicate that most of our freshmen students recognize the components of the scientific method and understand how to apply it. In general, upper division students in BIOL 3920 score higher than first-semester students. In the past, we concluded that reinforcement does occur throughout the program and that most senior students have retained some level of understanding of the process.

Table 9. Student performance (percent) on the scientific method exam administered to students in BIOL 1000 (freshman course) and BIOL 3920 (upper division).

	Average Score (%)		100% Correct (%)		> 90% Correct (%)		< 70% Correct (%)	
Year	1000	3920	1000	3920	1000	3920	1000	3920
2013-2014	81.3	86.5	13.3	28.4	33.3	42.9	26.7	13.2
2014-2015*	74.9	71.5	13.8	0.0	18.4	0.0	33.8	44.4
2015-2016	74.4	90.0	10.5	52.3	16.3	65.9	37.2	13.6
2016-2017	74.1	89.2	14.1	52.3	18.8	63.6	43.8	13.6
2017-2018	78.2	86.7	17.1	36.8	23.2	52.9	26.8	16.2

*Data from Spring 2014 only.

ACAT Major Field Examination (Student Learning Outcome 4) We first began use of the ACAT exam in Fall 2006 to **demonstrate student command of general biology and the general principles in various specific areas of biology**, and we now have sufficient data to compare results among cohorts (Student Learning Outcome 4). Our majors, on average, have consistently performed above average in some areas (e.g., genetics) and consistently low in others (e.g., evolution) (Table 10). We do not require a course that specifically addresses evolution, making the assumption that our course-by-course treatment of this unifying theory was a sufficient approach to provide an overall treatment of the subject. The more puzzling result is that some cohorts perform significantly better in some areas than other cohorts. We suspect that these differences reflect the concentrations and/or options pursued by students taking the exam. For example, Botany majors undoubtedly score higher on the botany section than Microbiology majors.

Table 10. Results of the ACAT Biology Exam during the last five years.

Year & Sample Size	Bacteriology		Cellular Biology		Ecology		Genetics		Botany		Zoology		Evolution	
	Score	%tile	Score	%tile	Score	%tile	Score	%tile	Score	%tile	Score	%tile	Score	%til
2013-2014 (n = 40)	505	52	489	46	478	41	524	59	448	30	489	46	514	56
2014-2015 (n = 44)	486	44	486	44	458	34	526	60	456	33	469	38	467	37
2015-2016 (n = 70)	488	45	490	46	487	45	508	53	471	39	461	35	487	44
2016-2017 (n = 49)	483	43	488	45	488	45	488	45	471	39	468	37	478	33
2017-2018 (n = 47)	489	46	506	52	509	54	516	56	498	49	481	41	484	43
AVG (n = 250)	490.2	46	491.8	46.6	484	43.8	512.4	54.6	468.8	38	473.6	39.4	486	42.6

VI. Modifications and Continuing Improvement: Program Changes due to Assessments

For Program Goal 1

Continued monitoring is necessary to assess the percent of Biology majors participating in internship and co-op assignments, and to determine if we want to modify this goal. During 2006-2007, we identified one bulletin board in the building as an internship board, and we post all announcements concerning such opportunities on the board. Having all announcements together in a prominent location should help increase student participation in internships and co-op assignments. The chair forwards email notifications to all students in the Biology program. We also discuss internships in BIOL 1000, but we need to develop additional strategies to encourage participation. The departmental Planning Committee will discuss and develop potential strategies for increasing participation.

Link to Assessment Data: The department continues to administer the student questionnaire to graduating Biology majors to assess Program Goal 1 and Student Learning Outcome 2, and evaluates the percentage data for participation in internship and co-op assignments on an annual basis. Due to low participation by Biology majors, departmental faculty post opportunities for Biology majors on the internship board, announce opportunities in classes, and forward e-mail announcements pertaining to internships and co-ops to students. The departmental Planning Committee will discuss and develop other potential strategies for increasing participation.

For Program Goal 2

The departmental chair periodically notifies faculty of off-campus opportunities for on- or off-campus training and development workshops devoted to active-learning teaching approaches, and funds are available to offset costs associated with such faculty development. The Department of Biology could join forces with other departments by holding joint workshops in the future. Alternatively, the department could design and offer its own active-learning workshop.

Mentors are identified and paired with new hires during the first year of employment. New faculty members and mentors are encouraged to interact often on active-learning and other academic issues. Initially, some experienced mentors may be members of other departments, but it is expected that mentors will primarily be members of the Department of Biology once active learning becomes more common in the department.

Faculty can participate in a developmental workshop and/or a mentor program to learn how to incorporate active-learning approaches into their courses. Newly hired faculty are required to work with faculty mentors during their first year of employment. We continue to monitor the percent of faculty that incorporate active-learning strategies into their courses.

It is expected that tenure-track faculty might be more conservative in their selection and ranking of IDEA objectives, because liberal selection can result in poor IDEA evaluations. Thus, tenured faculty have been encouraged to begin selecting teamwork, communication, and critical thinking objectives more frequently when they fill out IDEA forms. It is also expected that faculty will be modifying their courses to include more teamwork, communication, and critical thinking aspects.

Link to Assessment Data: Although the department has not conducted active-learning workshops, we are interested in this approach. Our data indicate that other than during 2006-2007 when this goal was added and we had 12 of 14 faculty members participating, we have maintained a relatively steady number of faculty members participating in active-learning workshops. All newly hired faculty members have been paired with mentors and have participated in active-learning workshops. More than 75% of faculty members incorporated active-learning strategies into their courses. This indicated that we have achieved our goal every year during the last five years that this goal has been monitored. These data will continue to be included in departmental annual reports that are submitted to the Dean of the College of Arts and Sciences. We will continue to monitor this goal using IDEA evaluations, and the departmental Planning Committee will conduct additional faculty discussions to determine what courses should emphasize these approaches and whether we wish to modify the target percentages to more adequately reflect faculty opinion.

For Program Goal 3

We need to examine retention trends in specific concentrations and options to better understand changes in enrollment and retention levels, and we need to compare these trends to those at other universities. We plan to continue monitoring retention closely in the future and attempt to determine reasons for low retention of our majors if a declining pattern develops.

Link to Assessment Data: The large enrollment increases experienced peaked three and four years ago and were largely due to increased enrollment within the health sciences concentration. Enrollment declined over the last two years and several reasons have been postulated. One reason

is thought to be the Tennessee Promise program. Students likely sought free tuition at community colleges over coming to TTU. A second potential reason is thought to be that Enrollment Management, responsible for marketing, has been in need of a permanent director in the last two years and this has likely affected recruitment.

For Program Goal 4

The Department continues to seek out minority and women students and to actively recruit these students into our programs. We examined our current efforts in recruiting minority students for the B.S. Biology degree during the 2016-2017 academic year via an ad-hoc committee. Several new approaches to address the issue were presented. Of the suggestions made, one approach was agreed upon by the faculty. That approach requires travel by a faculty member to several high schools to give talks to increase interest and visibility of the department. During the 2017-2018 academic year this approach was not completed. One of the champions of this approach transferred to another college within the university and the time required to conduct two tenure-track searches limited time available to see this approach through. Further discussions on this topic will be conducted by the departmental Planning Committee as the new approach is implemented.

Link to Assessment Data: Over 50% of our undergraduate Biology majors are female; however, the percentage of minority students has remained relatively stable for the past three years. We need to consider revising this goal to focus on minority representation given we are change our approach to recruiting minorities.

For Student Outcome 1

Continued monitoring is needed to identify trends and to determine why and what corrective measures are needed to make consistent progress in this area. Overall, results from 2017 indicate that we are meeting our current goals, but this has not been consistently achieved each year.

Link to Assessment Data: When compared with data from the National Survey of Student Engagement (NSSE) 2017 results, our students were found to be no different compared to the national average in critical thinking. We will continue to monitor these results and perhaps revise our goal for teamwork and communication. This learning outcome is closely tied to Program Goal 2.

For Student Outcome 2

In general, we are exceeding our goals in this area, but we will continue to monitor extracurricular activities to ensure that student participation continues. Senior questionnaires and discussions with individual students have indicated that professional extracurricular activities are considered an integral part of their educational experience. Consequently, we have intensified efforts to provide extracurricular opportunities. We are inviting outside seminar speakers more regularly, and departmental faculty members are presenting special seminars more often. We strongly encourage participation at professional meetings, and we often provide funds to help defray student travel expenses. We have incorporated a component in BIOL 1000 (Introduction to Biological Methods) that provides information on internship opportunities, student organizations, and undergraduate research opportunities. These efforts seem to be successful because over the last five years over

87% of undergraduate majors indicated that they participated in one or more activities, with most participating in several. We will continue to provide a wide diversity of extracurricular opportunities to all students, and we will increase our level of encouragement to participate. E-mail messages will be used, in addition to traditional postings, when advertising extracurricular activities. Some additional activities (e.g., extended field trips) are also being developed.

Link to Assessment Data: We will continue to use this learning outcome goal, but we will raise the desired participation rate to be consistent with current patterns of student participation. Since the level of participation varies among various activities (e.g., seminars vs. internships), we may develop target participation rates for various activities. Results from our survey indicate that a higher percent of our Biology graduates participated in extracurricular activities than data posted in the 2017 NSSE survey. We are pleased with our results and we would like to increase participation in internships and coop assignments as indicated in Program Goal 1.

For Student Outcome 3

Although most students respond satisfactorily on the scientific method exam, we are somewhat disappointed in the results. We have recently revised a number of our lower division laboratory courses to better teach the scientific method (i.e., an experimental component has been added). In addition, instructors are collaborating to ensure that the scientific method is being taught in appropriate courses and with a consistent focus. Students involved in research projects will be required to conceptualize their projects in the framework of the scientific method. We will continue to study these results to determine what additional tools can be used to ensure that all students retain an understanding of the scientific method.

Link to Assessment Data: The chair of the department ensures that exams are administered. We will continue to study these results to determine what additional tools can be used to ensure that all students retain an understanding of the scientific method. Recommendations for new survey tools or modifications to provide more meaningful results are discussed at departmental faculty meetings and voted upon before being implemented. This learning outcome is closely tied to Program Goal 2.

For Student Outcome 4

We intend to evaluate area weaknesses, and improve our students' skills in these areas by devoting more time to these topics in our courses. We also intend to emphasize the importance of major field exams because some students perform poorly because they do not take them seriously.

Link to Assessment Data: Since we have 7 different options and majors, we may need to evaluate each of these programs separately. The departmental Planning Committee will study this issue.

Appendix 1

GRADUATING SENIOR QUESTIONNAIRE

Department of Biology

1. Activities - Please check any of the extracurricular activities in which you participated during your program at Tennessee Tech, and briefly indicate if you felt that these activities contributed to your academic development.

_____ Beta Beta Beta active member

_____ Chem-Med Club active member

_____ Student Fisheries Association active member

_____ Wildlife Society active member

_____Internship (BIOL/WFS 4900)

_____ Special topics (BIOL/WFS 4990)

_____ Attended one or more professional meetings

_____ Attended special seminars or talks

_____ Attended departmental sponsored activities not class related

Do you believe that your participation in these activities contributed to your academic development? If so, how? (Please leave this section blank if you did not participate in any of the above activities).

_____

_____

_____

2. Classes - List below required classes that you felt best contributed to your academic development and classes that contributed least to your development. What other classes do you think should be required of your major?

Most Important Classes: _____

_____

_____

Least Important Classes: _____

_____

_____

Other Classes that should be required: _____

_____

_____

3. Other Suggestions - Please provide any suggestions that you believe would improve the quality of education in your major. (Use the back if necessary)

_____

_____

_____

_____

_____

_____

Degree and Concentration: _____

Appendix 2

Scientific Method Exam

Please select the response that best completes the sentence or answers the question.

_____ 1._____, in which the experimental variable has been omitted, are used in research as standards of comparison against which experimental data are compared.

A. Theories B. Controls C. Hypotheses D. Observations E. Replicates

_____ 2. A_____is a tentative answer to a research question, which will be evaluated using an experiment.

A. Theory B. Control C. Hypothesis D. Experiment E. Law

_____ 3._____is the use of multiple observations in a study.

A. Hypothesis B. Control C. Theory D. Experiment E. Replication

_____ 4. True (A) or False (B): Science is knowledge obtained by observation.

_____ 5. True (A) or False (B): A theory is a very tentative idea with little or no scientific evidence to support it.

_____ 6. True (A) or False (B): Publishing results in a peer-reviewed journal is an important part of the scientific process.

Does oatmeal really reduce bad cholesterol? You decide to try to answer this question. You predict that people who eat oatmeal 5 times a week for a month will have lower cholesterol than those who don't. You select 10 people, 5 of whom you put on this oatmeal diet, and 5 of whom you don't. At the end of the month, you measure cholesterol in all 10 people.

_____ 7. The statement "Oatmeal reduces bad cholesterol levels" is the _____of this research.

_____ 8. Using more than 1 person in each group illustrates the concept of_____.

_____ 9. Using a group of people who do not eat oatmeal illustrates the concept of_____.

A. Observation B. Control C. Hypothesis D. Experiment E. Replication

Please arrange the following steps of the scientific method in the correct order.

_____ design an experiment

_____ make observations

_____ publish results

_____ formulate research hypothesis

_____ draw conclusions

_____ collect data