

**Core Curriculum Assessment
College of Arts and Sciences
2007 - 2008**

During the 2007 – 2008 academic year, the College of Arts and Sciences (COAS) initiated an assessment of all courses in the baccalaureate core that are offered by COAS. The College contributes courses to three core component areas: core component area 2 (mathematics), core component area 3 (natural sciences), and core component area 4 (visual and performing arts). This report focuses on core component area three. The courses and number of students assessed are listed below.

Sciences (4372)

BIO 134, 137, 161, 162, 245 (1554 students)

CHM 135, 136, 138, 139 (948 students)

GEO 131 (142 students)

GEL 132, 133, 134 (676 students)

PHY 133, 134, 135, 138, 139, 141 (1052 students)

Assessment of Core Science Courses

The courses evaluated in this process may be taken by students at Sam Houston State University to satisfy the natural sciences requirement in the baccalaureate core. The Texas Higher Education Coordinating Board (THECB) publishes objectives for each core area that should be addressed by the courses offered at each institution. For the sciences, the objectives are:

- 1) To understand and apply methods and appropriate technology to the study of natural sciences;
- 2) To recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses and interpretation both orally and in writing;
- 3) To identify and recognize the differences among competing scientific theories;
- 4) To demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values and public policies;
- 5) To demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture.

The objective of the assessment was to determine if the THECB objectives were being met in our science core courses. Students taking these courses were surveyed, as part of the final exam, to assess their perception of whether or not these objectives were met. In addition, scientific questions were included in the exam to assess each student's actual acquisition of the knowledge and skills described in the THECB objectives. The questions were taken from EBAPS (EPISTEMOLOGICAL BELIEFS ASSESSMENT FOR PHYSICAL SCIENCE) [1]. Questions were selected from the EBAPS battery to correspond to the THECB objectives. The science core curriculum committee sought permission from the authors to use and modify the assessment questions to fit the assessment objectives.

Five survey questions were presented to the students corresponding to the 5 THECB objectives above to assess *their* perception of meeting these objectives. In addition, 5 contextual questions, modified from the EBAPS battery, were presented to the students to assess whether or not their knowledge indicates that the objectives were met. Appendix 1 contains the survey instrument and EPAB questions used in the assessment.

Table 1 contains percentage responses to the assessment questions. The questions are presented in the table to allow comparisons. The bold-faced THECB objective questions correspond to the student survey questions. Immediately following each of these responses in the table are the corresponding EBAP questions. The questions should indicate whether or not the objectives were actually met. The bold-faced number associated with each EBAP question is the percentage of correct responses. Note that THECB Objective 2 has two EBAP questions associated with it. For survey questions, students were asked whether or not they felt the THECB objective was met. Possible responses ranged from A-Strongly agree to D-Strongly disagree.

Table 1 Percentage responses to science core assessment questions

	A	B	C	D	E
THECB Objective 1	14.5	58.7	14.5	11.6	
Embedded Question 1	3.6	39.1	12.3	26.8	18.1
THECB Objective 2	8.7	63.8	19.6	8.0	
Embedded Question 2	10.9	13.0	57.2	13.8	4.3
Embedded Question 6	8.0	27.5	62.3		
THECB Objective 3	23.9	58.0	16.7	1.4	
Embedded Question 3	5.1	10.9	13.0	70.3	
THECB Objective 4	14.5	32.6	37.0	15.2	.
Embedded Question 4	3.6	10.9	9.4	75.4	0.7
THECB Objective 5	16.7	60.9	16.7	5.8	
Embedded Question 5	5.8	14.5	8.7	19.6	51.4

From the table, we see that approximately 73% of students felt that the first THECB objective, to understand and apply methods and appropriate technology to the study of natural sciences, was met. However, only 39.1% of students responded correctly to the first EBAP question. The student response seems to indicate that topics germane to this objective are covered, but student understanding of the use of scientific methods may be limited.

For THECB Objective 2, to recognize scientific and quantitative methods and the differences between these approaches and other methods of inquiry and to communicate findings, analyses

and interpretation both orally and in writing, approximately 72% of students felt the objective was met. For the corresponding EBAP questions, 57.2% and 62.3% responded correctly, respectively. In this case, there is not as severe a differential, but the findings still suggest that the students' perception that the objective is met is higher than indicated by the EBAP questions.

For THECB Objective 3, to identify and recognize the differences among competing scientific theories, approximately 83% of students feel the objective is met, while the EBAP question indicates 70% really understand this concept. Although the differential exists here as well, it is the consensus of the committee that we are meeting this objective.

For THECB Objective 4, to demonstrate knowledge of the major issues and problems facing modern science, including issues that touch upon ethics, values and public policies, only 47% of students feel that the objective is met, yet 75.4% of students responded correctly to the corresponding question. The consensus here is that the material related to this objective is integrated very well into the context of the course.

For THECB Objective 5, to demonstrate knowledge of the interdependence of science and technology and their influence on, and contribution to, modern culture, 77% of students feel that the objective is met, while only 51.4% of students responded correctly to the corresponding EBAP question. Again, the indication is that material related to this objective is covered, but students' level of understanding is limited.

Based on these findings, the following suggestions are being made to all departments offering core science courses:

- 1) While the scientific method and appropriate technological choices are taught in our courses, individual learning objectives should emphasize the students' deeper understanding of these topics;
- 2) Learning objectives in core science courses should emphasize a deeper understanding of the interpretation of experimental results;
- 3) Learning objectives in science core courses should emphasize a deeper understanding of the interdependence between science and modern culture.

Appendix 1 Science Core Assessment Questions

The following survey was attached to the final exam in all science core courses

Science Core Curriculum Assessment Instrument

To be administered to each course that is approved to satisfy Core Curriculum Area III

This survey is given to assess your understanding of the nature of science and certain basic science concepts. IT WILL NOT AFFECT YOUR GRADE. Please answer all items on the scantron provided by your instructor.

1. Through this course I have gained a good understanding of scientific methodology.
 - A. Strongly agree
 - B. Agree
 - C. Disagree
 - D. Strongly disagree

2. This course has taught me to differentiate between scientific methods of inquiry and other methods of inquiry.
 - A. Strongly agree
 - B. Agree
 - C. Disagree
 - D. Strongly disagree

3. Scientific theories are judged by how well they agree with other theories, how well they explain observations and how effective they are in predicting experimental and/or observational outcomes.
 - A. Strongly agree
 - B. Agree
 - C. Disagree
 - D. Strongly disagree

4. This course addressed the application of science to social and political issues.
 - A. Strongly agree
 - B. Agree
 - C. Disagree
 - D. Strongly disagree

5. This course demonstrated the interdependence of science and technology.
 - A. Strongly agree
 - B. Agree
 - C. Disagree
 - D. Strongly disagree

The following questions were included in the final exam. All questions are variations on EBAPS questions that were modified to assess whether the THECB objective was met. Corresponding THECB objectives are included in parentheses in this appendix, but were not included on the student version.

1. Which of the following is true? (THECB Objective 1)
 - A. Scientific experimentation usually involves trying something just to see what will happen, without predicting a likely outcome.
 - B. Science is primarily concerned with understanding how the natural world works.
 - C. All scientific problems are solved by The Scientific Method.
 - D. All of the above are true.
 - E. Only A and B are true.

2. Which of following is true? (THECB Objective 2)
 - A. Science can solve any problem or answer any question.
 - B. Science can use supernatural explanations if necessary.
 - C. Science always provides tentative (temporary) answers to questions.
 - D. All of the above are true.
 - E. Only A and B are true.

3. In daily life, people are often praised for maintaining some particular point of view, for the “courage of their convictions”. A change of mind is viewed as a sign of weakness. Is the same attitude true in science? (THECB Objective 3)
 - A. Yes. Scientists cling to their theories regardless of the truth.
 - B. Yes. Once discovered, scientific theories become absolute and unchanging truths.
 - C. No. Scientific theories are often changed to best suit the views of the majority in contemporary society. The best scientific theories are ones that are acceptable to the majority in society.
 - D. No. Scientific theories are often modified, refined, or improved but only when confronted with solid experimental evidence that requires modification of the original theory.

9. Which of the following is important for all educated people? (THECB Objective 4)
 - A. Knowledge of what science is and what science is not.
 - B. Knowledge of what science can and cannot do.
 - C. Knowledge of how science works.
 - D. All of the above are important.
 - E. Only A and B are important.

10. The interdependence of science and technology is demonstrated by which of the following? (THECB Objective 5)
 - A. The use of CT scans to be able to see inside fossils.
 - B. The use of particle accelerators to discover fundamental particles.
 - C. All scientists use the same instruments in the same way when making investigations in their field.

- D. All of the above.
- E. A & B but not C

11. A scientist traveling by train through Scotland sees one black sheep through the window of the train. The scientist's most appropriate conclusion would be: (THECB Objective 1)

- A. Scottish sheep are black.
- B. Some Scottish sheep are black
- C. All we know is that there is at least one sheep in Scotland, and that at least one side of that one sheep is black.