



Biochemical Sciences

Associate of Science

Program Overview

The objective of the Biochemical Sciences program at Ohio State ATI is to allow students to complete the first half of a Bachelor of Science degree in Biology and Food Science and obtain the prerequisites to apply for veterinary school.

The Biochemical Sciences program enables students to complete courses that meet requirements in general education, the food science or biology programs, and requirements for veterinary school admission. Areas of study include: biology, chemistry, microbiology, mathematics and data analysis.

Graduates with an Associate of Science in Biochemical Sciences can find careers as food science technicians, quality assurance technicians and research/laboratory technicians (plant, animal, and environmental).

Graduates with a Bachelor of Science in Food Science can become product development scientists, quality assurance supervisors, plant managers, food processing operations supervisor, food microbiologists, technical sales managers, flavor chemists, analytical laboratory directors, food research scientists or biotechnologists.

Graduates with a Bachelor of Science in Biology can find careers in communications, business (pharmaceutical or sales), teaching, and research or product development, or as research biologists, biomedical or health science researchers or scientific writers.

Graduates who further their education in a veterinary medicine program become practicing or research veterinarians.

Ohio State ATI is adjacent to the Ohio Agricultural Research and Development Center, the site of numerous biochemical research projects and laboratories. Ohio State ATI Biochemical Science students may have the opportunity to work with researchers in fields such as bioenergy and bio-based products (such as fuels, specialty chemical and fiber products), environmental quality and sustainability, and food security, production and human health.

Program Learning Goals & Outcomes

Goal 1.0

Have the ability to think critically in solving problems related to BioChemical Science

Outcome 1.1

Describe what critical thinking is, how evidence is used to develop an argument, and how to avoid errors in critical thinking

Outcome 1.2

Evaluate the extent to which critical thinking is employed in a group research project related to BioChemical Science

Outcome 1.3

Apply critical thinking to a real-world BioChemical issue

Goal 2.0

Communicate effectively in oral and written forms

Outcome 2.1

Demonstrate a basic level of sufficiency in written communication

Outcome 2.2

Demonstrate a basic level of sufficiency in oral communication

Goal 3.0

Understand biochemical sciences with breadth across inorganic and organic chemistry

Outcome 3.1

Apply theoretical concepts in inorganic chemistry to understand biochemical sciences

Demonstrate an understanding organic chemistry in biochemical sciences

Goal 4.0

Understand biochemical sciences with breadth across the field of physics

Outcome 4.1

Apply theoretical concepts in classical physics to understand biochemical science



THE OHIO STATE UNIVERSITY

COLLEGE OF FOOD, AGRICULTURAL,
AND ENVIRONMENTAL SCIENCES

Assessment Fundamentals

What is assessment?

While there are certainly many answers to this question, in the context of the CFAES academic community, assessment is the practice of evaluating the manner or degree to which students in academic programs in our college are learning what they are supposed to be learning. Academic units and programs within CFAES have developed student learning outcomes, which are statements of the key indicators of student learning in specific programs. Assessment is designed to compare actual student performance to these student learning outcomes: Simply put are students learning -- what we say they are? This is what assessment is designed to do.

Assessment is used to respond to at least two concerns:

1) Are students learning what they are supposed to be learning?
2) How can educators document that students are learning what they are supposed to be learning? While these two concerns are intertwined, they also fulfill separate functions. Concern one is primarily a question of academics: Are our teaching methods effective? Are our students learning what they should and as well as they should? What can we do to improve student learning? Concern one is aligned with continuing improvement of teaching and learning. Concern two is aligned more with the issue of accountability. Education is increasingly being asked and even required to document that students know and can do what we say they can do--and simple completion of course, program and graduation requirements is not enough. Accountability requires that educators show that students can actually demonstrate what they know and can do--and merely a grade on a test, a paper or in a course is not sufficient.

Why do assessment?

Assessment needs to take place for at least two reasons:

First, assessment is designed to function as continuing improvement for teaching and learning.

- ♦ Assessment helps educators improve the manner and degree to which students learn what they are supposed to be learning.
- ♦ Assessment provides information that allows educators to make good decisions based on quality information about student learning.
- ♦ Assessment encourages educators to look at what they do in the classroom, how their classroom practices affect student learning, and what changes could be made in teaching methods or materials to enhance student learning.

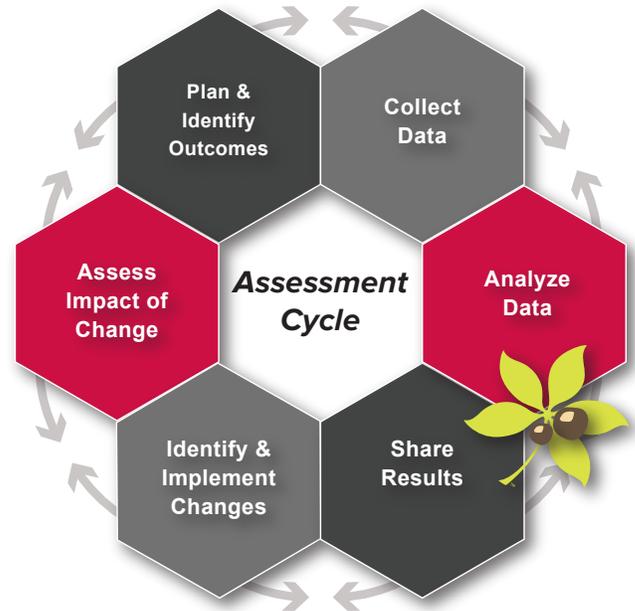
Second, we need to do assessment to remain accountable to the publics we serve.

- ♦ Students and their families should be able to see what we do in teaching and learning;
- ♦ accrediting agencies need to know that we are effective in our teaching and learning;
- ♦ legislative and executive governmental bodies provide funding and need to know that these funds are accomplishing their intended purposes.

Assessment of student learning should focus primarily on how we can improve teaching and learning; accountability should flow naturally from the focus on teaching and learning.

Assessment Cycle

The assessment cycle considers collection and review of data on an ongoing basis to formulate recommendations for incremental programmatic change. Accumulative findings for all program goals based on the contributing outcomes are used as the cornerstones for programmatic review. Assessment provides essential information for making strategic adjustments to the academic program, assuring continuous quality improvement with the intent of improving teaching and learning.



The language of assessment . . .

Goals: are stated in terms of achievement resulting from student learning. Goals provide a broad description identifying the foundations, concepts, theories, abstractions, principles, knowledge base, and/or skills, which are the products of what students are to be able to do, know, and care about upon the completion the program. -- Learning goals are frequently stated using the verbiage of: understand; appreciate; know about; become familiar with; learn about; become aware of; etc. -- Reoccurring learning goal concepts/themes for CFAES programs are Critical Thinking, Communications, Academic and Professional Integrity, Diversity, and Knowledge.

The stated learning goals of the programs within CFAES have the inferred prefix of: **Students will . . .**

Outcomes: Student Learning Outcomes (SLO's) (also commonly referred to as Expected Learning Outcomes (ELO's) or "objectives") are statements indicating changes in knowledge, skills, behaviors, attitudes, or values relative to a desired goal as a result of a specific activity, such as completion or participation in a program, activity, course, or project. -- Cognitive learning outcomes can most effectively be stated using verbs aligned with one of the six domains of the Bloom's Taxonomy of Educational Objectives (Remembering, Understanding, Applying, Analyzing, Evaluating, or Creating). -- Appropriately structured outcomes serve as the supportive methods/means of measuring student attainment of the associated learning goal.

The stated expected learning outcomes of the programs within CFAES have the inferred prefix of: **Students will have the ability to . . .**



Assessment & Curriculum Connection

Assessment results are used in concurrence with the program curricular map to form the underpinning for informing curricular decisions and to further enhance student learning. Curricular mapping demonstrates the opportunities for students to be introduced to knowledge (beginning), opportunities for reinforcement of knowledge (intermediate), and opportunities for students to demonstrate mastery of knowledge (advanced) relative to the stated programmatic learning goals.

Courses	Program Learning Goals B=Beginning, I=Intermediate, A=Advanced			
	Think critically in solving problems related to BioChemical Science	Communicate effectively in oral and written forms	Understand biochemical sciences with breadth across inorganic and organic chemistry	Understand biochemical sciences with breadth across the field of physics
PHYSICS 1200 <i>Mechanics, Kinematics, Fluids, Waves</i>		/ 2.1 Demonstrate a basic level of sufficiency in written communication		/ 4.1 Apply theoretical concepts in classical physics to understand biochemical sciences
CHEM 1210 <i>General Chemistry 1</i>		/ 2.1 Demonstrate a basic level of sufficiency in written communication	/ 3.1 Apply theoretical concepts in inorganic chemistry to understand biochemical sciences	
CHEM 1220 <i>General Chemistry 2</i>			/ 3.1 Apply theoretical concepts in inorganic chemistry to understand biochemical sciences	
AGRCOMM 2367 <i>Agricultural Issues in Contemporary Society</i>	B,A 1.1 Describe what critical thinking is, how evidence is used to develop an argument, and how to avoid errors in critical thinking 1.2 Evaluate the extent to which critical thinking is employed in a group research project related to BioChemical Science	/ 2.1 Demonstrate a basic level of sufficiency in written communication 2.2 Demonstrate a basic level of sufficiency in oral communication		
CHEM 2510 <i>Organic Chemistry 1</i>			/ 3.2 Demonstrate an understanding organic chemistry in biochemical sciences	
CHEM 2520 <i>Organic Chemistry 2</i>			/ 3.2 Demonstrate an understanding organic chemistry in biochemical sciences	
AGRCOMM 3130 <i>Oral Expression in Agriculture</i>		/ 2.2 Demonstrate a basic level of sufficiency in oral communication		
COMLDR 3537 <i>Data Analysis in the Applied Sciences</i>		/ 2.1 Demonstrate a basic level of sufficiency in written communication		
MICROBIO 4000 <i>Basic and Practical Microbiology</i>	/ 1.3 Apply critical thinking to a real-world BioChemical issue			



Assessment Methods

Achievement of program learning goals are assessed systematically utilizing the identified means for the aligned learning outcomes via direct and indirect measures that serve as authentic assessment methods.

Direct

Direct assessment methods are means of assessment that measure students' performance directly, are authentic, and minimize mitigating or intervening factors. In general, direct assessment methods are assessment tools that measure student learning by having students create or perform directly based on their learning. Direct methods are the direct evaluation of aggregate student achievement on specific learning outcomes.

Indirect

Indirect assessment methods are means of assessment that are steps removed from direct methods and are based upon perception of student learning from various constituents. In general indirect assessment methods infer whether learning has taken place by asking for perception of learning, typically from students, but also from those with whom they have worked. Indirect methods are tools that enable us to infer actual student achievement, very often from student self-reports of their perception of their learning.

Within the Biochemical Sciences program's assessment plan, the following methods have been identified as means of assessing student attainment of state learning outcomes:

Direct	
Other Classroom Assessment Method	Provide samples of student work, such as student papers and projects, from a variety of courses that are evaluated to see how well students are applying knowledge and skills to meet program goals.
Group Project	Assesses learning and performance in a group setting with evaluation on the group and/or individual process and end product. This tool can result in a group presentation, paper, demonstration, or developed project.
Embedded Testing	Student work in designated courses is collected and assessed in relation to the program learning outcomes, not just for the course grade. The assessment may be conducted at specific points in a program and the products of student work need to be considered in light of the multiple dimensions of the learning outcomes.
Laboratory Report	A report generated after the student completes designated experiment, process, research, or other laboratory procedure. The report should outline steps taken, materials used, methods, and results. This shows a student's comprehension of laboratory procedures and methods and ability to implement learned methods.
Oral Presentation	A classroom presentation or showcasing of the results of a particular project that has been conducted by an individual student or by a group of students in fulfilling a course assignment. The presentation might take place in a classroom or over the web and would typically present the results of a course-based assignment.
Writing Assignment	Written display of comprehension of course topic(s). This can be done through a research report, essay, journal entry, creative writing piece, or another suitable writing method.

Scaffolding to Support Learning Outcomes Assessment

The primary purpose of program learning outcomes assessment is to assure that all students have the opportunity to learn what is truly valued by the program. It is not enough to simply collect data for the programmatic learning outcome assessment; these data must be used to reflect and examine whether learning expectations are being obtained and when weaknesses are discovered, needed changes are determined. Educators must remember that the foremost purpose of learning outcomes assessment is for programs to continually be improving the quality of the teaching and learning experiences that enable significant learning.

To assure that all students have the opportunity to learn what is truly valued by the program, the program must engage all faculty and instructional staff at some level of the assessment process. To be successful a program must also have leadership and a supportive scaffolding structure in place to facilitate its assessment efforts.

Overview

The 2012 *Biochemical Sciences - AAS* program assessment plan was crafted under the leadership of the program coordinator for Biochemical Sciences located at Ohio State ATI. The CFAES Office for Teaching, Learning, and Assessment, in collaboration with the ATI Associate Director - Academic Affairs coached the program coordinator through the process by: 1) Elucidating program learning goals and developing measurable contributing outcomes; 2) Identifying the means and methods by which the embedded assessment of learning outcomes will be achieved; 3) Defining programmatic criteria for student achievement of each identified outcome; and 4) Planning for the use and implementation in the process of generating the comprehensive program learning outcomes assessment plan.

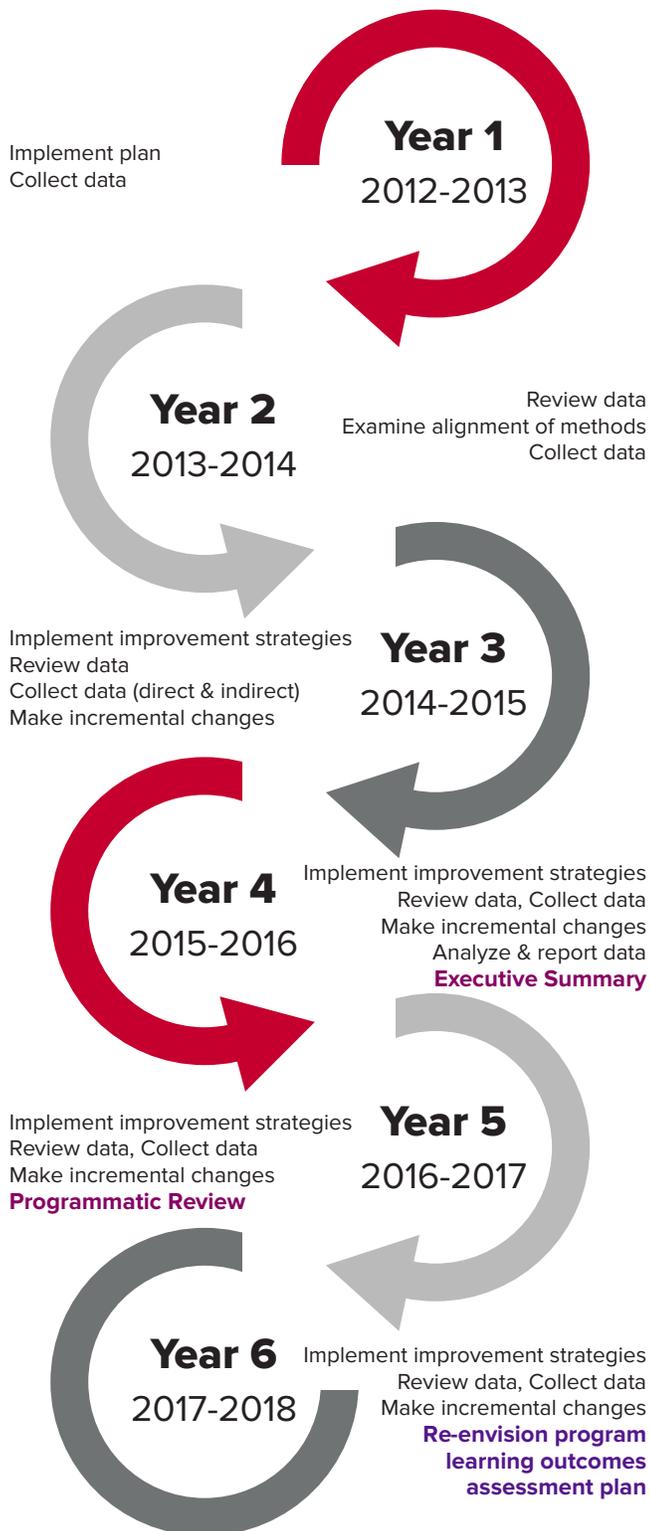
Commitment

Development, implementation, documentation and reporting associated with the 2012 *Biochemical Sciences - AS program learning outcomes assessment plan* are coordinated through the program coordinator with adherence oversight and support provided by the ATI Assistant Director - Academic Affairs. Data collection is a collaborative endeavor between the program coordinator, course instructors and academic advisors, and students. The program coordinator partners with the CFAES Office for Teaching, Learning, and Assessment to collect, report, and review results on the basis of the Ohio State's annual assessment reporting cycle. The program coordinator, Biochemical Sciences program, the Arts and Science and Business Technologies Division, and course instructors review the program, its supporting coursework, and the related assessment results annually, on an ongoing basis, to formulate recommendations for incremental programmatic change to the institute's Academic Affairs Committee. With the goal of improving learning, instruction, and curriculum, indicators from a summary report of the findings are used to plan the incorporation of needed modifications. Accumulative findings for all program goals based on the contributing outcomes will be used as the cornerstone in the programmatic review cycle, providing essential information for making strategic adjustments to this academic program, assuring continuous quality improvement.



Scaffolding . . . (continued)

Implementation



The data collection for the identified direct methods of the supporting learning outcomes is conducted annually (or each semester the affiliated course(s) is taught) starting Au2012. In adherence to the CFAES Academic Program Assessment Plan Revision Cycle, this program will go through a comprehensive outcomes assessment review every six years. During the first year of implementation of a new (or re-envisioned) program assessment plan, focused attention will be given to refining the measures used for assessing achievement, to assure alignment of identified assignments with outcomes. During the initial year of the plan, the program collected and reported supporting data for half of the documented learning goals. In year two, focused efforts explored and reexamined alignment of methods with specific program learning outcomes along with data collection and reporting the remainder of the program learning goals (those not addressed previously). During the third year, in addition to collecting and reporting data for all program learning goals, the program explored conducting faculty facilitated student, alumni, and/or stakeholder focus groups and/or surveys to aid in assessing success of learning outcomes attainment. For year four of the cycle, supporting data will continue to be collected and reported for all program learning goals; upon conclusion of the academic year, the program, with the assistance of the CFAES Assessment Coordinator and Academic Programs - Assessment Office, will craft and submit to the college's Academic Affairs Committee (prior to the end of Sp2017) an executive summary of findings based on the four years of Program Assessment Plan data collected. In the fifth year of the cycle the program will continue collecting and reporting data for all program learning goals and the program coordinator will review the stated set of program learning goals to determine if modifications should be made in the forthcoming rendition of the program assessment plan. During year six, data collection and reporting for all program learning goals will continue; in addition, upon notification from the CFAES Assessment Coordinator, the Coordinator, Biochemical Sciences program will work with ATI Assistant Director - Academic Affairs to assemble and convene a formal programmatic assessment review team, comprised of faculty, staff, students, alumni, and stakeholders, to: review the accumulated findings from the assessment review cycle; appraise the achievement and success of the program; examine alignment of program learning goals and outcomes; and produce a summary of recommendations for program modifications and enhancement. The efforts of the team's comprehensive review of the individual Program Assessment Plan in "year six" will produce a "re-envisioned" plan.



Assessment Findings

Reporting Synopsis

Data from identified methods (measures) were collected and reported as evidence of achievement of program learning goals via supporting outcomes (objectives) for the 2012-2016 assessment reporting cycles. Collectively in an annual meeting (review colloquy) the CFAES Office for Teaching, Learning, and Assessment, the program coordinator for the Biochemical Sciences program, and the ATI Assistant Director - Academic Affairs elaborated upon the process by which the program was going to review and use evidence (findings/results). They also discussed the procedure which was going to be followed for taking future actions and examined the approach for future planning for the program. One of the primary topics of discussion at these meetings was exploring how the information gathered about student learning was to be shared with the division's faculty, instructional staff, and leadership, and how to use it for improvement of learning outcomes.

This document, the *Assessment Executive Summary* which is a collaborative report compiled by the program coordinator, the ATI Assistant Director - Academic Affairs, and the Office for Teaching, Learning, and Assessment, is to serve as a mechanism for sharing the status of the program's assessment activities and results with the program faculty and instructional staff, ATI leadership, stakeholders, the institute's Committee on Academic Affairs, the college's Assessment Committee and CFAES Committee on Academic Affairs.

This summary covers 10 of the 10 identified methods for the 8 supporting outcomes of the 4 program learning goals of this program learning outcomes assessment plan were reviewed during the 2012-2016 assessment reporting cycle.

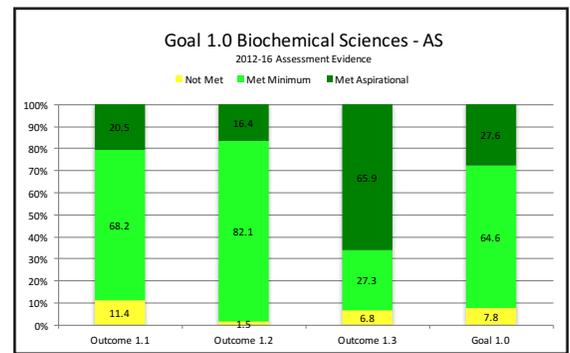
Use of Assessment Findings

Use and Actions Taken

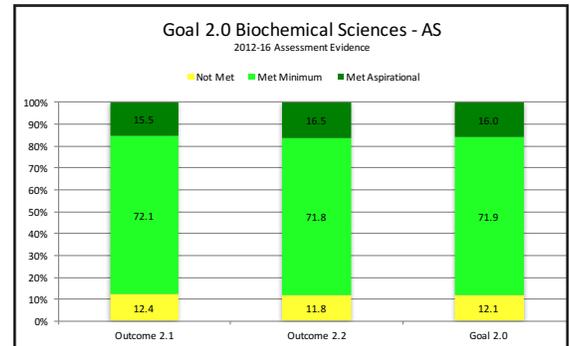
Any changes and/or modifications to this program and/or its learning outcomes assessment plan resulting from these assessment results were explored while reflecting upon collected and reported assessment data during the annual Autumn semester review colloquy. Resulting desired adjustments were then enacted during the following assessment reporting cycle.

The program's coordinator, in cohort with the ATI Assistant Director - Academic Affairs, the CFAES Office for Teaching, Learning, and Assessment, and other faculty and instructional staff has examined the program, its supporting course work, and the related assessment findings on an ongoing basis to formulate recommendations for incremental change. Areas for which assessment data has and will be used include:

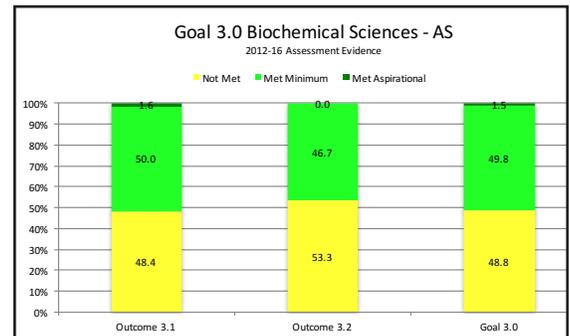
- Analyzing and discussing trends with the unit's faculty
- Analyzing and reporting to college/school
- Making improvements in curricular requirements
- Making improvements in course content
- Making improvements in course delivery and learning activities within courses
- Making improvements in learning facilities, laboratories, and/or equipment
- Periodically confirming that current curriculum and courses are facilitating student attainment of program goals



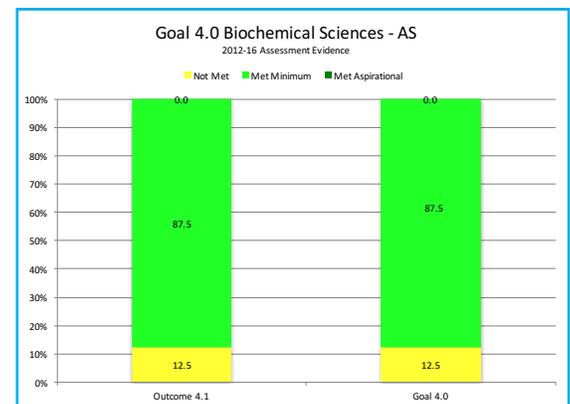
Learning Goal 1.0 has three identified unique contributing/supporting *Learning Outcomes* for which attainment is appraised via the use of three assessment methods (student n = 90 for reported assessment methods data)



Learning Goal 2.0 has two discerned contributing/supporting *Learning Outcomes* for which student achievement is gauged by the use of seven assessment methods (student n = 263 for reported assessment methods data)



Learning Goal 3.0 has two defined contributing/supporting *Learning Outcomes* for which student performance is assessed by using four assessment methods (student n = 57 for reported assessment methods data)



Learning Goal 4.0 has one established contributing/supporting *Learning Outcome* for which student accomplishment is rated by using one assessment measure (student n = 7 for reported assessment methods data)

Ohio State ATI

