

General Education

Learning Outcome Assessment

Quantitative Outcome

(Spring 2024)



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Executive Summary

The General Education curriculum provides foundational knowledge in academic disciplines, exposing students to diverse learning perspectives and ways of knowing in Mathematics, Science, Social Sciences, and Arts and Humanities (University System of Georgia). Georgia Institute of Technology (Georgia Tech) General Education (Gen Ed) has six learning outcomes: (1) Communication, (2) Quantitative, (3) Computing, (4) Humanities, Fine Arts, and Ethics (5), Natural Sciences, Math, and Technology, and (6) Social Sciences. They are assessed in accordance with our established timeline. Nurtured by the Subcommittee on Gen Ed and Policy, the 3-Year Georgia Tech Gen Ed Assessment Plan (2021-2024) sets the framework for good practice in course delivery and assessment, capitalizing on the good judgment of faculty members regarding students' levels of attainment of Gen Ed learning outcomes. Faculty develop signature assignments in their Gen Ed courses, and the assignments, along with student performance, are collected for review and analysis at the end of each semester. To better understand our students' performance, the Office of Academic Effectiveness (OAE) then partnered with faculty to develop a scale for scoring. The general scale is structured to assess each Gen Ed learning outcome on a continuum: 1-Developing, 2-Meets Expectations, 3-Exceeds Expectations.

This report summarizes the evidence of student learning (n = 1,019) and provides descriptive statistics for the **Quantitative** outcome to support conversations regarding General Education learning and opportunities for improvement.

Highlights

- **94.8% (n= 966)** of students met or exceeded the Quantitative outcome expectations, which means 94.8% of students demonstrate their abilities to apply basic elements of differential and integral calculus to solve relevant problems. Students' performance on the Quantitative outcome met or exceeded Georgia Tech's acceptable target (80%).
- Comparing student demographics for the Quantitative outcome, the results indicated that all demographic groups in this report met or exceeded the target of 80%.

Background

An integral part of the delivery of General Education (Gen Ed) at the Georgia Institute of Technology (Georgia Tech) includes the assessment of the learning outcomes. The learning outcomes were approved by the Undergraduate Curriculum Committee at Georgia Tech, the Faculty Senate, and by the University System of Georgia's (USG) Council on General Education in April 2011:

➤ **Communication (Core Area A1)**

Outcome: Student will demonstrate proficiency in the process of articulating and organizing rhetorical arguments in written, oral, visual, and nonverbal modes, using concrete support and conventional language.

➤ **Quantitative (Core Area A2)**

Outcome: Student will demonstrate the ability to apply basic elements of differential and integral calculus to solve relevant problems.

➤ **Computing (Institutional Options B)**

Outcome (2021 Fall): Student will be able to develop algorithms and implement them using an appropriate computer language and will understand algorithmic complexity and reasonable versus unreasonable algorithms. Based on the 2021 assessment results, the learning outcome was modified in Fall 2023:

Provisional Outcome (2023 Fall): Students will be able to develop solutions to problems involving data and to implement these solutions using an appropriate computer language.

➤ **Humanities, Fine Arts, and Ethics (Core Area C)**

Outcome: Student will be able to describe relationships among languages, philosophies, cultures, literature, ethics, or the arts.

➤ **Natural Sciences, Math, and Technology (Core Area D)**

Outcome: Student will be able to demonstrate the ability to obtain, analyze, interpret, and criticize qualitative observations and quantitative measurements to explain natural phenomena and to test hypotheses.

➤ **Social Sciences (Core Area E)**

Outcome: Student will demonstrate the ability to describe the social, political, and economic forces that influence social behavior.

The purpose of this report is to provide assessment results to support conversations regarding General Education learning and opportunities for improvement.

Methods

Georgia Tech conducted an intensive review of the Gen Ed learning outcomes and how students demonstrate their learning in these areas by engaging faculty in Gen Ed assessment conversations in the following steps: (1) Study course enrollment and identify representative courses. We examined enrollment patterns for students taking courses in

Gen Ed for the last five years. Patterns were determined, too, by class size (large class-100 or more students; medium class- 50-99 students; small class- 20-49 students). This exercise led to the value that all class sizes would be included in the 3-year Gen Ed Assessment Plan, as well as coverage of each discipline that contributes to Gen Ed. A total of 38 courses representing the appropriate colleges were selected (See Appendix A and B). (2) Identify or develop signature assignments that align with the outcome. Faculty identified measures that are tangible, visible, self-explanatory, and provide compelling evidence of what students have learned. (3) Develop performance scale. Faculty met and developed a scale for scoring. The general scale is structured to assess each Gen Ed learning outcome on a continuum: 1-Developing, 2-Meets Expectations, 3- Exceeds Expectations. All faculty transformed their scoring to the general scale. The following image indicates our goal for this step.

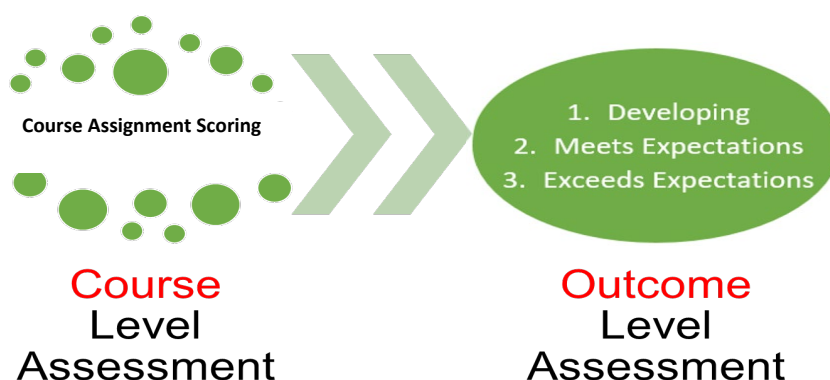


Figure 1 Scoring Method from Course Level Assessment to Outcome Level Assessment

This three-step process has become the basic collaboration framework across courses and units for meaningful Gen Ed assessment.

Sample

The following table indicates the representative nature of the sample by comparing the student demographic information of the sample and the undergraduate student population of the Institute.

Table 1 Sample Size by Student Demographics

Student Demographic	Sample N (%)	Institutional Population N(%)
Gender	(Total 1,019)	(Total 19,510)
Male	487 (47.8%)	11,860 (60.8%)
Female	532 (52.2%)	7,650 (39.2%)
Race/Ethnicity		
White	381 (42.2%)	6,793 (34.8%)
Black or African or American	138 (15.3%)	1,523 (7.8%)
Asian	186 (20.6%)	5,936 (30.4%)
Hispanic or Latino	127 (14.1%)	1,536 (7.9%)
Two or More Races	68 (7.5%)	887(4.5%)
Unknown	3 (0.3%)	209 (1.1%)

First Generation College Student		
Continuing Generation	752 (83.3%)	15,592 (79.9%)
First Generation	151 (16.7%)	1,310 (6.7%)
Citizenship		
Domestic Student	903 (88.6%)	16,902 (86.6%)
International Student	116 (11.4%)	2,608 (13.4%)
Transfer Student Status		
Non-Transfer Student	980 (96.2%)	18,754 (96.1%)
Transfer Student	39 (3.8%)	756 (3.9%)
Class		
Freshman	737 (72.3%)	2,330 (11.9%)
Sophomore	213 (20.9%)	4,257 (21.8%)
Junior	49 (4.8%)	4,529 (23.2%)
Senior	20 (2.0%)	7,151 (36.7%)
GA Residence		
GA Residence	690 (67.7%)	12,062 (61.8%)
Out of State Residence	329 (32.3%)	7,102 (38.2%)

The Quantitative Outcome Statement and Representative Courses

MATH 1552 Integral Calculus and MATH 1712 Survey of Calculus are listed under General Education Core Area A2 Quantitative, which is associated with the following outcome:

Student will demonstrate the ability to apply basic elements of differential and integral calculus to solve relevant problems.

Measures and Targets for the Quantitative Outcome

In MATH 1552 and MATH1712, students will be asked to respond to two problems:

1. Problem 1 will assess the students' ability to compute integrals and derivatives of functions. The student will be asked to compute an integral using an important technique of integration, such as integration by parts or substitution, to evaluate an integral. To solve this problem, the student will also need to demonstrate mastery of techniques to compute derivatives of functions.
2. Problem 2 will assess the students' ability to compute limits. The student will be asked to evaluate a problem that involves calculating a limit. To solve this problem, students need to demonstrate a clear understanding of limits.

On average, 80% of students are expected to achieve "Meets Expectations" or "Exceeds Expectations."

Data analysis

For the Quantitative outcome, students were asked to respond to 2 problems, and each problem addresses a part of the Quantitative outcome. This Quantitative outcome report presents student performance data collected for MATH 1552 and MATH 1712 classes from Spring 2024. The following table indicates the sample size and the scoring methods.

Table 2 Quantitative Scoring

Course Scoring	Signature Assignment	Scoring Method	N ¹
MATH 1552	2 problems	0-12 & 0-18	902
MATH 1712	2 problems	0-10	117
Total			1,019

The following table presents score interpretation by courses. Faculty determined this performance scale for the Quantitative outcome achievement.

Table 3 Score Interpretation

Score Interpretation			
Course	Developing	Meets Expectations	Exceeds Expectations
MATH 1552	Problem 1: Below 7.8 Problem 2: Below 11.7	Problem 1: 7.8-10.1 Problem 2: 11.7-15.2	Problem 1: 10.2-12 Problem 2: 15.3-18
MATH 1712	Problem 1: Below 5.5 Problem 2: Below 6.5	Problem 1: 5.5-8.5 Problem 2: 6.5-8.5	Problem 1: Above 8.5 Problem 2: Above 8.5

Findings

Based on faculty agreement on the score interpretation, the frequency and percentage were calculated. Overall, **94.8%** (n = 966) of students met or exceeded the Quantitative outcome expectations.

Table 4 Quantitative Outcome Overall Performance

Score Interpretation	% (n)	Target Achieved?
Developing	5.2% (n = 53)	
Meets expectations	21.5% (n = 219)	Yes (94.8%)
Exceeds expectations	73.3% (n = 747)	

The following table shows students' performance data by different demographic populations. The results indicated that all demographic groups met or exceeded the target of 80%.

Table 5 Quantitative Outcome Overall Performance by Demographic

(From All Represented Courses)	Developing n (%within subgroup)	Meets Expectations n (%within subgroup)	Exceeds Expectations n (% within subgroup)	Overall Score Mean (SD)	Target (80%) Achieved?
Gender					
Male (n=487)	28 (5.7%)	109 (22.4%)	350 (71.9%)	2.66 (0.58)	Yes(94.3%)
Female (n=532)	25 (4.7%)	110 (20.7%)	397 (74.6%)	2.70 (0.55)	Yes(95.3%)
Race/Ethnicity					
White (n=381)	19 (5.0%)	83 (21.8%)	279 (73.2%)	2.68 (0.56)	Yes(95.0%)
Black or African American (n=138)	10 (7.2%)	37(26.8%)	91 (65.9%)	2.59 (0.63)	Yes(92.7%)

Asian (n=186)	7 (3.8%)	41 (22.0%)	138 (74.2%)	2.70 (0.53)	Yes(96.2%)
Hispanic or Latino (n=127)	10 (7.9%)	32 (25.2%)	85 (66.9%)	2.59 (0.63)	Yes(92.1%)
Two or More Races (n=68)	3 (4.4%)	10 (14.7%)	55 (80.9%)	2.76 (0.52)	Yes(95.6%)
Unknown (n=3)	0 (0.0%)	1 (33.3%)	2 (66.7%)	2.67 (0.58)	Yes(100%)
First-Generation College Student					
Continuing Generation (n=752)	35 (4.7%)	158 (21.0%)	559 (74.3%)	2.70 (0.55)	Yes(95.3%)
First Generation (n=151)	14 (9.3%)	46 (30.5%)	91 (60.3%)	2.51 (0.66)	Yes(90.8%)
Citizenship					
Domestic Student (n=903)	49 (5.4%)	204 (22.6%)	650 (72.0%)	2.67 (0.58)	Yes(94.6%)
International student (n=116)	4 (3.4%)	15 (12.9%)	97 (83.6%)	2.80 (0.48)	Yes(96.5%)
Transfer Student Status					
Transfer Student (n=39)	2 (5.1%)	7 (17.9%)	30 (76.9%)	2.72 (0.56)	Yes(94.8%)
Non-Transfer Student (n=980)	51 (5.2%)	212 (21.6%)	717 (73.2%)	2.68 (0.57)	Yes(94.8%)
Class					
Freshman (n=737)	25 (3.4%)	151 (20.5%)	561 (76.1%)	2.73 (0.52)	Yes(96.6%)
Sophomore (n=213)	18 (8.5%)	48 (22.5%)	147 (69.0%)	2.61 (0.64)	Yes(91.5%)
Junior (n=49)	8 (16.3%)	14 (28.6%)	27 (55.1%)	2.39 (0.76)	No(83.7%)
Senior (n=20)	2 (10.0%)	6 (30.0%)	12 (60.0%)	2.50 (0.69)	Yes(90.0%)
GA Residence					
GA Residence (n=690)	41 (5.9%)	166 (24.1%)	483 (70.0%)	2.64 (0.59)	Yes(94.1%)
Out of State Residence (n=329)	12 (3.6%)	53 (16.1%)	264 (80.2%)	2.77 (0.50)	Yes(96.3%)

Appendix A: Representative Courses List

Outcomes	Represented Courses	Total
Communication	ENGL 1101, ENGL 1102	2
Quantitative	MATH 1552, MATH 1712	2
Computing	CS 1301, CS 1315, CS 1371	3
Humanities, Fine Arts, and Ethics	Large Class: FREN 1002, SPAN 2001, ID 2202, ID 2241, PHIL 3109, ARCH 2111 Middle Class: LMC 3226, ML 2500 Small Class: LMC 2100, PHIL 4176	10
Natural Sciences, Math, and Technology	CHEM 1310, BIOS 1207DL, EAS 1600, PHYS 2212, MATH 1554, MATH 1711	6
Social Sciences	Large Class: ECON 2100, HIST 2111, HIST 2112, INTA 1200, 2030, POL 1101, PSYC 1101, PSYC 2210, PSYC 2230, SOC 1101 Small Class: ARCH 3135, CP 4020, POL 2101, PUBP 3000, PUBP 3315	15

Appendix B: Representative Courses Associated by College

Represented course associated college	Number of courses from the represented course list	Associated outcome
Ivan Allen College of Liberal Arts	19	Communication, Humanities, Fine Arts, and Ethics, Social Sciences
College of Sciences	11	Quantitative, Natural Sciences, Math, and Technology, Social Sciences
College of Design	5	Humanities, Fine Arts, and Ethics, Social Sciences
College of Computing	3	Computing