Quantitative and Computational Thinking 2020-2021

Quantitative and Computational Thinking (QCT) courses are designated as either Foundational or Advanced/ Applied. Courses or course sequences addressing this concept must meet a majority of the student learning outcomes (SLOs). During the Spring 2021 semester,[1] Virginia Tech offered 50 Pathways courses that included the Core Concept of QCT. Of those, 30 courses were approved as Foundational and 20 courses were approved as Advanced/Applied.

	Foundational	Advanced/ Applied	Overall
Pathways Sections Offering QCT	143	59	202
Pathways Sections Reporting QCT Data[2]	115 (80%)	38 (64%)	153 (76%)
Pathways Sections Included in Analyses[3]	89 (62%)	37 (63%)	126 (62%)
Enrollment in Sections Offering QCT*	7,027	4,365	11,392
Enrollment in Sections Included in Analyses*	3,196 (45%)	2,112 (48%)	5,308 (47%)

* Values include students who may be enrolled and/or assessed in multiple Pathways courses.

Table 1: Competency Levels per SLO for QCT

	Sections Included in Analyses	Students Included in Analyses	Percentage of Students		
			Below Competent	Competent	Above Competent
SLO 1: Explain the application of computational or quantitative thinking across multiple knowledge domains.	107	3,619	21% (n=777)	46% (n=1,666)	32% (n=1,176)
SLO 2: Apply the foundational principles of computational or quantitative thinking to frame a question and devise a solution in a particular field of study.	115	3,998	19% (n=757)	38% (n=1,535)	43% (n=1,706)
SLO 3: Identify the impacts of computing and information technology on humanity.	11	323	6% (n=19)	24% (n=77)	70% (n=227)
SLO 4: Construct a model based on computational methods to analyze complex or large-scale phenomenon.	20	528	7% (n=39)	34% (n=178)	59% (n=311)
SLO 5: Draw valid quantitative inferences about situations characterized by inherent uncertainty.	98	3,561	20% (n=724)	41% (n=1,447)	39% (n=1,390)
SLO 6: Evaluate conclusions drawn from or decisions based on quantitative data.	98	3,757	11% (n=426)	36% (n=1,354)	53% (n=1,977)

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[1] Pathways assessment data collection was suspended for Fall 2020 due to the COVID-19 pandemic. Consequently, only data from the Spring 2021 semester are included in this report.

[2] 87 sections (57%) were missing data for one or more required SLOs; 66 sections (43%) provided complete data.

[3] Data from 46 sections (30%) were fully included; 80 sections (52%) were partially included; 27 sections (18%) were excluded.

SLO 1: Explain the application of computational or quantitative thinking across multiple knowledge domains.

	Foundational	Advanced/Applied
Pathways Sections Offered	125	48
Pathways Sections Reporting Data	110 (88%)	35 (73%)
Pathways Sections Included in Analyses	76* (61%)	31* (65%)
Enrollment in Sections Offering QCT 1**	5,096	2,551
Students Included in Analyses**	2,436 (48%)	1,183 (46%)

* Data from 21 sections (Foundational) were excluded. Seventeen sections were missing data for this SLO (13 Foundational and 4 Advanced/Applied).
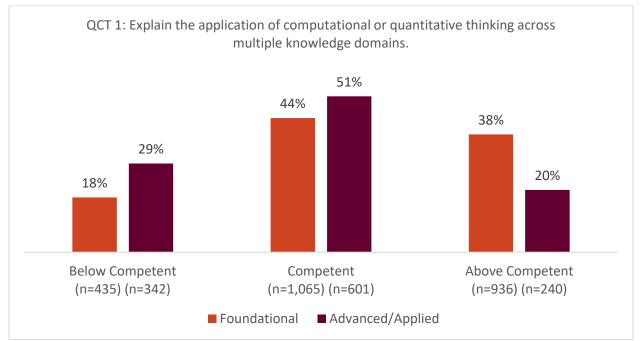
** Values include students who may be enrolled and/or assessed in multiple Pathways courses.

Figure 1. Foundational (n=2,436); Advanced/Applied (n=1,183)

SLO 2: Apply the foundational principles of computational or quantitative thinking to frame a question and devise a solution in a particular field of study.

	Foundational	Advanced/Applied
Pathways Sections Offered	137	55
Pathways Sections Reporting Data	107 (78%)	37 (67%)
Pathways Sections Included in Analyses	82* (60%)	33* (60%)
Enrollment in Sections Offering QCT 2**	6,987	4,207
Students Included in Analyses**	2,668 (38%)	1,330 (32%)

* Data from 23 sections (22 Foundational and 1 Advanced/Applied) were excluded. Six sections were missing data for this SLO (3 Foundational and 3 Advanced/Applied).
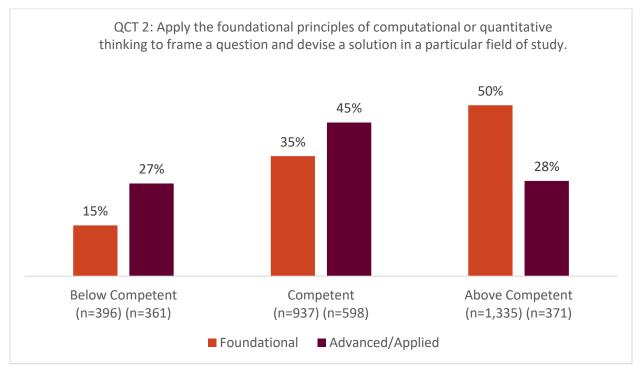
** Values include students who may be enrolled and/or assessed in multiple Pathways courses.

Figure 2. Foundational (n=2,668); Advanced/Applied (n=1,330)

SLO 3: Identify the impacts of computing and information technology on humanity.

	Foundational	Advanced/Applied*
Pathways Sections Offered	23	–
Pathways Sections Reporting Data	18 (78%)	–
Pathways Sections Included in Analyses	8** (35%)	–
Enrollment in Sections Offering QCT 3***	1,235	–
Students Included in Analyses***	257 (21%)	–

* Data are not reported when 5 or fewer sections were offered or included in the analyses.

** Data from 10 sections were excluded.

*** Values include students who may be enrolled and/or assessed in multiple Pathways courses.
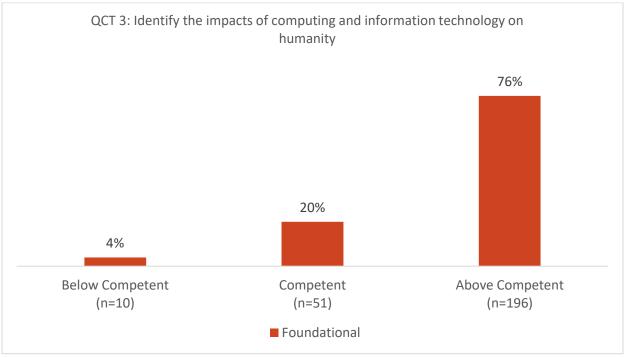

Figure 3. Foundational (n=257)

SLO 4: Construct a model based on computational methods to analyze complex or large-scale phenomenon.

	Foundational	Advanced/Applied*
Pathways Sections Offered	43	–
Pathways Sections Reporting Data	31 (72%)	–
Pathways Sections Included in Analyses	16** (37%)	–
Enrollment in Sections Offering QCT 4***	3,009	–
Students Included in Analyses***	263 (9%)	–

* Data are not reported when 5 or fewer sections were offered or included in the analyses.
** Data from 10 sections were excluded. Five sections were missing data for this SLO.
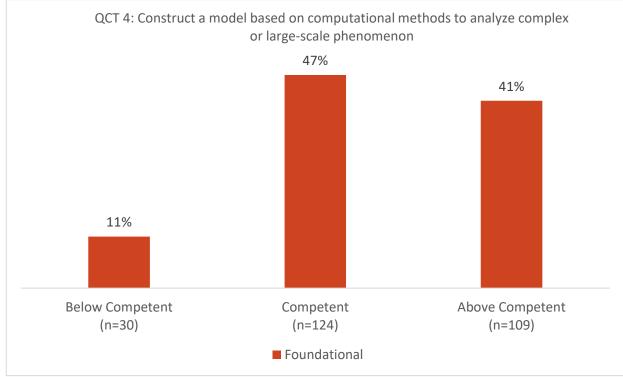*** Values include students who may be enrolled and/or assessed in multiple Pathways courses.

Figure 4. Foundational (n=263)

SLO 5: Draw valid quantitative inferences about situations characterized by inherent uncertainty.

	Foundational	Advanced/Applied
Pathways Sections Offered	120	53
Pathways Sections Reporting Data	92 (77%)	34 (64%)
Pathways Sections Included in Analyses	66* (55%)	32* (60%)
Enrollment in Sections Offering QCT 5**	5,800	4,086
Students Included in Analyses**	2,132 (37%)	1,429 (35%)

* Data from 16 sections (15 Foundational and 1 Advanced/Applied) were excluded. Twelve sections were missing data for this SLO (11 Foundational and 1 Advanced/Applied).
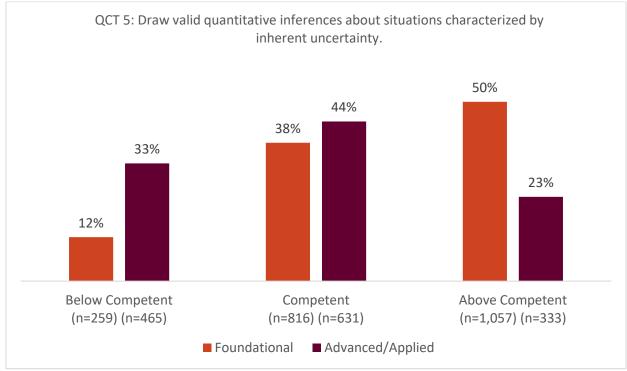** Values include students who may be enrolled and/or assessed in multiple Pathways courses.

Figure 5. Foundational (n=2,132); Advanced/Applied (n=1,429)

SLO 6: Evaluate conclusions drawn from or decisions based on quantitative data.

	Foundational	Advanced/Applied
Pathways Sections Offered	124	56
Pathways Sections Reporting Data	97 (78%)	36 (64%)
Pathways Sections Included in Analyses	66* (53%)	32* (57%)
Enrollment in Sections Offering QCT 6**	5,981	4,308
Students Included in Analyses**	2,285 (38%)	1,472 (34%)

* Data from 17 sections (16 Foundational and 1 Advanced/Applied) were excluded. Eighteen sections were missing data for this SLO (15 Foundational and 3 Advanced/Applied).
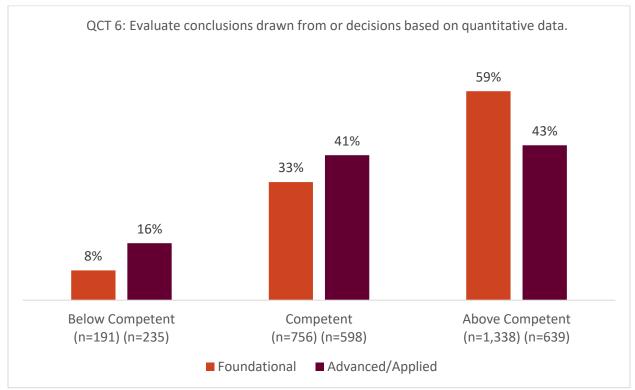** Values include students who may be enrolled and/or assessed in multiple Pathways courses.

Figure 6. Foundational (n=2,285); Advanced/Applied (n=1,472)