

Quantitative and Computational Thinking 2019-2020

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 Fall 2019 semester,¹ Virginia Tech offered 34 Pathways courses that included the Core Concept of QCT. Of those, 18 courses were approved as Foundational and 16 courses were approved as Advanced/Applied.

	Foundational	Advanced/ Applied	Overall
Pathways Sections Offering QCT	144	50	194
Pathways Sections Reporting QCT Data ²	115 (80%)	40 (80%)	155 (80%)
Pathways Sections Included in Analyses ³	113 (78%)	39 (78%)	152 (78%)
Enrollment in Sections Offering QCT*	8,059	3,639	11,698
Enrollment in Sections Included in Analyses*	6,908 (86%)	2,981 (82%)	9,889 (85%)

* 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.	131	6,110	18% (n=1,102)	24% (n=1,449)	58% (n=3,559)
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.	150	6,457	22% (n=1,395)	35% (n=2,261)	43% (n=2,801)
SLO 3: Identify the impacts of computing and information technology on humanity.	8	423	6% (n=24)	37% (n=156)	57% (n=243)
SLO 4: Construct a model based on computational methods to analyze complex or large-scale phenomenon.	27	1,624	9% (n=140)	37% (n=607)	54% (n=877)
SLO 5: Draw valid quantitative inferences about situations characterized by inherent uncertainty.	145	6,785	20% (n=1,338)	23% (n=1,533)	58% (n=3,914)
SLO 6: Evaluate conclusions drawn from or decisions based on quantitative data.	145	7,148	15% (n=1,073)	26% (n=1,835)	59% (n=4,240)

* Includes sections required to report data for a specific outcome and additional sections reporting data.

¹ Pathways assessment data collection was suspended for Spring 2020 due to the COVID-19 pandemic. Consequently, only data from the Fall 2019 semester are included in this report.

² Seven sections (5%) were missing data for one or more required SLOs (4 Foundational and 3 Advanced/Applied); 148 sections (95%) provided complete data (111 Foundational and 37 Advanced/Applied).

³ Data from 151 sections (97%) were fully included (113 Foundational and 38 Advanced/Applied); 1 section (<1%) was partially included (1 Advanced/Applied); 3 sections (2%) were excluded (2 Foundational and 1 Advanced/Applied).

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

	Foundational			Advanced/Applied		
	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses
Pathways Sections Offering SLO 1	129	N/A	129	36	N/A	36
Pathways Sections Reporting Data	105 (81%)	N/A	105 (81%)	28 (78%)	N/A	28 (78%)
Pathways Sections Included in Analyses	103* (80%)	N/A	103 (80%)	28 (78%)	N/A	28 (78%)
Enrollment in Sections Offering QCT 1**	6,983	N/A	6,983	2,107	N/A	2,107
Students Included in Analyses**	4,915 (70%)	N/A	4,915 (70%)	1,195 (57%)	N/A	1,195 (57%)

* Data from 2 sections (Foundational) were excluded.

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

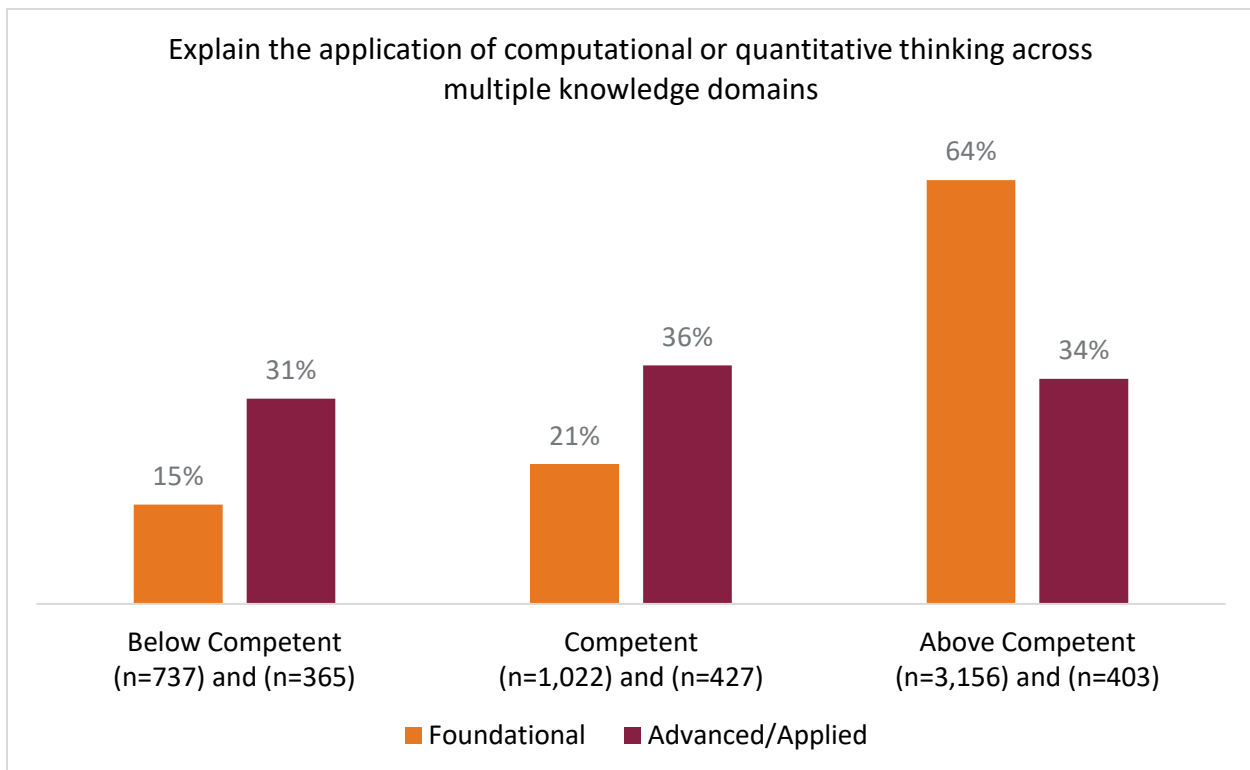


Figure 1. Foundational (n=4,915); Advanced/Applied (n=1,195)

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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		
	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses
Pathways Sections Offering SLO 2	143	N/A	143	46	N/A	46
Pathways Sections Reporting Data	112 (78%)	N/A	112 (78%)	39 (85%)	N/A	39 (85%)
Pathways Sections Included in Analyses	112 (78%)	N/A	112 (78%)	38* (83%)	N/A	38 (83%)
Enrollment in Sections Offering QCT 2**	8,011	N/A	8,011	3,505	N/A	3,505
Students Included in Analyses**	4,412 (55%)	N/A	4,412 (55%)	2,045 (58%)	N/A	2,045 (58%)

* Data from 1 section (Advanced/Applied) were excluded.

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

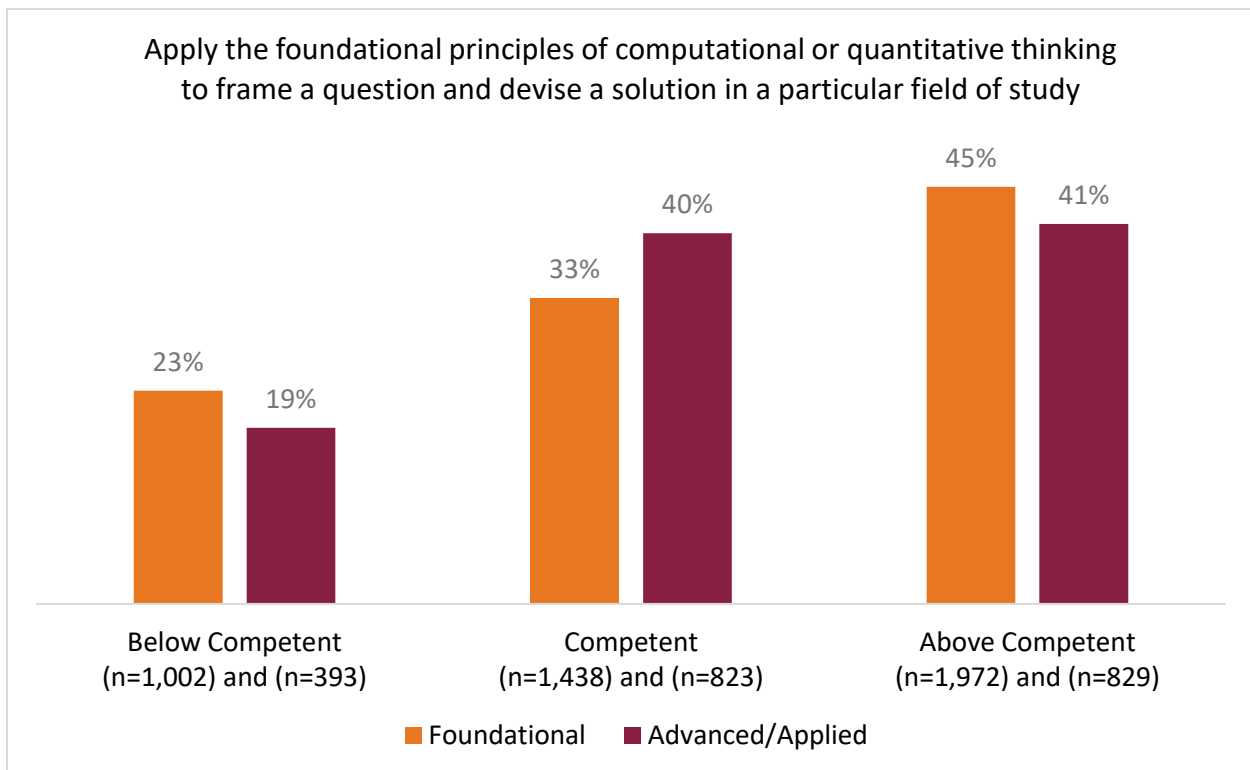


Figure 2. Foundational (n=4,412); Advanced/Applied (n=2,045)

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

	Foundational			Advanced/Applied		
	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses
Pathways Sections Offering SLO 3	5	1	6	6	N/A	6
Pathways Sections Reporting Data	4 (80%)	1 (100%)	5 (83%)	4 (67%)	N/A	4 (67%)
Pathways Sections Included in Analyses	4 (80%)	1 (100%)	5 (83%)	3* (50%)	N/A	3 (50%)
Enrollment in Sections Offering QCT 3**	295	92	387	188	N/A	188
Students Included in Analyses**	240 (81%)	92 (100%)	332 (86%)	91 (48%)	N/A	91 (48%)

* Data from 1 section (Advanced/Applied) were excluded.

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

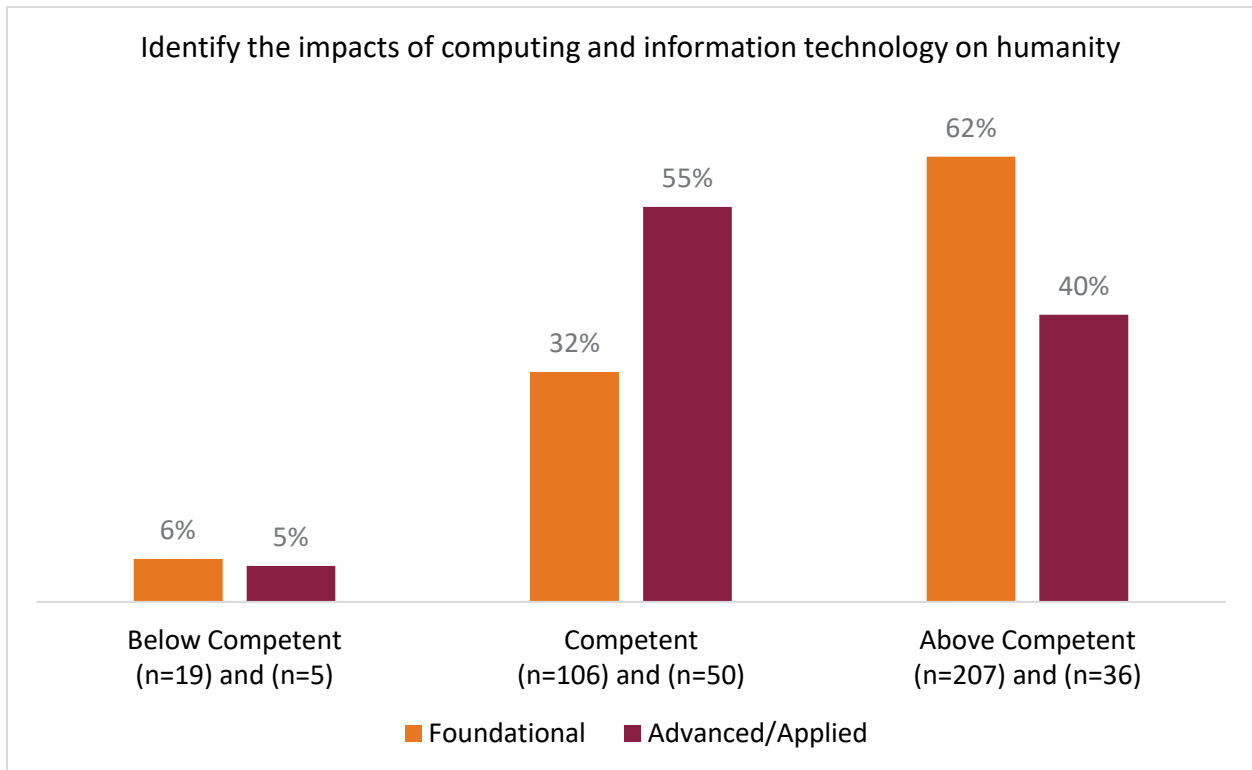


Figure 3. Foundational (n=332); Advanced/Applied (n=91)

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

	Foundational			Advanced/Applied		
	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses
Pathways Sections Offering SLO 4	20	1	21	19	1	20
Pathways Sections Reporting Data	11 (55%)	1 (100%)	12 (57%)	15 (79%)	1 (100%)	16 (80%)
Pathways Sections Included in Analyses	11 (55%)	1 (100%)	12 (57%)	14* (74%)	1 (100%)	15 (75%)
Enrollment in Sections Offering QCT 4**	1,378	72	1,450	1,755	38	1,793
Students Included in Analyses**	483 (35%)	72 (100%)	555 (38%)	1,032 (59%)	37 (97%)	1,069 (60%)

* Data from 1 section (Advanced/Applied) were excluded.

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

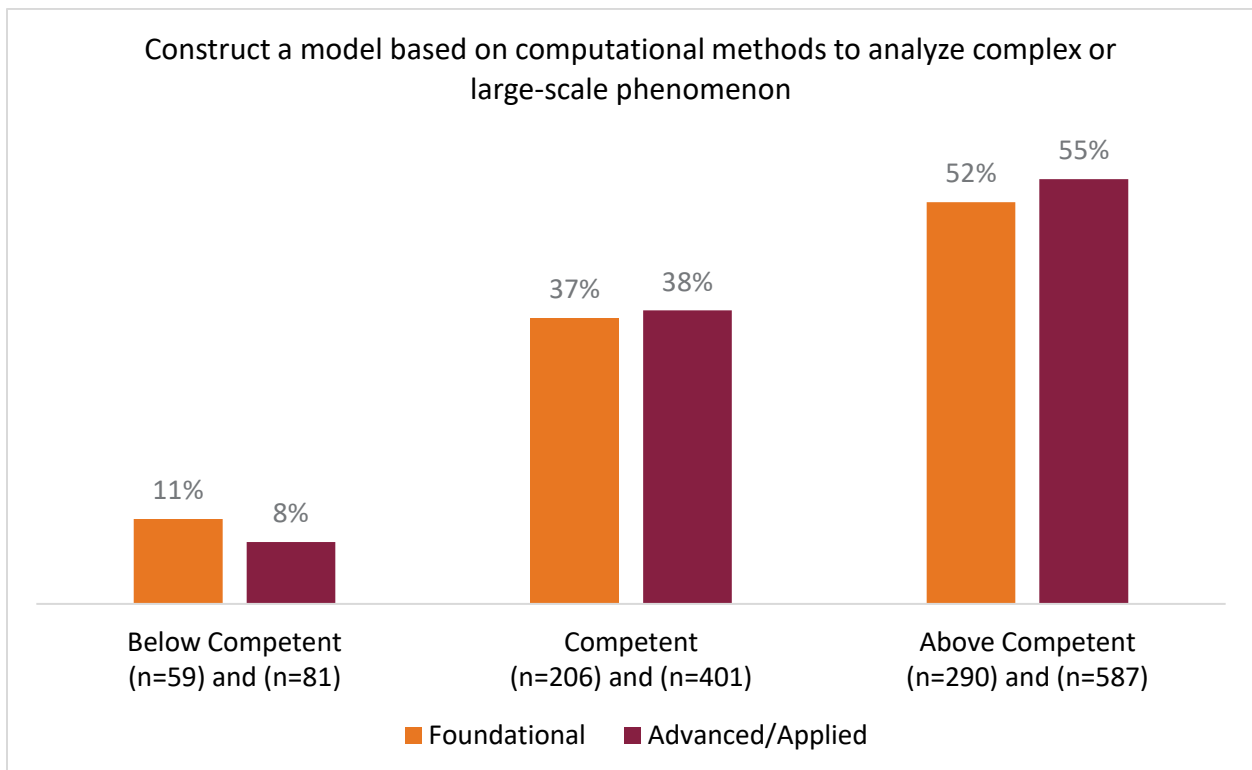


Figure 4. Foundational (n=555); Advanced/Applied (n=1,069)

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

	Foundational			Advanced/Applied		
	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses
Pathways Sections Offering SLO 5	138	2	140	44	N/A	44
Pathways Sections Reporting Data	109 (79%)	2 (100%)	111 (79%)	35 (80%)	N/A	35 (80%)
Pathways Sections Included in Analyses	109 (79%)	2 (100%)	111 (79%)	34* (77%)	N/A	34 (77%)
Enrollment in Sections Offering QCT 5**	7,704	149	7,853	3,378	N/A	3,378
Students Included in Analyses**	4,730 (61%)	149 (100%)	4,879 (62%)	1,906 (56%)	N/A	1,906 (56%)

* Data from 1 section (Advanced/Applied) were excluded.

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

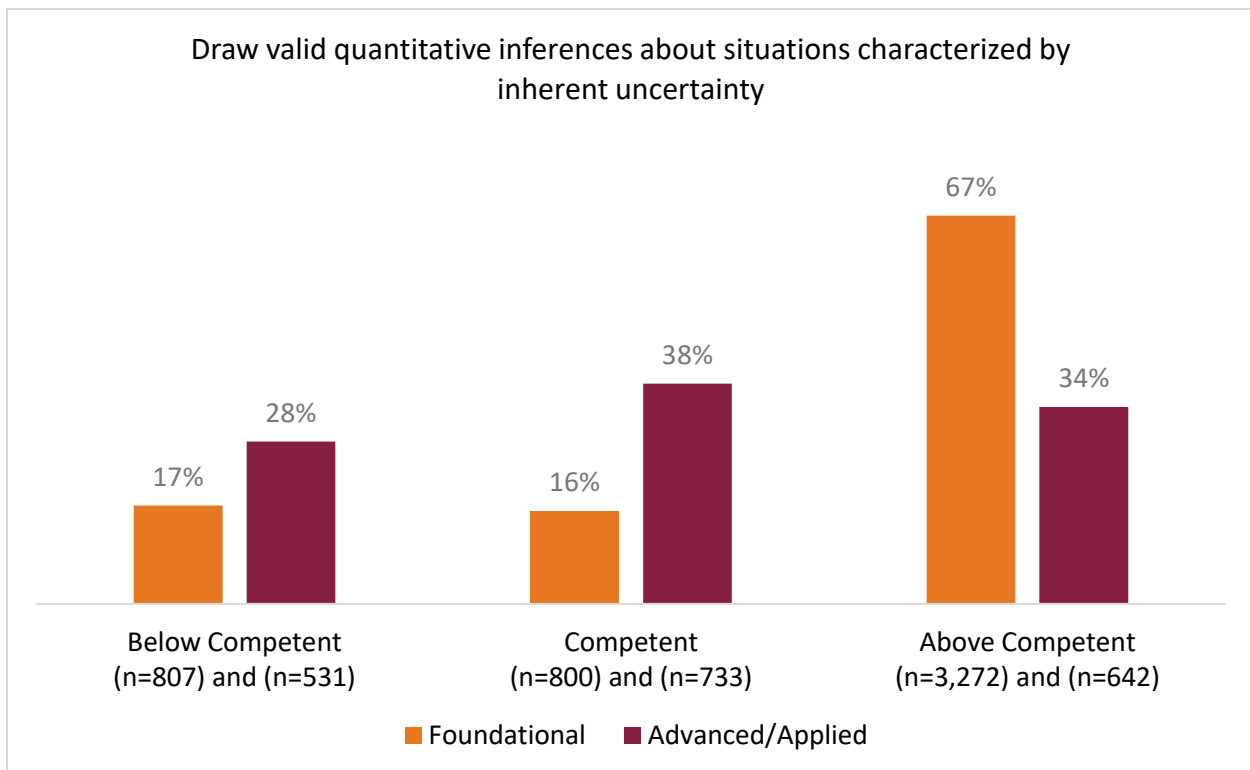


Figure 5. Foundational (n=4,879); Advanced/Applied (n=1,906)

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

	Foundational			Advanced/Applied		
	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses	Sections Required to Report	Additional QCT Sections Reporting	Total Sections Included in Analyses
Pathways Sections Offering SLO 6	141	1	142	49	N/A	49
Pathways Sections Reporting Data	109 (77%)	1 (100%)	110 (77%)	36 (73%)	N/A	36 (73%)
Pathways Sections Included in Analyses	109 (77%)	1 (100%)	110 (77%)	35* (71%)	N/A	35 (71%)
Enrollment in Sections Offering QCT 6**	7,865	57	7,922	3,623	N/A	3,623
Students Included in Analyses**	5,470 (70%)	57 (100%)	5,527 (70%)	1,621 (45%)	N/A	1,621 (45%)

* Data from 1 section (Advanced/Applied) were excluded.

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

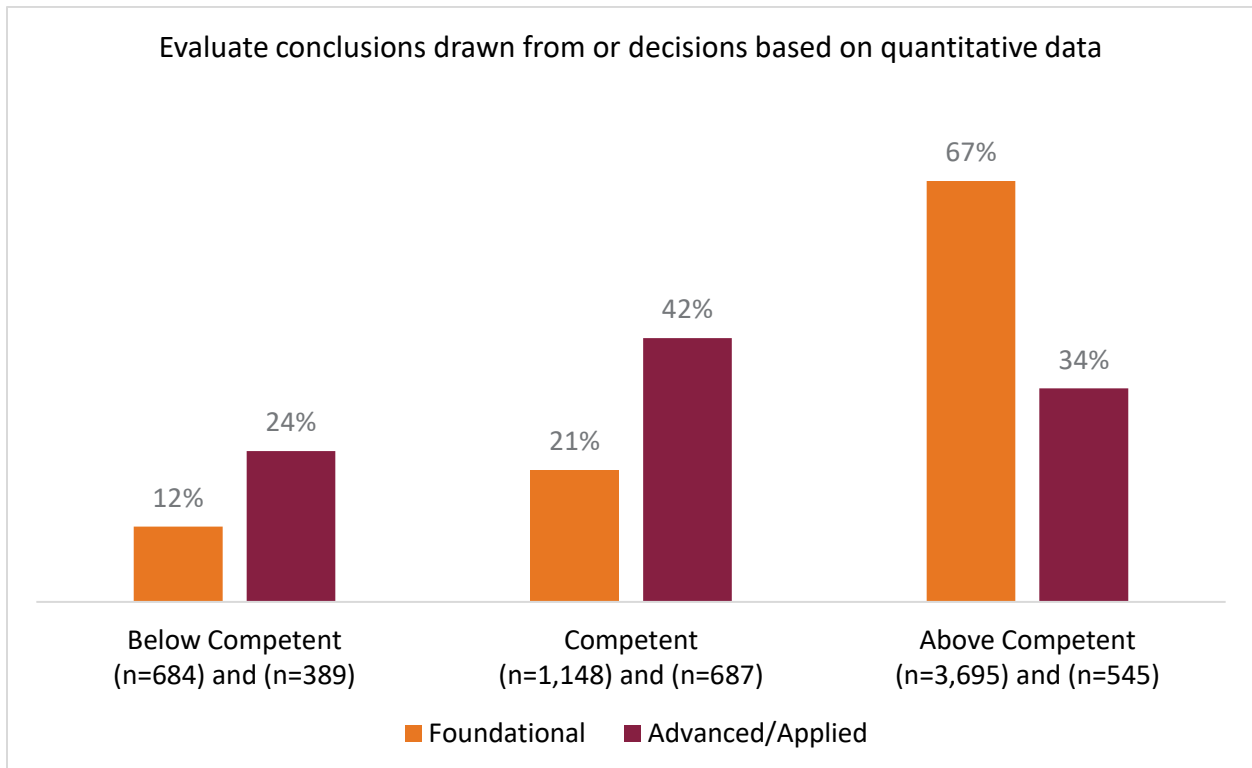


Figure 6. Foundational (n=5,527); Advanced/Applied (n=1,621)