



## ETS HEIghten™ Quantitative Literacy Assessment Report 2018-2019

### Executive Summary

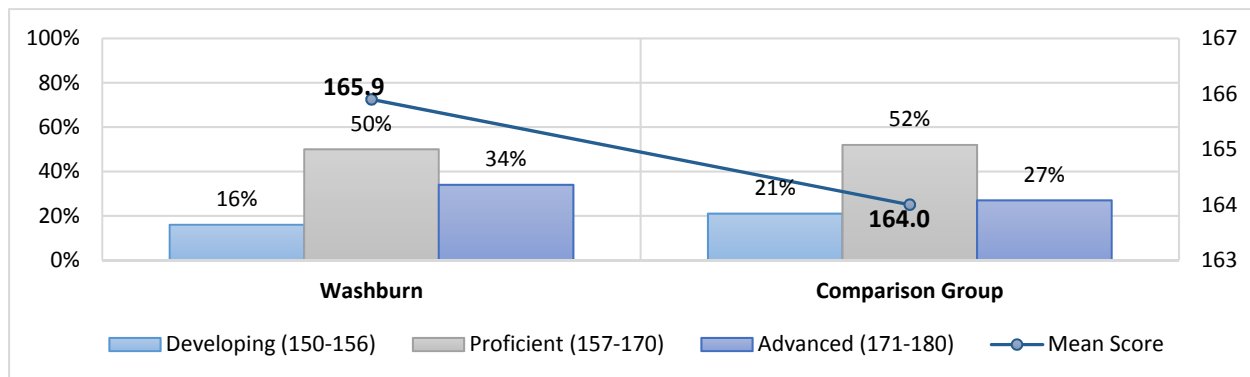
The Quantitative and Scientific Reasoning (QSR) University Student Learning Outcome (USLO) was assessed during the 2018-19 AY using the ETS HEIghten™ Quantitative Literacy Assessment.

The assessment was administered to 1,944 seniors:

- 140 responded; 7.2% response rate
- 134 completed more than 75% of the items on the assessment; 6.9% completion rate

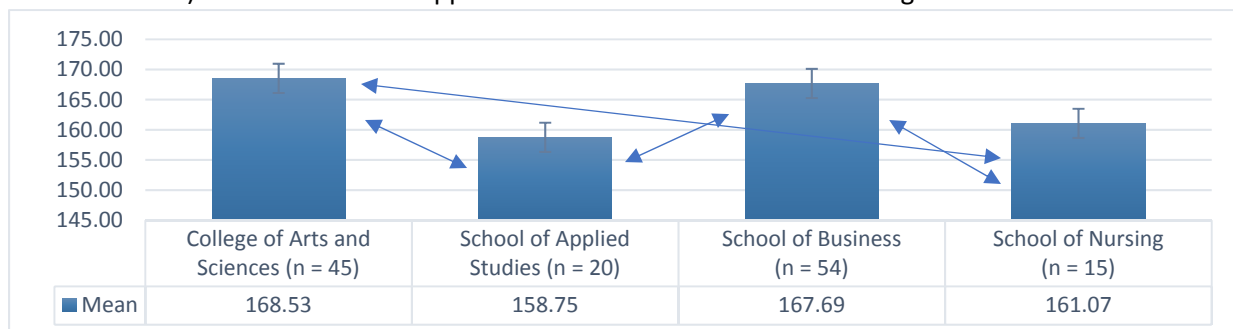
Compared to other institutions, Washburn students:

- scored in the 57th percentile
- scored a higher percentage in the Advanced proficiency level (34% vs. 27%)
- scored a total mean score of 165.9; 1.9 higher than the Comparison group of 164.0
- scored higher on the four subscores on a scale of 1-10; the mean score for Number and Operations was 5.4, and the mean scores for Algebra, Geometry and Measurement, and Statistics and Probability were 5.1 (see box and whiskers bar graphs in Figure 1 on Page 4)



Comparative analyses were conducted to determine if there were differences in scores among the College of Arts and Sciences, School of Applied Studies, School of Business, and School of Nursing:

- the College of Arts and Sciences yielded the highest total mean score ( $\bar{x} = 168.53$ )
- there were statistically significant differences between the College of Arts and Sciences and the School of Applied Studies ( $\bar{x} = 158.75$ ) and the School of Nursing ( $\bar{x} = 161.07$ )
- likewise, there were statistically significant differences between the School of Business ( $\bar{x} = 167.69$ ) and the School of Applied Studies and the School of Nursing



## Introduction

One of the methods by which Washburn University (Washburn) measures University Student Learning Outcomes (USLOs) is utilizing standardized, norm-referenced assessments. These assessments are administered to students on a rotating basis and measure the proficiency level of the five USLOs.

Previously the Madison Assessments were used to assess seniors on the Quantitative and Scientific Reasoning (QSR) USLO. The Madison Assessments results lacked a normative comparison group and therefore were determined not to be meeting Washburn's needs for QSR assessment. The QSR subcommittee re-convened to determine a replacement instrument, and a decision was made to adopt the ETS HEIghten™ Quantitative Literacy Assessment. AY 2019 was the first administration of the assessment; it is on a three-year cycle with the next administration scheduled for AY 2022.

The HEIghten™ Quantitative Literacy Assessment evaluates college students' abilities to comprehend, detect, and solve mathematics problems in authentic contexts across a variety of mathematical content areas. The assessment focused on three dimensions: Problem-solving Skills, Mathematical Content, and Context. Each question in the assessment was designed so that any student, regardless of major, has the ability to answer it. All HEIghten assessments are administered online utilizing a secure browser that prevents test takers from accessing anything other than the test content during an administration. The results are used to determine if seniors are attaining the quantitative literacy that Washburn emphasized through general education and major courses. Results are used to guide curriculum improvement, and to measure growth and development.

## Response Rates

The HEIghten™ Quantitative Literacy Assessment was administered to seniors in AY 2019. See Appendix for methodology. For the first administration window in Fall 2018, 1,509 seniors were sent emails to register; 220 registered. For the second window in Spring 2019, 1,089 students were sent the initial email to register for the assessment, and an additional 435 who were new Spring 2019 seniors for a total of 1,524 (also excluding those 77 who had accessed the assessment in Fall 2018); 190 registered.

For the Fall 2018 window, 77 responded to the request to take the survey. A total of 75 answered 75% or greater of the test questions; two did not. For the Spring 2019 window, 63 responded to take the survey. A total of 59 answered 75% or greater of the tests questions; four did not.

For AY 2019, 134 seniors completed more than 75% of the assessment. With an unduplicated count of 1,944, the response rate was 7.2% and the completion rate was 6.9%. See Table 1, below.

Table 1. Washburn Students ETS HEIghten™ Quantitative Literacy Assessment Response Patterns

Administration Window	Potential Respondents	Registered	Responded	Completed
Fall 2018	1,509	220 (14.5%)	77 (5.1%)	75 (5.0%)
Spring 2019	1,524	190 (12.5%)	63 (4.1%)	59 (3.9%)
Duplicate counts	1,089	24	--	--
<b>Total</b>	<b>1,944</b>	<b>386 (19.9%)</b>	<b>140 (7.2%)</b>	<b>134 (6.9%)</b>

## Results

At the end of the second testing window, data files were downloaded from the ETS testing website. ETS HEIghten™ provided an Institutional Score Report with aggregate information regarding Washburn students and a comparison group of 31 institutions with 5,257 students; individual student score reports with comparative data from past students who have taken the assessment; and the raw data results from Washburn students. The comparative data reports were examined and raw data were analyzed. The following provides a description of the Institutional Score Report and the results from the raw data.

### Institutional Comparison Group Findings

The Institutional Score Report contained information about the distribution of students' scaled scores within the Washburn group and the Comparison group. The Washburn group included students who completed at least 75% of the assessment ( $n = 134$ ), and the Comparison group included students from other institutions who also completed 75% of the assessment ( $n = 5,257$ ). The report provided general information about the results of the assessment to compare Washburn students' average performance to the performance of students in the Comparison group (i.e., senior students from all institutions).

The ETS HEIghten™ Quantitative Literacy consisted of 25 quantitative related questions or tasks with scores ranging from 150 to 180; scores of 150-156 are considered Developing, 157-170 are considered Proficient, and 171-180 are considered Advanced. See the Appendix for the ETS HEIghten™ Quantitative Literacy Sample Items and Performance Level Descriptions. The four subscores range from 1 to 10 for the domains of (1) Number and Operations – 8-9 tasks, (2) Algebra – 5-6 tasks, (3) Geometry and Measurement – 5-6 tasks, and (4) Probability and Statistics – 5-6 tasks. The Total Score represents the overall performance within the assessment. Higher scores indicate an estimate of higher performance than lower scores. Subscores represent performance in key aspects of each domain.

Table 2. Washburn Students and Comparison Group Descriptive Statistics for Overall Scaled Scores

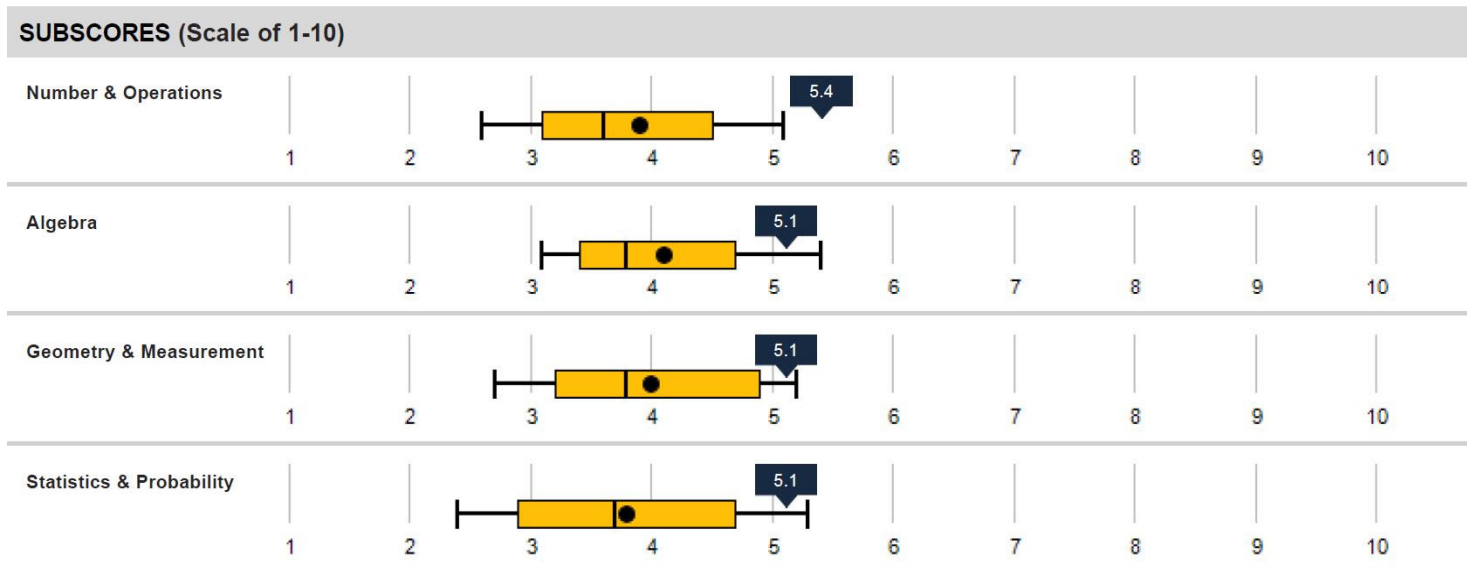
	Washburn Students	Comparison Group Students
Developing (150-156)	16%	21%
Proficient (157-170)	50%	52%
Advanced (171-180)	34%	27%
<b>Mean Score</b>	<b>165.9</b>	<b>164.0</b>

Washburn students scored higher than the Comparison group regarding overall performance scores. The percentage of Washburn students who achieved Developing was 16%, while the Comparison group was 21%; the percentage of Proficient was similar for both groups at 50% and 52%, respectively; and the percentage Advanced for Washburn students was 34%, while the Comparison group was 27%. The overall mean score from Washburn was 165.9 (Proficient), which was higher than the Comparison group mean score of 164.0 (Proficient). See Table 2 for overall scaled score percents and mean scores.

For the results of the sub-scores, ranging from 1-10 where higher scores represent better performance in the domain, the scores from 134 Washburn students were compared with the Comparison group. The Comparison group subscore means were derived from the performance of 5,257 students taking the assessment. Of the 134 Washburn students who completed the four domains, the mean score for Number and Operations was 5.4, and Algebra, Geometry and Measurement, and Statistics and

Probability were 5.1, respectively. ETS HEIghten™ does not provide a numeric descriptor of the mean scores for the Comparison group, instead a visual representation was provided. See Figure 1 for the subscore diagram with descriptive statistics.

Figure 1. Washburn Students and Comparison Group Descriptive Statistics for Subscores



The box and whiskers bar graphs in Figure 1 show the middle 50% of the Comparison group mean subscores represented by the yellow box, and the black lines or whiskers represent the middle 80% of the Comparison group mean subscores. From a visual examination of Figure 1, Washburn students' mean subscores, noted with callouts, were higher than the Comparison group mean subscores, noted with a black dot in the box. The black vertical line in the box and whiskers graph notes the median subscores for the Comparison group, which are lower than the Comparison group mean and the Washburn student group mean; median scores for the Washburn student group are not provided.

The Washburn student group subscore for Number and Operations is outside to the right of the middle 80% of the Comparison group mean subscores. This indicates that Washburn students scored a higher mean than the middle 80% of the Comparison group on this domain. For the three domains of Algebra, Geometry and Measurement, and Statistics and Probability, the Washburn students subscore is outside to the right of the bar, but within the right whisker. This indicates that Washburn students scored a higher mean than the middle 50-80% of students in the Comparison group for these three domains.

### Washburn Students Findings

The raw data file provides the individual student level overall total scores and subscores, student demographic information, and opinion on performance information from Washburn students who took the assessment. Again, the six students who completed 75% or less of the assessment were excluded in the following analyses, for a total of 134 students.

Table 3, on the following page, contains detailed descriptive statistics from the total scores, percentile and subscores. Individual student performance relative to the performance of students across all participating institutions is indicated by the percentile rank on a range of 0 to 100%.

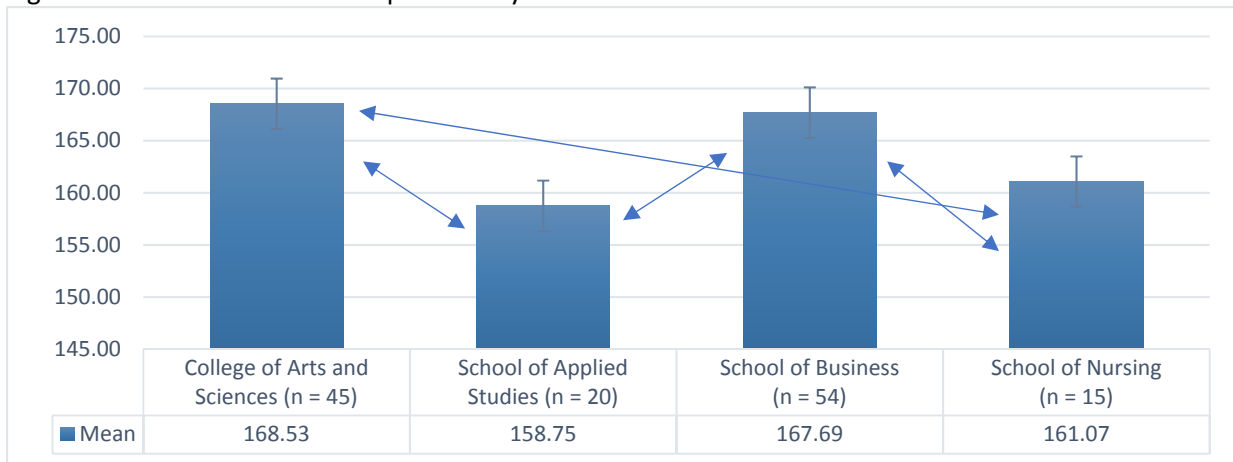
Table 3. Washburn Group Descriptive Statistics for Total Score and Subscores

	Total Score	Percentile	Number and Operations	Algebra	Geometry and Measurement	Probability and Statistics
Mean	165.90	56.98	5.40	5.05	5.10	5.12
Std. Deviation	8.30	27.44	2.63	2.80	2.64	2.56
Minimum	150	2	1	1	1	1
Maximum	180	98	10	10	9	10
Total	134	134	134	134	134	134

On average, Washburn students scored in the 57<sup>th</sup> percentile as compared to all other students who took the assessment. Number and Operations had the highest mean score ( $\bar{x} = 5.40$ ,  $sd = 2.63$ ). Algebra had the lowest mean subscore and the widest variability ( $\bar{x} = 5.05$ ,  $sd = 2.80$ ). No Washburn student scored a 10 on the Geometry and Measurement subscore.

Comparative analyses were conducted to determine if there were differences in the total score and subscores among the divisions the students reported their primary major residing in. See the Appendix for how the majors were grouped by division. A one-way ANOVA was conducted to assess if the mean total score was statistically equal across the four major divisions.

Figure 2. Total Score Mean Comparisons by Division



The College of Arts and Sciences yielded the highest mean score ( $\bar{x} = 168.53$ ) with the School of Business as the second highest ( $\bar{x} = 167.69$ ); the School of Nursing ( $\bar{x} = 161.07$ ) and the School of Applied Studies ( $\bar{x} = 158.75$ ) had the lower two mean scores. In regard to the analysis, the mean total scores were found to be different across the divisions,  $F(3, 130) = 11.04$ ,  $p = 0.000$ . See Figure 2; arrows indicate the significant differences. Specifically, there were statistically significant differences between the College of Arts and Sciences ( $\bar{x} = 168.53$ ) and the School of Applied Studies ( $\bar{x} = 158.75$ ) and the School of Nursing ( $\bar{x} = 161.07$ ) in that means were higher for the College of Arts and Sciences than the former two. There were no differences between the College of Arts and Sciences and the School of Business; however, there was a statistically significant difference between the School of Business ( $\bar{x} = 167.69$ ) and the School of Applied Studies and the School of Nursing in that the School of Business yielded higher means.

Similar one-way ANOVAs were conducted for the subscores to determine if the differences in the means would result in the same pattern across the subscores. See Figures 3-6, below.

Figure 3. Number and Operations Subscore

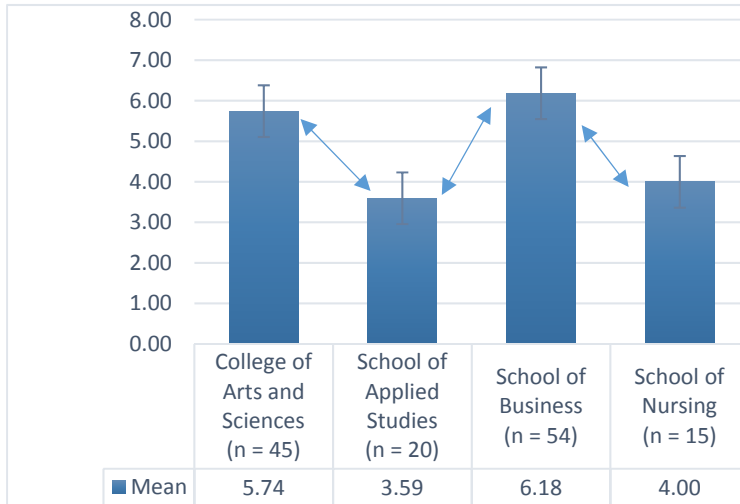


Figure 4. Algebra Subscore

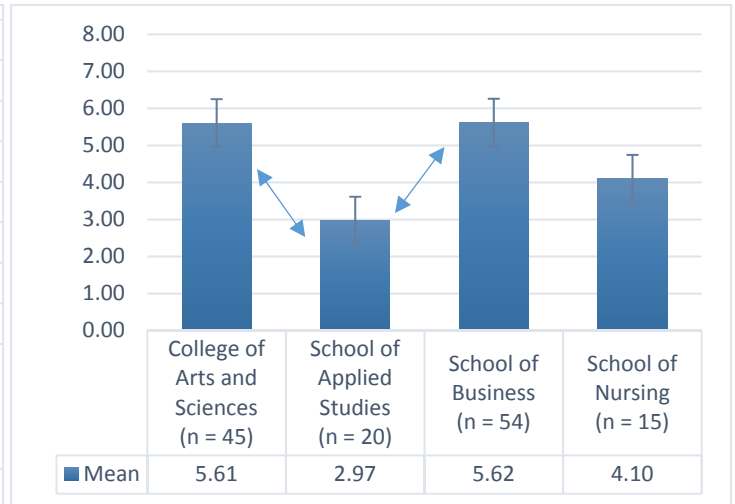


Figure 5. Geometry and Measurement Subscore

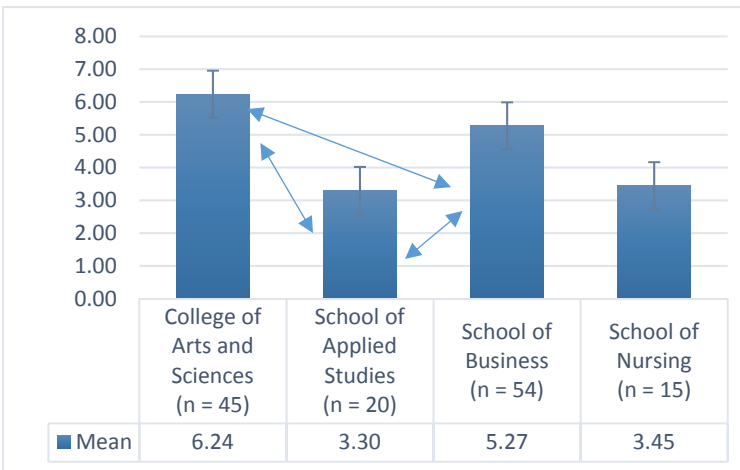
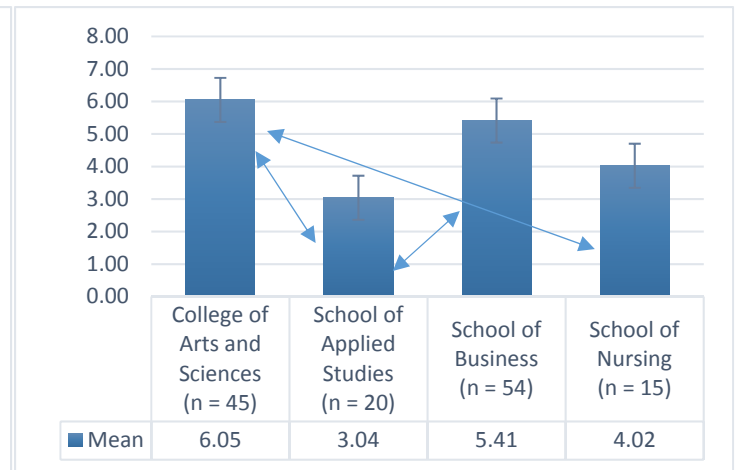


Figure 6. Probability and Statistics Subscore



All four subscores were found to be statistically significant in differences across divisions; however, the pattern differed from the pattern observed with the total score (Figure 2). The same pattern was most evident in the Geometry and Measurement,  $F(3, 130) = 9.40, p = 0.000$  (Figure 5), and Probability and Statistics,  $F(3, 130) = 8.87, p = 0.000$  (Figure 6) subscores, with the exception of no statistically significant relationship between the School of Business and the School of Nursing.

For the Number and Operations subscore,  $F(3, 130) = 7.37, p = 0.000$ , differences existed between the College of Arts and Sciences ( $\bar{x} = 5.74$ ) and the School of Applied Studies ( $\bar{x} = 3.59$ ), the School of Applied Studies and the School of Business ( $\bar{x} = 6.18$ ), and the School of Business and the School of Nursing ( $\bar{x} = 4.00$ ). Similarly, the Algebra subscore analysis,  $F(3, 130) = 6.27, p = 0.001$ , yielded differences between the College of Arts and Sciences ( $\bar{x} = 5.61$ ) and the School of Applied Studies ( $\bar{x} = 2.97$ ), and the School of Applied Studies and the School of Business ( $\bar{x} = 5.62$ ).

An analysis using Pearson’s correlation coefficient was conducted to determine if Washburn students’ scoring on the Total Score or subscores of the assessment were correlated with each other. It was anticipated that since the ETS HEIghten™ Quantitative Literacy Assessment is a good measure of the knowledge, skills and abilities of students’ quantitative literacy, the scores will have strong correlations. See Table 4.

Table 4. Washburn Group Correlations for Total Score and Subscore Correlations

		Total Score	Number and Operations	Algebra	Geometry and Measurement	Probability and Statistics
Total Score	Pearson Correlation		.89*	.80*	.80*	.84*
	Sig. (2-tailed)		0.00	0.00	0.00	0.00
	<b>Total</b>		<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>
Number and Operations	Pearson Correlation	.89*		.65*	.62*	.67*
	Sig. (2-tailed)	0.00		0.00	0.00	0.00
	<b>Total</b>	<b>134</b>		<b>134</b>	<b>134</b>	<b>134</b>
Algebra	Pearson Correlation	.80*	.65*		.51*	.56*
	Sig. (2-tailed)	0.00	0.00		0.00	0.00
	<b>Total</b>	<b>134</b>	<b>134</b>		<b>134</b>	<b>134</b>
Geometry and Measurement	Pearson Correlation	.80*	.62*	.51*		.60*
	Sig. (2-tailed)	0.00	0.00	0.00		0.00
	<b>Total</b>	<b>134</b>	<b>134</b>	<b>134</b>		<b>134</b>
Probability and Statistics	Pearson Correlation	.84*	.67*	.56*	.60*	
	Sig. (2-tailed)	0.00	0.00	0.00	0.00	
	<b>Total</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	

\* significance is at the  $p \leq 0.01$  level (2-tailed)

The total score and the subscores correlations were all statistically significant at the  $p \leq 0.01$  level. The strongest positive correlation was between Number and Operations and the Total Score ( $r = .889$ ), and the correlations Algebra ( $r = .803$ ), Geometry and Measurement ( $r = .803$ ), and Probability and Statistics ( $r = .836$ ) were less strong. This can be interpreted as those students who score higher on the total score performed better on Number and Operations than the other subscores. The lower, but still strong to moderate, positive correlations were between Algebra and Geometry and Measurement ( $r = .511$ ) and Algebra and Probability and Statistics ( $r = .562$ ).

An additional analysis using Pearson’s correlation coefficient was conducted to determine if there was a relationship between ACT scores and the total scores and subscores of the assessment. See table on the following page.



		Total Score	Number and Operations	Algebra	Geometry and Measurement	Probability and Statistics	ACT Composite	ACT English	ACT Math	ACT Science	ACT Reading
Total Score	Pearson Correlation	1	.889**	.803**	.803**	.836**	.633**	.400**	.717**	.645**	.365**
	Sig. (2-tailed)		0.000	0.000	0.000	0.000	0.000	0.008	0.000	0.000	0.009
	<b>Total</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>66</b>	<b>43</b>	<b>53</b>	<b>49</b>	<b>51</b>
Number and Operations	Pearson Correlation	.889**	1	.647**	.617**	.665**	.517**	0.264	.683**	.486**	0.168
	Sig. (2-tailed)	0.000		0.000	0.000	0.000	0.000	0.087	0.000	0.000	0.239
	<b>Total</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>66</b>	<b>43</b>	<b>53</b>	<b>49</b>	<b>51</b>
Algebra	Pearson Correlation	.803**	.647**	1	.511**	.562**	.551**	.426**	.604**	.619**	.387**
	Sig. (2-tailed)	0.000	0.000		0.000	0.000	0.000	0.004	0.000	0.000	0.005
	<b>Total</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>66</b>	<b>43</b>	<b>53</b>	<b>49</b>	<b>51</b>
Geometry and Measurement	Pearson Correlation	.803**	.617**	.511**	1	.601**	.565**	.355*	.551**	.562**	.354*
	Sig. (2-tailed)	0.000	0.000	0.000		0.000	0.000	0.019	0.000	0.000	0.011
	<b>Total</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>66</b>	<b>43</b>	<b>53</b>	<b>49</b>	<b>51</b>
Probability and Statistics	Pearson Correlation	.836**	.665**	.562**	.601**	1	.537**	.343*	.586**	.582**	.343*
	Sig. (2-tailed)	0.000	0.000	0.000	0.000		0.000	0.024	0.000	0.000	0.014
	<b>Total</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>134</b>	<b>66</b>	<b>43</b>	<b>53</b>	<b>49</b>	<b>51</b>
ACT Composite	Pearson Correlation	.633**	.517**	.551**	.565**	.537**	1	.821**	.680**	.874**	.845**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000		0.000	0.000	0.000	0.000
	<b>Total</b>	<b>66</b>	<b>66</b>	<b>66</b>	<b>66</b>	<b>66</b>	<b>66</b>	<b>66</b>	<b>40</b>	<b>48</b>	<b>46</b>
ACT English	Pearson Correlation	.400**	0.264	.426**	.355*	.343*	.821**	1	.481**	.670**	.799**
	Sig. (2-tailed)	0.008	0.087	0.004	0.019	0.024	0.000		0.001	0.000	0.000
	<b>Total</b>	<b>43</b>	<b>43</b>	<b>43</b>	<b>43</b>	<b>43</b>	<b>40</b>	<b>43</b>	<b>43</b>	<b>42</b>	<b>42</b>
ACT Math	Pearson Correlation	.717**	.683**	.604**	.551**	.586**	.680**	.481**	1	.684**	.422**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.001		0.000	0.002
	<b>Total</b>	<b>53</b>	<b>53</b>	<b>53</b>	<b>53</b>	<b>53</b>	<b>48</b>	<b>42</b>	<b>53</b>	<b>48</b>	<b>50</b>
ACT Science	Pearson Correlation	.645**	.486**	.619**	.562**	.582**	.874**	.670**	.684**	1	.742**
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000		0.000
	<b>Total</b>	<b>49</b>	<b>49</b>	<b>49</b>	<b>49</b>	<b>49</b>	<b>46</b>	<b>42</b>	<b>48</b>	<b>49</b>	<b>48</b>
ACT Reading	Pearson Correlation	.365**	0.168	.387**	.354*	.343*	.845**	.799**	.422**	.742**	1
	Sig. (2-tailed)	0.009	0.239	0.005	0.011	0.014	0.000	0.000	0.002	0.000	
	<b>Total</b>	<b>51</b>	<b>51</b>	<b>51</b>	<b>51</b>	<b>51</b>	<b>48</b>	<b>42</b>	<b>50</b>	<b>48</b>	<b>51</b>

\*\* significance is at the  $p \leq 0.01$  level (2-tailed)

\* significance is at the  $p \leq 0.05$  level (2-tailed)

Most relationships were strong to moderate, and statistically significant at the  $p \leq 0.01$  or  $.05$  level. The ACT Composite and the total score correlation was statistically significant at the  $p \leq 0.01$  level, and the strength of the relationship was strong to moderate ( $r = .63$ ). The only exception was ACT English and the Number and Operations subscore which did not yield a statistically significant relationship.



## Demographic and Personal Background Information

Respondents were asked several questions regarding their demographics and personal background information, such as age, gender, and race/ethnicity, questions about their abilities, and their past and current school statuses for their personal profile. See Tables 5a-g. Note that not all respondents completed each question in the personal profile.

<b>5a. Race/Ethnicity</b>	Frequency	Percent		Frequency	Percent	
White	93	66.4%	<b>5b. Gender</b>	Female	64.3%	
Asian or Asian American	13	9.3%		Male	29.3%	
Hispanic/Latino	10	7.1%		No Response	6.4%	
Black or African American	6	4.3%		<b>Total</b>	<b>140</b>	<b>100%</b>
No Response	5	3.6%				
I prefer not to respond	4	2.9%				
Black or African American   White	3	2.1%				
Hispanic/Latino   White	3	2.1%				
Asian or Asian American   White	1	0.7%				
Black or African American   Hispanic/Latino	1	0.7%				
Other	1	0.7%				
<b>Total</b>	<b>140</b>	<b>100%</b>				

The majority of respondent indicated that they were White (66.4%) and Female (64.3%). An additional personal background question required by participants responded to was date of birth. From this date, age at the time the assessment was taken was calculated. The average age of the student who took the assessment was 24.37, the minimum age was 20 and the maximum age was 48.

Next, respondents were asked if they communicate better (or as well) in English than in any other language and what range their high school GPA was in.

<b>5c. Communicate better in English or another language</b>	Frequency	Percent	<b>5d. HS GPA</b>	Frequency	Percent
Yes	104	74.3%	2.00-2.49	2	1.4%
Equally well in English and another language	8	5.7%	2.50-2.99	5	3.6%
No Response	28	20.0%	3.00-3.49	38	27.1%
<b>Total</b>	<b>140</b>	<b>100%</b>	3.50-4.00	78	55.7%
			No Response	9	6.4%
			I do not recall	6	4.3%
			I prefer not to respond	2	1.4%
			<b>Total</b>	<b>140</b>	<b>100%</b>

Most respondents (74.3%) selected that they communicate better in English, and a little over half of respondents (55.7%) reported their high school GPA as between 3.50 and 4.00.

<b>5d. Program</b>	Frequency	Percent	<b>5e. Credit hours successfully completed</b>	Frequency	Percent
BA/BS	131	93.6%	More than 90 semester hours or more than 145 quarter hours	112	80.0%
No Response	5	3.6%	61-90 semester hours or 91-145 quarter hours	20	14.3%
Other	2	1.4%	No Response	5	3.6%
AA/AS	1	0.7%	30-60 semester hours or 45-90 quarter hours	3	2.1%
Certificate	1	0.7%	<b>Total</b>	<b>140</b>	<b>100%</b>
<b>Total</b>	<b>140</b>	<b>100%</b>			

In addition, almost all respondents reported they were enrolled in a BA or BS program (93.6%) and 80.0% selected that they had completed more than 90 semester hours or more than 145 quarter hours.

<b>5f. Major</b>	Frequency	Percent
Accounting	17	12.1%
Other	12	8.6%
Business Administration and Management	11	7.9%
Psychology	9	6.4%
Allied Health	8	5.7%
Biological and Biomedical Sciences	8	5.7%
Health and Medical Sciences	8	5.7%
No Response	5	3.6%
Education	5	3.6%
Marketing	5	3.6%
Banking and Finance	4	2.9%
Accounting   Banking and Finance	3	2.1%
Business Administration and Management   Marketing	3	2.1%
Chemistry	3	2.1%
Computer Science - Applied, Information Technology	3	2.1%
Social Work	3	2.1%
Anthropology and Archaeology	2	1.4%
Arts – History, Theory, and Criticism	2	1.4%
Banking and Finance   Business Administration and Management	2	1.4%
Criminal Justice	2	1.4%
English Language and Literature	2	1.4%
Marketing   Other	2	1.4%
Political Science	2	1.4%
Accounting   Computer Science - Applied, Information Technology	1	0.7%
Accounting   Economics	1	0.7%
Allied Health   Health and Medical Sciences	1	0.7%
Arts – Performance and Studio	1	0.7%
Banking and Finance   Business Administration and Management   Economics	1	0.7%
Banking and Finance   Business Administration and Management   Other	1	0.7%
Banking and Finance   Marketing	1	0.7%
Biological and Biomedical Sciences   Chemistry	1	0.7%
Biological and Biomedical Sciences   Education	1	0.7%
Business Administration and Management   Marketing   Other	1	0.7%

Business Administration and Management   Other	1	0.7%
Criminal Justice   Psychology	1	0.7%
Education   Mathematical Sciences	1	0.7%
English Language and Literature   Other	1	0.7%
Foreign Languages and Literature   Political Science	1	0.7%
History   Political Science	1	0.7%
Mathematical Sciences	1	0.7%
Philosophy   Psychology	1	0.7%
Sociology	1	0.7%
<b>Total</b>	<b>140</b>	<b>100%</b>

In reporting their current major, 12.1% of respondents indicated it was Accounting, while 8.6% selected Other, 7.9% selected Business Administration and Management, and 6.4% selected Psychology.

Students were asked to self-report their scores on standardized tests; however, the ACT was the only response option to yield responses greater than five. Washburn students self-reported scoring on average a 25.14 on ACT English, 24.32 on ACT Math, 24.59 on ACT Science, and 25.63 on ACT Reading. The average reported ACT Composite score was 25.41. See Table 5g.

<i>5g. Standardized Test Scores</i>	<i>ACT English</i>	<i>ACT Math</i>	<i>ACT Science</i>	<i>ACT Reading</i>	<i>ACT Composite</i>
Mean	25.14	24.32	24.59	25.63	25.41
Median	24.00	25.00	24.00	25.00	25.00
Std. Deviation	5.05	4.12	4.02	5.13	4.01
Minimum	15	13	18	18	18
Maximum	35	32	35	36	33
<b>Total</b>	<b>43</b>	<b>53</b>	<b>49</b>	<b>51</b>	<b>66</b>

Next, students were asked their perceptions on a variety of related questions. See Tables 6a.-j. on the following pages for their responses. Again, note that not all respondents completed each question.

Respondents were asked to indicate their primary reason for taking the assessment, if they tried their best, and what the consequence of the scoring was (6a.-c.). About half of the respondents indicated their primary reason was for extra credit (40.3%), most respondents indicated that they tried their best (76.9%), and there wasn't really a consequence associated with their score (70.9%).

<i>6a. Primary Reason for Taking Assessment</i>	Frequency	Percent	<i>6b. Tried Your Best</i>	Frequency	Percent
Extra Credit	54	40.3%	Yes	103	76.9%
Financial Incentive	22	16.4%	No	16	11.9%
University/College/Program Requirements	19	14.2%	No Response	15	11.2%
Volunteer	14	10.4%	<b>Total</b>	<b>134</b>	<b>100%</b>
Other	12	9.0%			
No Response	11	8.2%			
Course Requirement	2	1.5%			
<b>Total</b>	<b>134</b>	<b>100%</b>			

<b>6c. Consequences of Score</b>	Frequency	Percent
Not Really	95	70.9%
No Response	23	17.2%
Some Consequence(s) (E.G., Requirement for Extra Credit)	16	11.9%
<b>Total</b>	<b>134</b>	<b>100%</b>

Respondents were then asked how many college-level classes they took related to quantitative literacy, their reasons for taking these types of classes, and what type of other academic activities they participated in related to quantitative literacy. Almost a quarter of respondents (24.6%) indicated that they took three, while slightly less indicated two (23.9%). About a third of respondents indicated that they take related college-level classes due to college level requirements or requirements for their major (30.6%). For other activities related to quantitative literacy, most did not respond to this question (46.3%), but of those who did, about 20% responded with Other and 13.4% indicated Capstone Courses.

<b>6d. Related College-Level Classes</b>	Frequency	Percent
No Response	33	24.6%
Three	33	24.6%
Two	32	23.9%
Four or more	23	17.2%
One	10	7.5%
None	3	2.2%
<b>Total</b>	<b>134</b>	<b>100%</b>

<b>6e. Reasons for Taking Related College-level Classes</b>	Frequency	Percent
College Level Requirement(s)   Major Requirement	41	30.6%
No Response	35	26.1%
Major Requirement	23	17.2%
College Level Requirement(s)	20	14.9%
College Level Requirement(s)   Major Requirement   Electives	5	3.7%
Not Applicable	4	3.0%
College Level Requirement(s)   Electives	3	2.2%
Major Requirement   Electives	3	2.2%
<b>Total</b>	<b>134</b>	<b>100%</b>

<b>6f. Other Activities</b>	Frequency	Percent
No Response	62	46.3%
Other	27	20.1%
Capstone Courses	18	13.4%
CO-OPS/Practicum/Internships	5	3.7%
Capstone Courses  CO-OPS/Practicum/Internships	4	3.0%
CO-OPS/Practicum/Internships  Seminars  Other	3	2.2%
Capstone Courses  CO-OPS/Practicum/Internships  Seminars	2	1.5%
Capstone Courses  Other	2	1.5%
Capstone Courses  CO-OPS/Practicum/Internships  Other	1	0.7%
Capstone Courses  CO-OPS/Practicum/Internships  Study Abroad	1	0.7%
Capstone Courses  CO-OPS/Practicum/Internships  Study Abroad   Service Learning	1	0.7%
Capstone Courses  Seminars	1	0.7%
Capstone Courses  Study Abroad  Other	1	0.7%
Capstone Courses  Study Abroad  Seminars  Other	1	0.7%
CO-OPS/Practicum/Internships  Other	1	0.7%
CO-OPS/Practicum/Internships  Seminars	1	0.7%
Seminars	1	0.7%
Seminars  Other	1	0.7%
Study Abroad	1	0.7%
<b>Total</b>	<b>134</b>	<b>100%</b>

Respondents were also asked to what extent their coursework requires skill, and to rate their skill level. A little less than a third indicated that their coursework sometimes required skill (29.9%), while a similar percentage would rate their skill level as “Good” (28.4%).

<b>6g. Extent Coursework Requires Skill</b>	Frequency	Percent	<b>6h. Rate Skill Level</b>	Frequency	Percent
No Response	40	29.9%	No Response	41	30.6%
Sometimes Required	40	29.9%	Good	38	28.4%
Frequently Required	29	21.6%	Average	27	20.1%
Rarely Required	25	18.7%	Excellent	22	16.4%
<b>Total</b>	<b>134</b>	<b>100%</b>	Poor	6	4.5%
			<b>Total</b>	<b>134</b>	<b>100%</b>

In an effort to promote student motivation, the HEIghten assessment suite provided students with a certificate upon completion to represent the skills demonstrated in the assessment. Respondents were asked if they would use the certificate, and what they would use it for. Responses were varied, yet the most responses indicated “I would not use the certificate” (14.9%), while the second most frequent response was “Resume” (11.9%).

<b>6i. Planned Use of Certificate</b>		Frequency	Percent
No Response		46	34.3%
I would not use the certificate		20	14.9%
Resume		16	11.9%
Resume   Graduate Program Admission   Linked in or social media site (Facebook, Pinterest, Twitter, etc.)   Admission to an internship program		11	8.2%
Resume   Graduate Program Admission		10	7.5%
Resume   Linked in or social media site (Facebook, Pinterest, Twitter, etc.)		9	6.7%
Resume   Graduate Program Admission   Admission to an internship program		7	5.2%
Resume   Linked in or social media site (Facebook, Pinterest, Twitter, etc.)   Admission to an internship program		5	3.7%
Resume   Admission to an internship program		2	1.5%
Admission to an internship program		1	0.7%
Graduate Program Admission   Admission to an internship program		1	0.7%
Linked in or social media site (Facebook, Pinterest, Twitter, etc.)		1	0.7%
Other		1	0.7%
Resume   Graduate Program Admission   Linked in or social media site (Facebook, Pinterest, Twitter, etc.)		1	0.7%
Resume   Graduate Program Admission   Other		1	0.7%
Resume   Linked in or social media site (Facebook, Pinterest, Twitter, etc.)   Admission to an internship program   Other		1	0.7%
Resume   Other		1	0.7%
<b>Total</b>		<b>134</b>	<b>100%</b>

Finally, students were asked how difficult the test was and if they had enough time to complete the test. Almost half of respondents indicated that it was at the right level of difficulty (41.8%) and about a third selected the response that that time allotted was more than enough time to complete the test (37.3%).

<b>6j. Difficulty of Test</b>			<b>6k. Time Allotted</b>		
	Frequency	Percent		Frequency	Percent
At the right level of difficulty	56	41.8%	More than enough time to complete the test	50	37.3%
No Response	45	33.6%	No Response	48	35.8%
Too easy	21	15.7%	Enough time to complete the test	30	22.4%
Too difficult	12	9.0%	Not enough time to complete the test	6	4.5%
<b>Total</b>	<b>134</b>	<b>100%</b>	<b>Total</b>	<b>134</b>	<b>100%</b>

## Limitations and Further Research

Caution should be used in generalizing the scores from the ETS HEIghten™ Quantitative Literacy assessment to all the knowledge and skills students attained in quantitative literacy at Washburn and at the Comparison group institutions. First, the response rate for Washburn senior level students was 7.2% and the completion rate was 6.9%. This is a fairly low response rate and may not be representative of all senior level students at Washburn. Second, students and institutions are not likely to be representative of all students or institutions because not all institutions choose to use the HEIghten assessment modules as their outcomes assessment. Also, the method of administration and the numbers of students assessed vary among institutions. These conditions impact the representativeness of each institution's student population.

Another consideration is student motivation when the assessment is taken in a nonproctored setting. If students are not motivated to do well, their scores will not reflect their actual knowledge, skills and abilities. However, 76.9% of Washburn students self-reported that they tried their best on the assessment.

Additionally, student demographic groups such as transfer and non-traditional may have impacted the scores. These types of contextual factors may need further research to determine if these impacted the scores on the ETS HEIghten™ Quantitative Literacy assessment.



## Appendix

### Methodology

Washburn administered the unproctored version of the ETS HEIghten™ Quantitative Literacy assessment to students with a classification of Senior during the semesters of Fall 2018 and Spring 2019, which excluded the School of Law, Washburn Tech, and graduate level students. During AY 2018-19, there were two administration windows: October 24, 2018 – November 21, 2018 and February 18, 2019 – March 29, 2019.

First, a notice was sent to all Washburn faculty and adjunct faculty to request Seniors in their classes to take the assessment. Faculty and adjunct faculty were asked to announce the upcoming assessment to Seniors in their classes and consider incentivizing them by awarding extra credit to complete the assessment. This email was sent prior to the first contact with students.

Senior students were sent an email asking them to register for the assessment. A registration survey was administered via the Qualtrics survey system to the seniors. Seniors were offered the ability to take the assessment with a \$5 e-gift certificate as an incentive for completing. Students were told they would need one continuous 45-minute session to complete the necessary components. They could also be asked to complete a personal profile that may take an additional 10-15 minutes. Seven reminder emails were sent in Qualtrics every three to four days to non-respondents.

### ETS HEIghten™ Quantitative Literacy Sample Items

Sample Item 1. In 2014, the price of one share of Company X Stock increased by 25 percent from January 1 to February 1 and decreased by 20 percent from February 1 to March 1.

#### Quantity A

The price of one share of Company X stock on January 1, 2014 before the increase

#### Quantity B

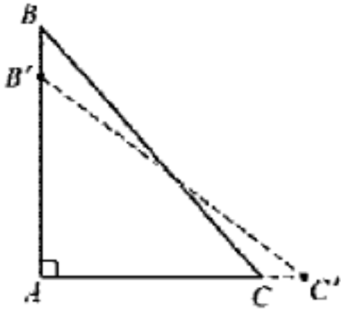
The price of one share of Company X on March 1, 2014

- (A) Quantity A is greater.
- (B) Quantity B is greater.
- (C) The two quantities are equal.
- (D) The relationship cannot be determined from the information given.

Sample Item 2. In a certain company there are 22 employees. There are at least 8 employees age 40 or older and at most 12 employees with an age less than 40. Which of the following CANNOT be true regarding the 22 employees?

- (A) All the employees are age 40 or older.
- (B) There are exactly 8 employees with an age less than 40.
- (C) There are exactly 9 employees age 40 or older.
- (D) There are an equal number of employees age 40 or older and employees with an age less than 40.

Sample Item 3.



A triangular garden, represented by the triangle ABC, is redesigned into a garden represented by triangle AB'C' as shown in the diagram. The change is made by increasing the length of AC by 20 percent to form AC' and decreasing the length of AB by 20 percent to form AB'.

Quantity A

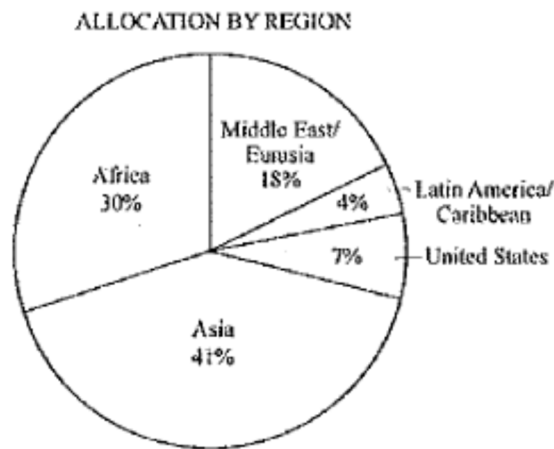
The area of the original garden ABC

Quantity B

The area of the redesigned garden AB'C'

- (A) Quantity A is greater.
- (B) Quantity B is greater.
- (C) The two quantities are equal.
- (D) The relationship cannot be determined from the information given.

Sample Item 4.



The circle graph above shows how a certain charity allocated money to certain regions of the world during a certain year. If the charity allocated a total of \$576 million to regions other than Latin America/Caribbean, what is the total amount of money the charity allocated to regions other than Asia and Latin America/Caribbean?

\$ \_\_\_\_\_ million

## ETS HEIghten™ Quantitative Literacy Performance Level Descriptions

### Advanced

*A typical student at the advanced level has demonstrated the ability to:*

parse long, complicated word problems and extract relevant information to develop an appropriate model.

recall and apply standard definitions, formulas or algorithms that are appropriate for a given problem.

set up and solve a model in a real-world context with two or three variables.

solve multi-step problems.

recall and use basic algebra to solve equations that model a problem — e.g., use variables appropriately, manipulate and simplify algebraic expressions.

recall and use basic facts of Euclidean geometry to model and solve problems — e.g., know formulas for perimeter, area, and volume, parallel and perpendicular lines.

compute and interpret percents and percent change.

read and interpret a chart or graph and extract data needed solve a problem.

solve problems using proportional reasoning.

perform the four basic operations (addition, subtraction, multiplication and division) with integers, decimals and fractions.

recognize when there is insufficient information provided to solve a problem.

read and interpret relationships between quantities expressed in terms of equations, formulas or data representations.

### Proficient

*A typical student at the proficient level has demonstrated the ability to*

reason through a problem in a real context, understand relevant nuances of context, and translate to an equation to solve.

correctly use solution strategy of “plugging in appropriate numbers” or using a relevant example.

set up a model in a real-world context with two or three variables, but may have difficulty solving the model.

solve two- to three-step problems.

recall and use basic algebra to solve equations that model a problem, but may have difficulty with algebraic manipulation.

recall and use basic facts of Euclidean geometry to model and solve problems, but may not recall all the necessary facts.

compute and interpret percents and percent change, but may have difficulty with percents greater than 100, and negative percent change.

read a chart or graph, but may have difficulty interpreting the data presented.

perform the four basic operations (addition, subtraction, multiplication and division) with integers and decimals, but not necessarily fractions.

choose appropriate variables for data in a problem — e.g., let  $J$  be the number of cartons of juice purchased.

read and interpret relationships between quantities expressed in terms of equations, formulas or data representations, but may have difficulty with multiple variables or complex data representations.

identify mathematical terminology and notation for communicating

### Developing

*A typical student at the developing level may sometimes:*

parse simple word problems, but may react to surface features rather than apply quantitative reasoning.

reason through a single-step word problem and translate to an equation to solve, but may have difficulty with complicated equations or calculations with large numbers.

recognize when algebraic techniques are required to solve a problem, but may not recall the specific facts or techniques needed.

recognize when facts from Euclidean geometry are required to solve a problem, but may not recall the specific facts or techniques needed.

read a chart or graph, but may have difficulty extracting the data required to solve a problem.

perform the four basic operations (addition, subtraction, multiplication and division) with integers but not necessarily with decimals or fractions.

read and interpret relationships between quantities expressed in terms of simple equations, well-known formulas or simple data representations, but may have difficulty with multiple variables, new formulas or complicated data representations.

identify that mathematical terminology and notation are needed to communicate results, but may use incorrect terminology or incomplete notation.

## Majors by Division

Respondents could select options for their major(s), and the categories of majors to choose from were provided by the instrument. For analysis, where respondents selected Other or no response, their major was determined by reviewing their student profile. Likewise, where the major(s) respondents selected were ambiguous as to what division they fell under, the student's profile was examined to determine the correct division. The first major selected was considered their primary major, and were grouped into the primary major's division. See the table below for the 134 respondents' majors by division.

	College of Arts and Sciences	School of Applied Studies	School of Business	School of Nursing	Total
Biological and Biomedical Sciences	8				8
Psychology	8				8
Education	5				5
Chemistry	3				3
Computer Science - Applied, Information Technology	3				3
Anthropology and Archaeology	2				2
Arts – History, Theory, and Criticism	2				2
English Language and Literature	2				2
Political Science	2				2
Arts – Performance and Studio	1				1
Biological and Biomedical Sciences   Chemistry	1				1
Biological and Biomedical Sciences   Education	1				1
Education   Mathematical Sciences	1				1
English Language and Literature   Other	1				1
Foreign Languages and Literature   Political Science	1				1
History   Political Science	1				1
Mathematical Sciences	1				1
Philosophy   Psychology	1				1
Sociology	1				1
Allied Health		8			8
Criminal Justice		3			3
Integrative Practice		2			2
Social Work		2			2
Allied Health   Health and Medical Sciences		1			1
Criminal Justice   Psychology		1			1
Health and Medical Sciences		1			1
Addiction Counseling		1			1
Technology Administration		1			1
Accounting			17		17
Business Administration and Management			11		11
Marketing			5		5
Banking and Finance			4		4
Accounting   Banking and Finance			3		3
Business Administration and Management   Marketing			3		3
Banking and Finance   Business Administration and Management			2		2
Marketing   Other			2		2

Accounting   Computer Science - Applied, Information Technology	1	1		
Accounting   Economics	1	1		
Banking and Finance   Business Administration and Management   Economics	1	1		
Banking and Finance   Business Administration and Management   Other	1	1		
Banking and Finance   Marketing	1	1		
Business Administration and Management   Marketing   Other	1	1		
Business Administration and Management   Other	1	1		
Health and Medical Sciences			15	15
<b>Total</b>	<b>45</b>	<b>20</b>	<b>54</b>	<b>134</b>