Salisbury University HEIghten Critical Thinking & Reasoning Assessment Report, Fall 2017

This report, authored by SU office of University Analysis, Reporting & Assessment (UARA) staff and reviewed by the University Academic Assessment Committee (UAAC), discusses Critical Thinking & Reasoning assessment data collected during fall 2017 GULL Week sessions.

To request more information about the assessment, results, or additional analyses, please contact the Assessment Coordinator, Dr. Sarah Winger.

Executive Summary

Background and Findings

1. Faculty and UARA agreed that the ETS HEIghten Critical Thinking (H-CT) assessment is aligned with the General Education student learning outcome, Critical Thinking & Reasoning.
2. The H-CT instrument comprises 26 items with an overall scaled score as well as 2 scaled subscores, for Analytic and Synthetic skills. The item formats include: critical thinking sets, short arguments or informational passages, and sets that present conditions applicable to a fictional situation. The item types include: single-selection, multiple choice; multiple-selection, multiple choice; select-in-passage; inline choice; and composite items.
3. The results of our administration of the H-CT instrument supported its validity and reliability.
    a. H-CT scores demonstrated validity:
        i. Content Validity: instrument was designed based upon literature review, review of existing measures, market research and survey of both higher education leaders and employers, as well as expert review of items
        ii. Scale Analysis: supported using both exploratory and confirmatory factor analyses
        iii. Criterion and Construct Validity: supported by published group differences, particularly based on class level (i.e., freshmen vs. seniors) and positive correlations with SAT/ACT scores– also, the overall score and subscores on this instrument had moderate positive correlations with the SU students' related measures of SAT Verbal score range categories and SAT Math score range categories
    b. H-CT scores in published studies satisfactorily supported reliability for both individual-level reliability and institution-level total score reliability of the overall score and subscores
4. A limitation of this administration is that only specific student types [freshmen (all majors) and junior Business majors] are represented within cohorts in the sample – due to sampling requirements of a longitudinal study. Therefore, the students that completed the H-CT instrument were not very representative of the overall and non-test-taker populations at SU. However, when compared to demographically similar non-test-takers, by cohort, they were somewhat similar.

5. The average SU H-CT overall scaled scores for both the freshman cohort (160.3) and the junior Business majors cohort (161.0) were below the average of the comparison group (163.3) as well as below the proficiency benchmark (162). 62.3% of the freshman cohort and 51.7% of the junior Business majors cohort had scores below the 162-level proficiency benchmark. Similarly, the average SU H-CT scaled Analytic and Synthetic subscores for both cohorts (freshman cohort: 3.6 and 3.5; junior Business majors cohort: 3.8 and 3.8) were below the averages of the comparison group (4.4 and 4.5, respectively).
6. Significance between H-CT overall scaled score, Analytic scaled subscore, and Synthetic scaled subscore averages of transfer students and SU native, first-time students could not be evaluated due to small sample sizes of transfer students within the cohorts.
7. H-CT overall scaled score, Analytic scaled subscore, and Synthetic scaled subscore averages of students by class level could not be evaluated due to the sampling requirements of the longitudinal study.
8. There was no significant difference between average H-CT overall scaled score in the freshman cohort by SU School (i.e., Fulton, Henson, Perdue, and Seidel; based on students' primary major). However, analysis only included Henson and Perdue – due to low sample sizes in other School groups. See full report for scaled subscore results.

Suggested Action Items

1. The benchmarks with which SU students' Critical Thinking & Reasoning are compared should be evaluated by objective faculty and/or staff with expertise in the discipline or assessment of those skills.
2. Perform an area/course mapping of the current SU courses that align with the revised Critical Thinking & Reasoning student learning outcome.
3. Teaching faculty, General Education Steering Committee, and other relevant parties should consider whether the H-CT instrument is well aligned with revised (as of November 2018) General Education Critical Thinking & Reasoning student learning outcome. If the H-CT instrument is not aligned, then an alternative assessment that is aligned should be identified.
4. Consider results from the assessment to develop interventions or review and update curriculum to align with areas that need improvement.
5. Relevant stakeholders at SU should request further analyses of the H-CT data to address additional questions of interest that were not described here.
6. Determine a timeline to re-collect assessment data related to Critical Thinking & Reasoning, tentatively set for re-assessing using the H-CT in fall 2022 and then every 3 years.
7. Continue collaborative longitudinal study and share updates with SU.

Contents

Detailed Critical Thinking & Reasoning Report

Instrument

ETS HEIghten Outcomes Assessment Suite

The ETS HEIghten Outcomes Assessment Suite comprises "innovative, modular, computer-delivered assessment tool[s that enable] colleges and universities to measure the student learning outcomes that are essential for academic success" (About the HEIghten Outcomes Assessment Suite 2020). The capitalized HEI in "HEIghten" stands for Higher Education Institution, indicating that the HEIghten Outcomes Assessment Suite instruments align with common general education areas in Higher Education. The instruments are designed and aligned with national frameworks, for the respective instruments. The instrument reporting includes score/subscore benchmark comparisons versus similar institutions. The benchmark comparison values in this report are from the most recently available ETS institutional score reports for the particular HEIghten assessment addressed.

H-CT Instrument

The HEIghten Critical Thinking (H-CT) assessment is one of the five ETS HEIghten Outcomes Assessment Suite instruments. The H-CT assessment is an instrument which comprises 26 items, whose formats include: "critical thinking sets, short arguments or informational passages, and sets that present conditions applicable to a fictional situation" (ETS HEIghten Critical Thinking Assessment 2020). Within those item formats are the following item types: single-selection, multiple choice; multiple-selection, multiple choice; select-in-passage; inline choice (i.e., drop-down menu items); and composite items. There are also other follow-up items (e.g., demographics, reason for taking test, did you try your best on this, etc.) following the 26 items. See H-CT sample items in Appendix 1 and information about the instrument's alignment with SU's student learning goals, outcomes, and curricular area mapping in Table 1 [both prior to and subsequent to the November 20, 2018 revision of the General Education (GenEd) Student Learning Goals (SLGs) and Student Learning Outcomes (SLOs)]. However, since this report was written subsequent to the revision, the latter alignment is detailed throughout. Details about the instrument can be found at the ETS HEIghten Critical Thinking Assessment website (2020), the ETS HEIghten Critical Thinking Test at a Glance document (2015), and the Liu *et al.* (2014) ETS Research Report, "Assessing Critical Thinking in Higher Education: Current State and Directions for Next-Generation Assessment" that explains the operational definitions and assessment considerations for the development of this particular assessment.

There are several indices which are measured by the H-CT and are described below. The first index is the overall scaled score as well as 2 scaled subscores, for Analytic and Synthetic skills. Analytical skills involve: 1) analyzing argument structure; 2) evaluating argument structure; and 3) evaluating evidence and its use. Synthetic skills involve: 1) developing valid or sound arguments; as well as 2) demonstrating understanding of the implications or consequences of information and argumentation. Each skill is aligned to approximately 50% of the H-CT items. Also, although it is not measured as a separate scaled subscore, the Understanding Causation and Explanation skill is embedded as a third dimension of critical thinking – within the overall scaled score. That skill involves understanding, evaluating, and creating arguments that invoke causal claims or that offer explanations for collections of information.

The University Academic Assessment Committee, representing Faculty Senate and multiple departments and programs, and UARA staff agreed that the H-CT instrument is aligned with the General Education Critical Thinking & Reasoning student learning outcome (Table 1).

Table 1. The SU General Education student learning goals, outcomes, and area mapping related to Critical Thinking (prior to November 20, 2018) and Critical Thinking & Reasoning (after November 20, 2018).

SU GenEd SLG/SLO Version	Student Learning Goal	Student Learning Outcome	Area Mapping
Prior to November 20, 2018	1.1. Critical Thinking	1.1.1. Analyze, synthesize, and/or evaluate ideas, concepts, and/or evidence.	IA, IIA, IIB, IIIA, IVA, IVB, IVC, V
		1.1.2. Describe diverse aspects of a discipline using discipline-specific concepts.	IB, IIA, IIB
		1.1.3. Apply appropriate problem-solving strategies to discipline-specific issues.	IIA, IIB, IIIA, IIIB, IVA, IVB, IVC
		1.1.4. Compare and contrast theories within a discipline.	IIA, IIB, IIIB
After November 20, 2018	Essential Competencies	**Critical Thinking & Reasoning:** Students will be able to comprehensively analyze evidence before they create, critique, or accept an opinion, conclusion, or determine a need for further investigation.	TBD*

Note. Revised SU General Education student learning goals and outcomes were approved by Faculty Senate November 20, 2018. Asterisk (*) denotes that, at this time, there has not been an official area mapping of current courses to the revised SU General Education student learning goals and outcomes.

Related to Critical Thinking & Reasoning, results from this instrument can: provide a benchmark of student outcomes at SU; inform instructional efficacy and possible interventions; evaluate curricular strengths and weaknesses; and continuously improve student outcomes if we use this instrument for future GULL Week administrations.

Methodology and Sample

Longitudinal Study of Student Learning Outcomes in Multiple Dimensions

Since GULL Week in fall 2017, SU has collaborated with ETS and other Higher Education Institutions to assess student learning outcomes over time in a longitudinal study.

- **Outcomes & Assessments:** Specifically, there were three types of student learning outcomes being assessed as a part of this study: generic (i.e., Critical Thinking; assessed with H-CT), "noncognitive" (e.g., organization, self-efficacy; assessed with SuccessNavigator), and domain-specific (i.e., Business-related knowledge; assessed with the ETS Major Field Test in Business). See Appendix 2 and Appendix 3 for more information on the latter two assessments, which are not assessed as part of the SU General Education.
- **Proctored Testing Sessions:** The first two outcomes were assessed during GULL Week in "longitudinal study sessions," although only certain students had access to these sessions (see study cohorts below) – whereas other students had access to GULL Week sessions that included different assessments that were aligned to other General Education student learning outcomes (non-longitudinal study sessions). Otherwise, the third outcome, assessed with the Major Field Test in Business was administered in separate proctored sessions by either UARA staff (fall 2017) or Perdue School of Business (hereafter, "Perdue") staff or graduate students (subsequent semesters, both fall and spring). Prior to participation in this study, Perdue had used and required student participation in the Major Field Test in Business as part of their capstone course, Management 492, which students generally take during their final semester prior to graduation. Perdue uses these results to evaluate and report upon student learning outcomes

for their programs, both for informing internal continuing improvement of the programs as well as external accreditation required reporting.

- **Cohorts:** In fall 2017 there were two cohorts included in this study: 1) freshmen (all majors) or 2) junior Business majors. This report refers to those two fall 2017 cohorts - as freshman and junior Business majors, respectively. Subsequently, in fall 2018, those two cohorts were re-assessed – as sophomores (all majors) or senior Business majors, respectively. Finally, in fall 2019, only the former cohort was re-assessed, as juniors (all majors).
    - ***Sampling Limitations:*** Some students may have participated (or given consent to be included in the study) in only one GULL Week collection sample during the study. This could have been related to issues with GULL Week registration, participant turn-out, attrition from SU, etc. For example, one common issue with the GULL Week registration system is that students need to manually adjust their class level from GULL Week to GULL Week so that they can access and enroll in the correct session type (see above). If the students do not manually update their class level, then they cannot sign up for the longitudinal study sessions and instead can only sign up for non-longitudinal study sessions that include different assessments that were aligned to other General Education student learning outcomes. Similarly, new students that had not participated in the original fall 2017 study may have joined the study in their sophomore or junior year. It is also the case that some students accidentally participated in a longitudinal study session when they were not in the correct class level/cohort for the specific GULL Week year and therefore should not have been included in the study (e.g., showed up to the wrong testing room and couldn't reschedule for a different time, therefore the proctor allowed them to take the H-CT and SN to get GULL Week participation credit; issues with GULL Week registration).

Fall 2017 GULL Week

Data were collected from volunteer students at SU who self-selected and signed up to participate in various Gaining Understanding as a Lifelong Learner (GULL) Week testing sessions during a week in September, 2017. GULL Week sessions were open to the entire SU undergraduate student population. The assessments were administered in a proctored computer lab setting and lasted approximately one hour, of which ~45 minutes was dedicated to the H-CT administration and the remaining ~15 minutes was dedicated to the SuccessNavigator instrument (Appendix 3; Markle *et al*. 2013; Rikoon *et al*. 2014; Rikoon & Midkiff 2018; longitudinal study sessions). The SuccessNavigator has subskill scores which align with student characteristics across four skills: academic skills, commitment, self-management, and social support (Appendix 3). These SuccessNavigator subskill scores were analyzed to evaluate if there were any relationships between those scores and the H-CT scores, for those students that participated in both.

Some faculty offered incentives (such as extra credit) to participating students, some mentioned GULL Week and encouraged students to participate, and some did not interact with students about GULL Week. The office of University Analysis, Reporting & Assessment (UARA) publicized GULL Week across campus via many avenues. Particularly, competitions between both Schools and Greek life groups were set up to improve participation.

In all, n = 2,158 undergraduates participated in fall 2017 GULL Week and, of those, n = 225 students (18 years or older) completed the H-CT with quality data within one of two cohorts (27.7% and 2.9% of total SU fall 2017 undergraduate enrollment (n = 7782), respectively). Of the 225 H-CT test-takers with quality

data, 138 students were in the freshman cohort (7.6% of all freshmen enrolled in fall 2017, n = 1822) and the remaining 87 were in the junior Business majors cohort (20.0% of all junior Business majors enrolled in fall 2017, n = 434). In fall 2017, 4 students had taken the H-CT but were excluded from analyses because they were neither freshmen nor junior Business majors. In GullNet, class level of students is defined by 30-credit increments (e.g., freshman = 0 – 30; sophomore = 31 – 60, etc.). However, some students take more or less than the recommended 30 credits per academic year, come to SU with additional credits transferred, enroll in summer/winter sessions, etc. which can cause variations in their class level variable as compared to their number of years enrolled at SU. To ensure the matched, longitudinal cohorts were as large and accurate as possible, students who should have been freshmen or junior business majors (e.g., based upon original date enrolled in SU courses) but were classified as sophomores or seniors for any reason (mostly due to many transferred credits for the former or completing too few or too many credits in the previous year for the latter) were retained in the freshman or junior Business majors cohort, respectively. Also, students who had a secondary major in Perdue were also retained in the latter cohort, regardless of their primary major.

The H-CT cut-off determination for "quality data" for the analyses in this report was based upon the UAAC decision of a student self-report measure of effort, informed by an *ad hoc* UARA analysis of various quality control metrics. Therefore, any student that self-reported less effort was marked as "not quality data" and therefore not included in these analyses. For the H-CT test, this is based upon the ETS follow-up question "Did you try your best?" and 43 students (8.9% of the total H-CT test-takers that included both "quality data" and "not quality data") that responded "No" were marked as "not quality data" and were only included as H-CT non-test-takers for these analyses. Additionally, 213 students (43.9% of the total H-CT test-takers) did not answer the question, and were also excluded from the analysis. Similarly, the SuccessNavigator cut-off determination for "quality data" is imposed by ETS, since any student that had particular quality data flags (i.e., "Minimum minutes answering questions too low" or "Percent completed in test too low") had "invalid" instead of a raw score for the 10 subskill values in the SuccessNavigator exported data file.

Demographic analyses of the H-CT demographically similar non-test-takers, by cohort, specifically freshmen students and junior Business majors (n = 1684 and n = 347, respectively) including those who participated without providing quality data, were compared to the test-takers that completed H-CT with quality data to evaluate the extent to which the sample of test-takers was representative of the specific demographic group during fall 2017, by cohort. This was done since, due to the sampling requirements of the longitudinal study, these cohort groups were not representative of entire SU undergraduate population during fall 2017.

Further analyses within the test-takers were performed to evaluate the validity and reliability of the instrument administration at SU as well as to determine whether scores on the instrument varied by student characteristic(s), based upon available data in the Student Information System (GullNet). Some of the data may be missing for some demographic or student data variables for some students, therefore some of these total numbers maybe different in the tables and results. The students with data for both the H-CT and the SuccessNavigator were analyzed to evaluate student scores on those subskills.

Results

Demographic Comparison of Test-takers vs. Non-test-takers

Because of the limitations due to the designs of the targeted students in the previously mentioned longitudinal study sampling, the demographics of the students who took the H-CT were not similar to the non-test-takers. However, when compared against the specific demographics (e.g., freshman cohort H-CT test-takers compared to the remaining SU freshmen that were non-test-takers), they were somewhat similar (based upon z-test results of column comparisons) when analyses were possible (Tables 2-9; lack of significance annotations). The impact of the longitudinal study's sampling targeting specific student groups are noted and evident in: 1) Table 5 (freshman-level students) as well as 2) both Table 5 and Table 6 (junior Business majors). Otherwise, Asian students (Table 2) and SU native, first time students (Table 4) were disproportionately high in both the freshman and junior Business majors cohorts' test-taker groups, whereas females (Table 3) were only disproportionately high in the former. Additionally, in three cases of student success metrics (i.e., High School GPA, SU Cumulative GPA, and SAT Verbal scores), the freshman cohort H-CT test-takers were significantly more successful than the non-test-takers (Table 8 and Table 9). However, the final student success metric (SAT Math scores) indicated that the two groups were mostly comparable in the freshman cohort (Table 7). For the junior Business majors cohort, the H-CT test-takers were significantly more successful than the non-test-takers for only one student success metric, SU Cumulative GPA (Table 9). For the other three student success metrics (i.e., High School GPA and both SAT scores), the two groups were comparable in the junior Business majors cohort (Table 7, Table 8, and Table 9).

Table 2. Student Race/Ethnicity Compared between the H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

Race/Ethnicity	Freshman Cohort			Junior Business Majors Cohort		
	Test-taker	Non-test-taker	Total	Test-taker	Non-test-taker	Total
African American	14 (10.1%)	256 (15.2%)	270 (14.8%)	7 (8.0%)	39 (11.2%)	46 (10.6%)
American Indian/ Alaska Native	0 (0.0%)	15 (0.9%)	15 (0.8%)	0 (0.0%)	4 (1.2%)	4 (0.9%)
Asian	11 (8.0%)*	72 (4.3%)*	83 (4.6%)	7 (8.0%)*	7 (2.0%)*	14 (3.2%)
Caucasian	102 (73.9%)	1151 (68.3%)	1253 (68.8%)	65 (74.7%)	261 (75.2%)	326 (75.1%)
Hispanic	5 (3.6%)	91 (5.4%)	96 (5.3%)	5 (5.7%)	9 (2.6%)	14 (3.2%)
Native Hawaiian/ Pacific Islander	0 (0.0%)	3 (0.2%)	3 (0.2%)	0 (0.0%)	3 (0.9%)	3 (0.7%)
Non-resident Alien	2 (1.4%)	12 (0.7%)	14 (0.8%)	1 (1.1%)	12 (3.5%)	13 (3.0%)
Two or more races	1 (0.7%)	34 (2.0%)	35 (1.9%)	0 (0.0%)	3 (0.9%)	3 (0.7%)
Unknown/ Not specified	3 (2.2%)	50 (3.0%)	53 (2.9%)	2 (2.3%)	9 (2.6%)	11 (2.5%)
Total	138 (100.0%)	1684 (100.0%)	1822 (100.0%)	87 (100.0%)	347 (100.0%)	434 (100.0%)

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue)

that did not participate in the H-CT or that did participate, but not with quality data. Cell values are counts with percentages reported parenthetically. Significant difference of participation categories between test-takers' and non-test-takers' proportions are indicated by an asterisk (*), $p \leq .05$.

Table 3. Student Gender Compared between the H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

Gender (code)	**Freshman Cohort**			**Junior Business Majors Cohort**		
	Test-taker	**Non-test-taker**	**Total**	**Test-taker**	**Non-test-taker**	**Total**
Male (1)	37 (26.8%)*	797 (47.3%)*	834 (45.8%)	54 (62.1%)	251 (72.3%)	305 (70.3%)
Female (2)	101 (73.2%)*	883 (52.4%)*	984 (54.0%)	32 (36.8%)	95 (27.4%)	127 (29.3%)
Unknown (3 + 4)	0 (0.0%)	4 (0.2%)	4 (0.2%)	1 (1.1%)	1 (0.3%)	2 (0.5%)
Total	138 (100.0%)	1684 (100.0%)	1822 (100.0%)	87 (100.0%)	347 (100.0%)	434 (100.0%)

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue) that did not participate in the H-CT or that did participate, but not with quality data. Cell values are counts with percentages reported parenthetically. Significant difference of participation categories between test-takers' and non-test-takers' proportions are indicated by an asterisk (*), $p \leq .05$.

Table 4. Student Admit Type, to SU, Compared between the H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

SU Admit Type (code)	**Freshman Cohort**			**Junior Business Majors Cohort**		
	Test-taker	**Non-test-taker**	**Total**	**Test-taker**	**Non-test-taker**	**Total**
First time student (F)	136 (98.6%)*	1575 (93.5%)*	1711 (93.9%)	60 (69.0%)*	185 (53.3%)*	245 (56.5%)
Transfer (T + U)	2 (1.4%)*	109 (6.5%)*	111 (6.1%)	27 (31.0%)*	162 (46.7%)*	189 (43.5%)
Total	138 (100.0%)	1684 (100.0%)	1822 (100.0%)	87 (100.0%)	347 (100.0%)	434 (100.0%)

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue) that did not participate in the H-CT or that did participate, but not with quality data. Cell values are counts with percentages reported parenthetically. Significant difference of participation categories between test-takers' and non-test-takers' proportions are indicated by an asterisk (*), $p \leq .05$.

Table 5. Student Undergraduate Class Level Compared between the H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

Class Level (code)	**Freshman Cohort**			**Junior Business Majors Cohort**		
	Test-taker	**Non-test-taker**	**Total**	**Test-Taker**	**Non-test-taker**	**Total**
Freshmen (1)	138 (100.0%)	1684 (100.0%)	1822 (100.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Sophomores (2)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Juniors (3)	0 (0.0%)	0 (0.0%)	0 (0.0%)	87 (100.0%)	347 (100.0%)	434 (100.0%)
Seniors (and +) (4)	0 (0.0%)	0 (0.0%)	0 (0.2%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Unclassified non-degree undergrads (7)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	138 (100.0%)	1684 (100.0%)	1822 (100.0%)	87 (100.0%)	347 (100.0%)	434 (100.0%)

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue) that did not participate in the H-CT or that did participate, but not with quality data. Cell values are counts with percentages reported parenthetically. The disproportionately high number of freshmen in the freshman cohort as well as the juniors in the junior Business majors cohort is an impact of the longitudinal study's sampling during fall 2017 GULL Week. Therefore, significant difference analyses of participation categories between test-takers' and non-test-takers' were not performed since there was only one group per cohort (freshmen and juniors, respectively).

Table 6. Student School Enrollment Compared between the H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

School	**Freshman Cohort**			**Junior Business Majors Cohort**		
	Test-taker	**Non-test-taker**	**Total**	**Test-taker**	**Non-test-taker**	**Total**
Fulton	26 (18.8%)	326 (19.4%)	352 (19.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Henson	49 (35.5%)	515 (30.6%)	564 (31.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Perdue	30 (21.7%)	383 (22.7%)	413 (22.7%)	87 (100.0%)	347 (100.0%)	434 (100.0%)
Seidel	20 (14.5%)	266 (15.8%)	286 (15.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Undeclared	13 (9.4%)	194 (11.5%)	207 (11.4%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Total	138 (100.0%)	1684 (100.0%)	1822 (100.0%)	87 (100.0%)	347 (100.0%)	434 (100.0%)

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue) that did not participate in the H-CT or that did participate, but not with quality data. Cell values are counts with percentages reported parenthetically. Students in the freshman cohort are summarized by reported primary major only (so none are counted more than once and since second majors are not common). For this cohort, there were no significant differences of participation categories between test-takers' and non-test-takers' proportions ($p > .05$). However, by definition, the students in the junior Business majors cohort include any juniors that have a Business major (Perdue) as either their reported primary or secondary major. The disproportionately high number of students with a major in Perdue in the junior Business majors cohort is an impact of the longitudinal study's sampling during fall 2017 GULL Week. Therefore, significant difference analysis of participation categories between test-takers' and non-test-takers' was not performed in that cohort since there was only one group (Perdue).

Table 7. Student SAT Math Scores Compared between the H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

SAT Math Score Range	Freshman Cohort			Junior Business Majors Cohort		
	Test-taker	Non-test-taker	Total	Test-taker	Non-test-taker	Total
< 500	18 (15.9%)	313 (24.0%)	331 (23.4%)	10 (20.0%)	35 (17.6%)	45 (18.1%)
500-599	61 (54.0%)	686 (52.7%)	747 (52.8%)	21 (42.0%)	112 (56.3%)	133 (53.4%)
600-699	33 (29.2%)	281 (21.6%)	314 (22.2%)	18 (36.0%)	49 (24.6%)	67 (26.9%)
700-800	1 (0.9%)	22 (1.7%)	23 (1.6%)	1 (2.0%)	3 (1.5%)	4 (1.6%)
Total	113 (100.0%)	1302 (100.0%)	1415 (100.0%)	50 (100.0%)	199 (100.0%)	249 (100.0%)

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue) that did not participate in the H-CT or that did participate, but not with quality data. Cell values are counts with percentages reported parenthetically. Within each SAT subject, significant difference of participation categories between test-takers' and non-test-takers' proportions are indicated by an asterisk (*), $p \leq .05$. The SAT score ranges were used so that both the student scores on the old and 2016 SAT versions could be included. Total values will not match the aforementioned sample values because students do not always self-report this information.

Table 8. Student SAT Verbal Scores Compared between the H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

SAT Verbal Score Range	Freshman Cohort			Junior Business Majors Cohort		
	Test-taker	Non-test-taker	Total	Test-taker	Non-test-taker	Total
< 500	11 (9.7%)*	326 (25.0%)*	337 (23.8%)	12 (24.0%)	67 (33.7%)	79 (31.7%)
500-599	65 (57.5%)*	619 (47.5%)*	684 (48.3%)	30 (60.0%)	100 (50.3%)	130 (52.2%)
600-699	35 (31.0%)	330 (25.3%)	365 (25.8%)	8 (16.0%)	31 (15.6%)	39 (15.7%)
700-800	2 (1.8%)	27 (2.1%)	29 (2.0%)	0 (0.0%)	1 (0.5%)	1 (0.4%)
Total	113 (100.0%)	1302 (100.0%)	1415 (100.0%)	50 (100.0%)	199 (100.0%)	249 (100.0%)

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue) that did not participate in the H-CT or that did participate, but not with quality data. Cell values are counts with percentages reported parenthetically. Within each SAT subject, significant difference of participation categories between test-takers' and non-test-takers' proportions are indicated by an asterisk (*), $p \leq .05$. The SAT score ranges were used so that both the student scores on the old and 2016 SAT versions could be included. Total values will not match the aforementioned sample values because students do not always self-report this information.

Table 9. Student GPA Scores Compared between H-CT Test-takers and Demographically Similar Non-test-takers, by Cohort

Success Metric	Freshman Cohort				Junior Business Majors Cohort			
	Test-taker		Non-test-taker		Test-taker		Non-test-taker	
	n	Avg (SD)	n	Avg (SD)	n	Avg (SD)	n	Avg (SD)
High School GPA	133	3.73 (.41)**	1532	3.52 (.44)**	59	3.66 (.36)	213	3.56 (.42)
SU Cumulative GPA	138	3.10 (.78)**	1684	2.61 (.97)**	87	3.12 (.43)**	347	2.93 (.62)**

Notes. The non-test-takers groups, by cohort, comprise students of similar demographics (freshman cohort: freshman undergraduates; junior Business major cohort: junior undergraduates with a Business major in Perdue) that did not participate in the H-CT or that did participate, but not with quality data. Cell values are sample sizes (n) or averages with standard deviation reported parenthetically. Significant difference of participation categories between test-takers' and non-test-takers' average values are indicated by two asterisks (**), $p \leq .001$. Total values will not match the aforementioned sample values because students do not always self-report this information (High School GPA).

Validity and Reliability of the H-CT Administration at SU

The results of our administration of the 26-item H-CT supported its validity and reliability. Much of the validity of the H-CT was described in ETS-related publications (Liu *et al.* 2014, Liu *et al*. 2016, Swiggett 2017). Content validity was supported via the steps of literature review, review of existing measures, as well as expert review of items (Liu *et al.* 2014, Swiggett 2017). This latter step also included a standard setting method to identify students' proficiency in Critical Thinking based on ranges in the overall scaled score and scaled subscores (Table 10; Swiggett 2017). Additionally, ETS performed market research and surveyed higher education leaders and employers to develop the H-CT (Guangming Ling, *personal communication*). Furthermore, scale analysis was supported using both exploratory and confirmatory factor analyses (Liu *et al*. 2016). Similarly, both individual-level reliability (Cronbach's alpha; α) and institution-level total score reliability satisfactorily supported the reliability of the overall score and subscores (Liu *et al*. 2016).

Table 10. Performance level descriptions and score/subscore interpretations for the H-CT (ETS HEIghten Critical Thinking Assessment Performance Level Descriptions 2016; ETS HEIghten Critical Thinking Sample Institutional Score Report. 2016; ETS HEIghten Outcomes Assessment Suite Scores 2020)

Score/Subscore Name	SU Proficiency Level	ETS Proficiency Level	Score/Subscore Range	A typical student at this level…
overall scaled score	Proficient	Advanced	173 – 180	…**has demonstrated the ability to:** • extrapolate implications • describe the logic of complex arguments • understand subtle logical relationships between assertions/arguments and supporting information • identify needed evidence and implicit assumptions • identify possible alternative causes or explanations
		Proficient	162 – 172	…**has demonstrated the ability to:** • make inferential connections • follow the logic of an argument • understand logical relationships between assertions/arguments and supporting information • identify implicit assumptions and evidence that supports or undermines a claim • distinguish causation from correlation
	Need Improvement	Developing	150 – 161	**…may:** • make inferential connections between two explicitly related points • follow the logic of an explicitly structured argument • mistake evidence that is broadly related to a topic for evidence that is relevant to a specific assertion • identify evidence that directly supports or undermines a claim • have difficulty distinguishing causation from correlation
Analytic scaled subscore	n/a	n/a	1 – 10	Varies
Synthetic scaled subscore	n/a	n/a	1 – 10	Varies

Note. Although the H-CT documentation describes the Advanced and Proficient proficiency levels, SU will only evaluate whether students are proficient or not and the "SU Proficiency Level" information details that difference.

Criterion and construct validity were supported based upon performance differences between freshmen and seniors at higher education institutions, while controlling for SAT/ACT scores, where seniors scored significantly greater than freshmen on average (Liu *et al*. 2016). Also, the SAT/ACT scores were correlated with the overall H-CT score.

Based on all SU H-CT student scores in fall 2017, criterion and construct validity were also supported because students' overall scaled score on this instrument had moderate positive correlations with the SU students' related measures of SAT Verbal score range categories, $r = .429$ ($p < .01$), and SAT Math score range categories, $r = .403$ ($p < .01$). Similarly, the students' Analytic scaled subscore on this instrument had moderate positive correlations with the SU students' related measures of SAT Verbal score range categories, $r = .346$ ($p < .01$), and SAT Math score range categories, $r = .318$ ($p < .01$). Also, the students' Synthetic scaled subscore on this instrument had moderate positive correlations with the SU students' related measures of SAT Verbal score range categories, $r = .376$ ($p < .01$), and SAT Math score range categories, $r = .360$ ($p < .01$). The SAT score range categories were from 1 - 4 where: 1 = < 500; 2 = 500-599; 3 = 600-699; and 4 =700-800). Correlation coefficients ≥ .3 but less than .5 are evidence of medium effect sizes and those ≥ .5 are evidence of large effect sizes (Field 2013).

SU Student Scores on the H-CT

On average, the students who participated in the freshman cohort (n = 138) had an overall scaled score of 160.3 (SD = 5.5) with a range of 150 to 175 on the H-CT instrument (Table 11). For the Analytic skill, the average scaled subscore of participants was 3.6 (SD = 2.0) with a range of 1 to 10. For the Synthetic skill, the average scaled subscore of participants was 3.5 (SD = 1.7) with a range of 1 to 9.

On average, the students who participated in the junior Business majors cohort (n = 87) had an overall scaled score of 161.0 (SD = 6.2) with a range of 150 to 177 on the H-CT instrument (Table 11). For the Analytic skill, the average scaled subscore of participants was 3.8 (SD = 2.2) with a range of 1 to 9. For the Synthetic skill, the average scaled subscore of participants was 3.8 (SD = 1.9) with a range of 1 to 8.

The possible overall scaled score range is 150 – 180 and the possible scaled subscores ranges are 1 – 10 (Table 10). The SU average overall scaled scores are less than that of the comparison group, 163.3 (SD = 7.1), which comprises 16,224 undergraduate students of different class levels across 66 Higher Education institutions (either 2-year or 4-year institutions). Also, the H-CT proficiency levels (Table 10) indicate that improvement is needed since the SU average overall scaled scores of 160.3 (freshman cohort) and 161.0 (junior Business majors cohort) are less than 162, which is the benchmark cut-off for proficiency. Individual analyses indicate that 62.3% of the freshman cohort (n = 138) and 51.7% of the junior Business majors cohort (n = 87) have overall scaled scores less than 162 and therefore need improvement. Similarly, both cohorts' average Analytic scaled and Synthetic scaled subscores, ranging from 3.5 to 3.8, are less than as those of the comparison group, 4.4 and 4.5, respectively (Table 11).

Table 11. SU (white columns) and Comparison Group (gray columns) Students' Proficiency Levels on the Scores/Subscores of the H-CT, by Cohort

Score/ subscore	**Comparison Group** (n = 16,224)			**Freshman Cohort** (n = 138)			**Junior Business Majors Cohort** (n = 87)		
	Avg (SD) *SU Proficiency Level*	**Percent of Students**		**Avg (SD) *SU Proficiency Level***	**Percent of Students**		**Avg (SD) *SU Proficiency Level***	**Percent of Students**	
		Proficient	**Need Improvement**		**Proficient**	**Need Improvement**		**Proficient**	**Need Improvement**
Overall scaled score	163.3 (7.1) *Proficient*	58%	42%	160.3 (5.5) *Need Improvement*	37.7%	62.3%	161.0 (6.2) *Need Improvement*	48.3%	51.7%
Analytic scaled subscore	4.4 (2.3) *n/a*	n/a	n/a	3.6 (2.0) *n/a*	n/a	n/a	3.8 (2.2) *n/a*	n/a	n/a
Synthetic scaled subscore	4.5 (2.3) *n/a*	n/a	n/a	3.5 (1.7) *n/a*	n/a	n/a	3.8 (1.9) *n/a*	n/a	n/a

Notes. The comparison group data (gray) is based on the HEIghten Outcomes Assessment Suite Guide to Score Interpretation (2020). SU proficiency levels are: Proficient = students with scores ranging from 162 – 180; Need Improvement = students with scores ranging from 150 – 161 (see Table 10 for more details). Highlighted values denote where the SU fall 2017 scaled score or subscore averages were less than those of the comparison group.

Statistical analyses to compare the H-CT scaled scores and subscores by SU Student Admit type could not be performed as there were fewer than 30 students in the transfer group in both cohorts (Table 12). In the freshman cohort, there were only two students who were admitted as transfers, so these data are hidden to protect those students. While statistical analyses of the junior Business majors cohort were also not performed because there were fewer than 30 students in the transfer group, a cautious comparison can be made since the sample size (n = 27) was close to the minimum requirement of 30 students. Transfer students in the junior Business majors cohort had a slightly lower H-CT overall scaled score average (as compared to the native, first time students), although percentages of proficient students were nearly the same between the two groups. Otherwise, transfer students had a greater Analytic scaled subscore (-.1 difference), but a lower Synthetic scaled subscore (.4 difference) as compared to native, first time students (Appendix 4 - Table 1).

Table 12. Student Admit Type, to SU, Average Overall Scaled Scores on the H-CT, by Cohort

SU Admit Type (code)	**Freshman Cohort**					**Junior Business Majors Cohort**				
	n	**Score**	**SD**	**Percent of Students**		**n**	**Score**	**SD**	**Percent of Students**	
				Proficient	**Need Improvement**				**Proficient**	**Need Improvement**
First Time Student (F)	136	160.3	5.6	37.5%	62.5%	60	161.3	6.0	48.3%	51.7%
Transfer (T + U)	2	-	-	-	-	27	160.5	6.7	48.1%	51.9%

Notes. Data with sample sizes (n) fewer than 10 are hidden to protect those students. Results from sample sizes fewer than 30 should be interpreted with caution.

Statistical analyses to compare the H-CT scaled scores and subscores by students' class level (e.g., freshmen, senior) could not be performed because of the limitations due to the designs of the targeted students in the previously mentioned longitudinal study sampling.

Student performance by SU School is listed in Table 13. Although analyses comparing the H-CT scaled scores and subscores by students' School enrollment were performed for the freshman cohort, they

were not performed for the junior Business majors cohort. This is because, by definition, the students in this latter cohort include only juniors that have a Business major (Perdue) as either their reported primary or secondary major.

School groups with fewer than 30 students in the freshman cohort (Fulton, Seidel, undeclared students) were excluded from the statistical analysis. An independent samples T test was used to identify whether the Henson and Perdue Schools' average scores were significantly different. The difference, 2.4, 95% CI [-.101, 4.971] was not significant [t(77) = 1.912, p > .05]. Similarly, the independent T test results for the H-CT scaled subscores in the freshman cohort indicated that the Henson and Perdue Schools' average scores were not significantly different [Analytic scaled subscore difference = .8, 95% CI [-.079, 1.700], t(77) = 1.814, p > .05; Synthetic scaled subscore difference = -.67, 95% CI [-.139, 1.482], t(77) = 1.649, p > .05; Appendix 4 - Table 2).

Table 13. Student School Enrollment Average Overall Scaled Scores on the H-CT, by Cohort

School	Freshman Cohort					Junior Business Majors Cohort				
	n	Score	SD	Percent of Students		n	Score	SD	Percent of Students	
				Proficient	Need Improvement				Proficient	Need Improvement
Fulton	26	161.3	6.1	46.2%	53.8%	0	n/a	n/a	n/a	n/a
Henson	49	161.7	5.7	53.1%	46.9%	0	n/a	n/a	n/a	n/a
Perdue	30	159.3	5.1	23.3%	76.7%	87	161.0	6.2	48.3%	51.7%
Seidel	20	158.0	4.3	20.0%	80.0%	0	n/a	n/a	n/a	n/a
Undeclared	13	158.5	4.8	23.1%	76.9%	0	n/a	n/a	n/a	n/a

Notes. Students in the freshman cohort are summarized by reported primary major only (so none are counted more than once and since second majors are not common). For this cohort, there were fewer than 30 students in certain groups (Fulton, Seidel, Undeclared), therefore, those students were removed prior to the independent samples T test analysis. Results from sample sizes fewer than 30 should be interpreted with caution. However, by definition, the students in the junior Business majors cohort include any juniors that have a Business major (Perdue) as either their reported primary or secondary major. Therefore, that cohort's analysis was not performed since there was only one group (Perdue).

Although not presented here, student performance by primary major is available upon request to programs or Departments when at least 30 students in that major participated in this instrument's administration. These data can be used for informal review and improvement efforts, or for more formal program review and improvement efforts such as Academic Program Review required reporting related to assessment of program student learning outcomes aligned with this instrument, when applicable.

H-CT and SuccessNavigator Student Scores

Some of the H-CT test-takers, those in the longitudinal study sessions, also took the SuccessNavigator with quality data (freshman cohort: n = 121; junior Business majors cohort: n = 80; Table 14). The reliability and validity of the instrument were examined by Markle *et al*. (2013). SuccessNavigator is an instrument which includes 94 Likert-style items (6-point, strongly disagree to strongly agree) that align with 4 skills and 10 subskills (Table 14; Appendix 3; Markle *et al*. 2013). The skill and subskill scores are standardized and scaled to a mean of 100 and a standard deviation of 15. For each score, the qualitative categories' ranges are based on the ETS benchmark sample population where: Low = the bottom 25 percent; Moderate = middle 50 percent; and High = top 25 percent.

In general, students' SuccessNavigator skill and subskill scores are indicative of the Moderate category. These indicate that, on average, there is not a high need for interventions or that the students are not at high risk for attrition from the institution. Furthermore, the correlation analyses of the SuccessNavigator skills and subskills with the H-CT overall scaled score as well as the two scaled subscores indicated that there were significant correlations for the freshman cohort and junior Business majors cohort (Table 14).

The freshman cohort's H-CT overall scaled score had statistically significant small negative correlations with the *Connectedness* subskill score (r = -.196, p < .05). The H-CT Synthetic scaled subscore for the freshmen cohort also had a statistically significant small positive correlation with the *Test Anxiety* subskill score (r = .188, p < .05). The *Test Anxiety* subskill score is reverse-scored so that higher scores refer to lower test anxiety. These correlation results indicate a small inverse relationship with the freshman cohort's H-CT overall scaled score and their skills related to connectedness. However, they also indicate that students' critical thinking abilities are positively correlated with their reactions to academic and daily stress (Appendix 3). Specifically, students with higher H-CT Synthetic scaled subscores also have lower *Test Anxiety*, as compared to the students with lower H-CT Synthetic scaled subscores.

The junior Business majors cohort's H-CT overall scaled score had statistically significant small negative correlations with the *Academic Skills* score (r = -.241, p < .05) and the *Institutional Support* subskill score (r = .226, p < .05), although for the latter, the BCa 95% CI [-.437, .003] cross zero and, therefore, indicate an unclear relationship (Table 14). The junior Business majors cohort's H-CT Analytic subscore had similar results, with a small negative correlation with the *Academic Skills* score (r = -.229, p < .05) as well as the *Social Support* skill score (r = -.241, p < .05) and its subskill scores: the *Connectedness* subskill score (r = .-221, p < .05) and the *Institutional Support* subskill score (r = -.290, p < .01). Although the *Connectedness* subskill correlation is also unclear because the BCa 95% CI [-.458, .029] again crosses zero. These correlation results indicate some evidence that students with higher H-CT overall scaled scores and Analytic scaled subscores have a small inverse relationship between their critical thinking skills and their academic skills and social support.

Table 14. SuccessNavigator Skill (darker rows) and Subskill (lighter rows) Average Scores for the Students who also Participated in the H-CT, by Cohort

SKILL/Subskill Name	Freshman Cohort (n = 121)					Junior Business Majors Cohort (n = 80)				
	Score	SD	H-CT Correlations (*r*)			Score	SD	H-CT Correlations (*r*)		
			Overall	Analytic	Synthetic			Overall	Analytic	Synthetic
ACADEMIC SKILLS	108.1	13.7				104.7	16.0	-.241*	-.229*	
Organization	107.3	15.4				104.1	18.2			
Meeting Class Expectations	106.9	13.2				104.1	13.2			
COMMITMENT	106.7	11.7				101.2	14.9			
Commitment to College Goals	105.4	10.4				99.1	15.0			
Institutional Commitment	106.0	14.4				102.4	17.6			
SELF-MANAGEMENT	81.6	17.1				91.3	18.5			
Sensitivity to Stress[Rev]	96.9	155				104.3	16.3			
Academic Self-Efficacy	103.3	13.0				103.5	14.6			
Test Anxiety[Rev]	92.5	12.4			.188*	98.7	12.8			
SOCIAL SUPPORT	106.7	14.0				106.1	14.3		-.241*	
Connectedness	102.4	16.7	-.196*			102.3	17.6		-.221*‡	
Institutional Support	102.1	14.3				102.6	15.9	-.226*‡	-.290**	
Barriers to Success[Rev]	111.2	14.0				109.2	14.2			

Notes. "Rev" denotes subskills that are reverse-scored, where higher scores for these subskills represent positive probabilities to success and lower instances of stress sensitivity, test anxiety, or barriers to success. Similarly, higher values in the other skill/subskill scores represent positive probabilities to success. The effect sizes (*r*) of the correlations between the H-CT score and subscores and the SuccessNavigator skills and subskills have significance indicated by an asterisk (*), $p \leq .05$; two (**), $p \leq .01$; or three (***), $p \leq .001$. The symbol ǂ denotes when a significant correlation exists, but the lower and upper Bias corrected and accelerated bootstrap (BCa) 95% Confidence Intervals (CIs) cross zero, indicating that it is unclear if there is a positive relationship, a negative relationship, or no relationship at all. Non-significant correlation values ($p > .05$) are not shown.

Discussion

Based on the results presented here it seems that there is room for improvement in the Critical Thinking & Reasoning student learning outcome at SU. Several action items are suggested below towards this end.

1. To determine whether our students are meeting SU expectations for Critical Thinking & Reasoning, the benchmarks with which SU students' Critical Thinking & Reasoning are compared should be evaluated by objective faculty and/or staff with expertise in the discipline or assessment of it. For example, what percentage of students do we expect to be proficient?
2. Perform an area/course mapping of the current SU courses that align with the revised Critical Thinking & Reasoning student learning outcome.
3. Based on discussions and decisions related to Action Items #1-2, relevant parties such as faculty teaching courses aligned with this student learning outcome and the General Education Steering Committee should consider whether the H-CT instrument is aligned well with the revised (as of November 2018) SU General Education Critical Thinking & Reasoning student learning outcome. If it is not aligned, then an alternative assessment that is aligned should be identified.

4. Relevant stakeholders at SU should consider the results from the H-CT assessment to develop interventions or review and update curricula to align with areas that need improvement. In particular, and possibly in conjunction with Action Item #2, these data can be re-evaluated to help identify particular courses that students with high H-CT score/subscores have completed at SU to investigate potentially successful Critical Thinking & Reasoning-related interventions on campus. Successful projects at other institutions may be considered to guide instructional interventions at SU.
5. Relevant stakeholders at SU should request further analyses of the H-CT data to address additional questions of interest that were not described here (e.g., potential analyses for particular courses or programs).
6. Based on discussions and decisions related to Action Items #1-5, a timeline for re-assessment of the SU General Education Critical Thinking & Reasoning student learning outcome should be finalized. At this time, in addition to being re-assessed as part of the ETS "Longitudinal Study of Student Learning Outcomes in Multiple Dimensions" in at least fall 2018 and fall 2019, the H-CT is planned to be re-assessed in fall 2022, and every three years after. This will allow an analysis of whether there is change in student learning outcomes based upon either a change in assessment or instructional or curricular interventions.
7. UARA will continue to collaborate with ETS on the "Longitudinal Study of Student Learning Outcomes in Multiple Dimensions" and share any subsequent findings, updates, or reports with stakeholders at SU.

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Salisbury University H-CT Reporting Documentation

The following related reporting documentation can be found at the General Education Outcome Assessment Report website:

1. Fall 2017 Critical Thinking & Reasoning ONESHEET
2. Fall 2018 Critical Thinking & Reasoning Assessment Report
3. Fall 2018 Critical Thinking & Reasoning ONESHEET
4. Fall 2019 Critical Thinking & Reasoning Assessment Report
5. Fall 2019 Critical Thinking & Reasoning ONESHEET

Appendices

Appendix 1. ETS HEIghten Critical Thinking Sample Items

Note: These following sample items and answer key are for reference only and are originally from the ETS HEIghten Critical Thinking Sample Items document (2020). They provide examples of skills measured, contexts covered and the difficulty of the questions.

Questions 1 - 2 are based on the material below.

1. Records indicate that William Shakespeare was baptized on April 26, 1564, and buried April 25, 1616, in Stratford-upon-Avon, England.
2. There is no evidence that William Shakespeare attended school, but had he done so, it would have been the local grammar school, and he would have left by age 14.
3. Documents show that by the early 1590s William Shakespeare was a managing partner of the Lord Chamberlain's Men, an acting company in London that built the Globe Theatre.
4. A total of 37 plays list Shakespeare as the author, including 13 that are set in Italy and several that make references to London politics.
5. There is no evidence that Shakespeare traveled outside of England.
6. In writings by others during Shakespeare's lifetime, Shakespeare was often referred to as a writer.
7. There is no manuscript of any play in William Shakespeare's own handwriting; only print versions of his plays exist.
8. No one questioned Shakespeare's authorship of the plays attributed to him during his lifetime or for centuries after his death.
9. Christopher Marlowe (1564–1593) was a brilliant poet and dramatist, educated at Cambridge University, who pioneered blank verse (unrhymed lines, almost always in the pattern of stressed syllables called "iambic pentameter") for dramatic plays.
10. Blank verse praised for its beauty appears frequently in the works attributed to Shakespeare.
11. Edward de Vere, 17th Earl of Oxford (1550–1604), whose aristocratic crest of arms depicted a lion shaking a spear, was trained in law, was a court poet, and visited Italy extensively.

Argument 1: (an abstract of an academic paper in a literary journal)

Abstract: "William Shakespeare of Stratford Could Not Have Written the So-called Shakespearean Plays"

We all know that there was a real person named William Shakespeare, who was born in Stratford in 1564, the son of a middle-class glove-maker, and who died in 1616. He was also a well-known actor and managing partner of an acting company in London in the 1590s. Beyond that, there is not a shred of evidence linking him to the 37 plays ascribed to him. How could an uneducated actor from Stratford have such intimate knowledge of court politics, legal matters, royalty, and Italy (the

setting of 13 plays including *Othello, Merchant of Venice*, and *All's Well That Ends Well*)? Clearly, the plays reflect a sophisticated intellect, a familiarity with London politics, and a deep understanding of Latin and Greek literature—all improbable for a mere actor who grew up in Stratford and who had at best a grammar-school education. Either Edward de Vere (who is known to have visited Italy and was a court favorite) or Christopher Marlowe (who was college educated and the pioneer of blank verse for dramatic plays) was the real author of these brilliant and nuanced plays.

Argument 2: The argument below is a rebuttal in the form of a letter to the editor, published in a subsequent issue of the journal that published Argument 1 above.

It is ludicrous to question Shakespeare's authorship of the plays. The argument presented in this journal smacks of elitism. Other arguments for that position rely on conspiracy theory and convoluted logic. There is a historical record of such a man who was connected to London theater and whose name was given as the author of the plays. No one questioned Shakespeare's authorship until hundreds of years after his death. Those who put forward names of the "real" author—over 60 such names have been suggested—have their own agendas, including the elitism already mentioned, or a preference for a particular alternative author. Circumstantial evidence or outrageous ideas such as that Marlowe faked his own death in 1593 and authored some of the plays afterward, or that the real author, for whatever reasons, wanted to keep his own identity hidden, are flimsy and do not hold up under serious scrutiny.

1. Given the information in the facts list, someone wishing to establish that Marlowe is most likely the author of the plays attributed to Shakespeare would be aided in that task if which of the following were found and determined to be authentic? Select <u>all</u> that apply.

□ 1. Comparisons of Marlowe's plays with Shakespeare's plays that show strong linguistic parallels and similar range of vocabulary
□ 2. Journal entries in Marlowe's handwriting that note plot elements of a Shakespearean play prior to its being performed
□ 3. Historical events that continue into the 1600s and parallel key plot elements in the plays

2. From the following facts excerpted from the list, select the <u>two</u> that <u>together</u> most help to support a claim central to Argument 1.

□ 2. There is no evidence that William Shakespeare attended school, but had he done so, it would have been the local grammar school, and he would have left by age 14.
□ 4. A total of 37 plays list Shakespeare as the author, including 13 that are set in Italy and several that make references to London politics.
□ 5. There is no evidence that Shakespeare traveled outside of England.
□ 7. There is no manuscript of any play in William Shakespeare's own handwriting; only print versions of his plays exist.
□ 9. Christopher Marlowe (1564–1593) was a brilliant poet and dramatist, educated at Cambridge University, who pioneered blank verse (unrhymed lines, almost always in the pattern of stressed syllables called "iambic pentameter") for dramatic plays.

3. The following is an exchange between two contributors to an online literary forum.

Kate: Ursula Seti's undated poem "Eucalyptus," which compares the eucalyptus tree's periodic shedding of its bark to various momentous events in her own life, could not have been written before 1960. Before that date, Seti had never left her native Alaska, where it is far too cold for most species of eucalyptus trees to grow. In 1960, however, she visited Australia, where eucalyptus trees are very common, so the poem must have been written during or after that visit.

Miriam: But Seti could certainly have known that eucalyptus trees periodically shed their bark without having personally observed that process, so she could have written the poem at any time during her career, which began well before 1960.

Which of the following most accurately characterizes Miriam's response to Kate?

(A) It shows that Kate's argument assumes the very point that it attempts to demonstrate.
(B) It draws an opposing conclusion from the evidence cited in Kate's argument.
(C) It refutes Kate's argument by rejecting one of its unstated assumptions.
(D) It calls into question one of the statements Kate makes to support her conclusion.

4. In Longport, a survey of residents showed that more of them had taken continuing education classes in literature than in the arts over the last twelve months. If so, some residents must have taken multiple arts classes, because an examination of enrollment figures showed that overall enrollment in continuing education arts classes was higher than overall enrollment in continuing education literature classes.

The reasoning in the passage depends on assuming which of the following?

(A) There was no substantial enrollment in arts classes by people who were not residents of Longport.
(B) There were no more literature classes than arts classes.
(C) Few, if any, residents took both an arts class and a literature class in the last twelve months.
(D) Most Longport residents took at least one arts class in the last twelve months.

Questions 5 - 6 are based on the information below.

In a benefit concert, seven solo performers—Harris, Jones, McIntyre, Nelson, Strapp, Trevino, and Williams—will each sing once only and one after another. The order in which the performers will sing is governed by the following conditions:

Harris must sing at some time before McIntyre sings.
Strapp must sing at some time before Jones sings.
Trevino must sing either immediately before or immediately after Nelson sings.
Williams must sing third.

5. If McIntyre is to sing immediately before Strapp sings, Trevino can sing
    (A) second
    (B) fourth
    (C) sixth
    (D) seventh

6. If McIntyre is to sing fourth, which of the following must be true?
    (A) Harris sings at some time before Strapp sings.
    (B) Jones sings at some time before Trevino sings.
    (C) Nelson sings at some time before McIntyre sings.
    (D) Strapp sings at some time before Williams sings.

Answer Key
1) 1, 2
2) 4, 5
3) C
4) A
5) A
6) D

Appendix 2. Information about Additional Assessments in the Longitudinal Study of Student Learning Outcomes in Multiple Dimensions: SuccessNavigator and the Major Field Test in Business

SuccessNavigator

- *Note: SuccessNavigator has been discontinued for institutional purchase as of September 2019 and the ETS website resources dedicated to it were removed in October 2020.*
- For information regarding the development and utility of the instrument, please see the related references above (i.e., Markle *et al*. 2013 for the former and Rikoon *et al*. 2014 as well as Rikoon & MidKiff 2018 for the latter)
- See more details regarding the instrument in Appendix 3

ETS Major Field Test for the Bachelor's Degree in Business (MFT-B)

- General Information about the ETS Major Field Tests (MFT):
  - About the MFT: https://www.ets.org/mft/about/
  - Design of the MFT: https://www.ets.org/mft/about/test_design/
  - MFT Research: https://www.ets.org/mft/about/research/
  - MFT FAQs: https://www.ets.org/mft/faq/
- Specific Information about the MFT-B:
  - About the MFT-B: https://www.ets.org/mft/about/content/bachelor_business - including the details that the assessment, "contains 120 multiple-choice questions designed to measure a student's subject knowledge and the ability to apply facts, concepts, theories and analytical methods. Some questions are grouped in sets and based on diagrams, charts and data tables. The questions represent a wide range of difficulty and cover depth and breadth in assessing students' achievement levels."
  - MFT-B Test Description document: https://www.ets.org/s/mft/pdf/mft_testdesc_business.pdf
  - MFT-B Sample Questions document: https://www.ets.org/s/mft/pdf/mft_samp_questions_business.pdf
  - 9 MFT-B Assessment Indicators (aka discipline-specific subscales) from the Departmental Summary of Assessment Indicators Sample Report document (https://www.ets.org/Media/Tests/MFT/pdf/MFT_sample_reports_2007/BusinessAISummary.pdf):
    1. Accounting
    2. Economics
    3. Management
    4. Quantitative Business Analysis
    5. Finance
    6. Marketing
    7. Legal and Social Environment
    8. Information Systems
    9. International Issues

Appendix 3. SuccessNavigator Construct Map and Question Details (modified from: Appendix from Markle et al. 2013 and Table 1 and Table 2 from Rikoon & Midkiff 2018)

Skill	Skill Definition	Subskill	Subskill Definition	Questions/ Subskill	Example Questions
Academic Skills	Tools and strategies for academic success	Organization	Strategies for organizing work and time	9	• I write a daily to-do list. • I use a calendar to plan my school day.
		Meeting Class Expectations	Doing what's expected to meet the requirements of courses including assignments and in-class behaviors	10	• I am on time for class. • I complete my assignments on time.
Commitment	Active pursuit toward an academic goal	Commitment to College Goals	Perceived value and determination to succeed in and complete college	10	• One of my life goals is to graduate college. • The benefit of a college education outweighs the cost.
		Institutional Commitment	Attachment to and positive evaluations of the school	8	• This is the right school for me. • I'm proud to say I attend this school.
Self-Management	Reactions to academic and daily stress	Sensitivity to Stress[Rev]	Tendency to feel frustrated, discouraged or upset when under pressure or burdened by demands	10	• I get stressed out easily when things don't go my way. • I am easily frustrated.
		Academic Self-Efficacy	Belief in one's ability to perform and achieve in an academic setting	9	• I'm confident that I will succeed in my courses this semester. • I can do well on tests if I apply myself.
		Test Anxiety[Rev]	General reactions to test-taking experiences, including negative thoughts and feelings (e.g., worry, dread)	9	• When I take a test, I think about what happens if I don't do well. • The night before a test, I feel troubled.
Social Support	Connecting with people and student resources for success	Connectedness	A general sense of belonging and engagement	7	• I feel connected to my peers. • People understand me.
		Institutional Support	Attitudes about and tendency to seek help from established resources	11	• If I don't understand something in class, I ask the instructor for help. • I know how to find out what's expected of me in classes.
		Barriers to Success[Rev]	Financial pressures, family responsibilities, conflicting work schedules, and limited institutional knowledge	11	• Family pressures make it hard for me to commit to school. • People support me going to college.

Notes. "Rev" denotes subskills that are reverse-scored. Higher scores for these subskills represent positive probabilities to success and lower instances of stress sensitivity, test anxiety, or barriers to success (e.g., the *Test Anxiety* and *Sensitivity to Stress* subskill scores are reverse-scored so that higher scores refer to lower test anxiety and stress responses, respectively).

Appendix 4: Additional H-CT scaled subscore results by demographic groups

Appendix 4 - Table 1. Student Admit Type, to SU, Average Scaled Subscores on the H-CT, by Cohort

SU Admit Type (code)	**Scaled Subscore**	**Freshman Cohort**			**Junior Business Majors Cohort**		
		n	**Score**	**SD**	**n**	**Score**	**SD**
First Time Student (F)	Analytic	136	3.6	2.0	60	3.8	2.2
	Synthetic		3.5	1.7		3.9	1.8
Transfer (T + U)	Analytic	2	-	-	27	3.9	2.3
	Synthetic		-	-		3.5	2.1

Notes. Data with sample sizes (n) fewer than 10 are hidden to protect those students. Results from sample sizes fewer than 30 should be interpreted with caution.

Appendix 4 - Table 2. Student School Enrollment Average Scaled Subscores on the H-CT (Freshman Cohort)

Scaled Subscore	**School**; sample size									
	Fulton; n = 26		**Henson**; n = 49		**Perdue**; n = 30		**Seidel**; n = 20		**Undeclared**; n = 13	
	Score	**SD**	**Score**	**SD**	**Score**	**SD**	**Score**	**SD**	**Score**	**SD**
Analytic	4.1	2.2	4.0	1.9	3.2	2.0	2.8	1.4	3.6	2.1
Synthetic	3.7	1.8	4.0	1.9	3.3	1.4	3.1	1.6	2.7	1.2

Notes. Students in the freshman cohort are summarized by reported primary major only (so none are counted more than once and since second majors are not common). For this cohort, there were fewer than 30 students in certain groups (Fulton, Seidel, Undeclared), therefore, those students were removed prior to the independent samples T test analysis. Results from sample sizes fewer than 30 should be interpreted with caution. However, by definition, the students in the junior Business majors cohort include any juniors that have a Business major (Perdue) as either their reported primary or secondary major. Therefore, that cohort's analysis was not performed since there was only one group (Perdue), but see Table 11 for the junior Business majors cohort's H-CT scores.