Critical Thinking (Synthesis and Capstone)

Description and Learning Outcomes

Synthesis Courses

The purpose of the Synthesis course is to provide students with the opportunity to synthesize the knowledge, skills and values gained from the Mason Core curriculum. Synthesis courses strive to expand students' ability to master new content, think critically, and develop life-long learning skills across the disciplines. While it is not feasible to design courses that cover "all" areas of general education, synthesis courses should function as a careful alignment of disciplinary goals with a range of Mason Core learning outcomes.

A Mason Core Synthesis course must address outcomes 1 and 2, and at least one outcome under 3. Upon completing a Synthesis course, students will be able to:

1. Communicate effectively in both oral and written forms, applying appropriate rhetorical standards (e.g., audience adaptation, language, argument, organization, evidence, etc.)

2. Using perspectives from two or more disciplines, connect issues in a given field to wider intellectual, community or societal concerns

3. Apply critical thinking skills to:

    1. Evaluate the quality, credibility and limitations of an argument or a solution using appropriate evidence or resources, OR,

    2. Judge the quality or value of an idea, work, or principle based on appropriate analytics and standards

Capstone Courses

The purpose of the Capstone course or sequence of courses is to provide a high impact, culminating element of an undergraduate education, to help students develop a more comprehensive and integrative understanding of their area of study and to utilize critical thinking skills. Capstone courses provide students opportunities to apply and demonstrate their knowledge and generally involve integrative/applied/experiential projects. Student learning in a Capstone course is assessed using a set of identified learning outcomes, and for critical thinking, as defined by the Association of American Colleges & Universities (AAC&U).

While each academic degree program defines its own learning outcomes, a Capstone course or sequence should follow these guidelines:

- Minimum of 3 credits

- Later in the curriculum, after a student has taken at least 85 credits, and at the 400-course level
- No more than 35 students in the course or equivalent instructional/mentored support
- Emphasis on experiential/applied/integrative learning
- Allow students to apply critical thinking skills
- Learning outcomes defined by the degree program

Approved Courses and Enrollment

The Capstone was introduced as a Mason Core category in AY2017. Academic units were encouraged to designate appropriate courses for the Capstone using guidance provided by the Mason Core Committee. Students are required to pass either a Synthesis or Capstone course; students enroll in the approved Capstone course for their major. Courses that were approved as Synthesis or Capstone during the assessment period are listed on page 37.

Synthesis courses now enroll over 5,200 students each year with an average class size that ranges from 19 to 30 and varies by school and college (see Table 4). Figure 11 on shows enrollment trends over the past three years by college and school.

Capstone courses now enroll over 3,500 students each year with an average class size that varies by school and college (see Table 5). One-quarter of Capstone courses share a designation with Synthesis. Figure 12 shows enrollment trends over the past three years by college and school.

Courses Included in Assessment

Synthesis and Capstone courses were chosen for the critical thinking assessment because they share critical thinking as a key learning outcome. These courses are also taught across nearly all of the undergraduate majors, providing for a representative sample of upper-division student work. All Synthesis courses are identified as lecture or seminar courses. Capstone courses are taught as lecture or seminar (69%), internship (21%), or studio (10%).
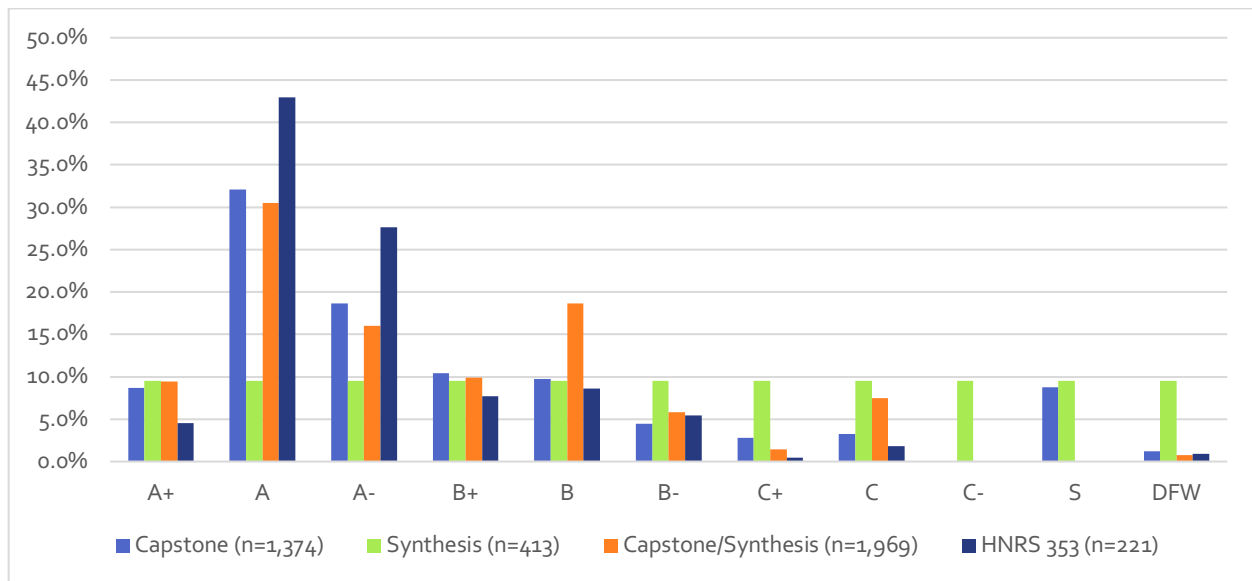
The assessment period included all but 30 sections of the 80 Synthesis and Capstone courses taught in spring 2018, and ten sections of Honors 353 in spring 2019. All courses that were offered in the assessment period were expected to participate, with some exceptions: BUS 498 was excluded because the program contributed data from an assessment conducted in the previous semester using the same method; and three courses were removed from the Mason Core by their departments due to curriculum changes. Of the 150 course sections included in the assessment period, 62% submitted materials.

Students in the Honors College take HNRS 353: Tech in Contemporary World to fulfill their learning outcomes in this category. Although not formally a part of the Mason Core, HNRS 353 is also included in this assessment.

Enrollment and Grades Distribution

A total of 4,004 students enrolled in courses across 53 subjects in the assessment period. Of these students, 96.7% passed their courses with a C- or above, and 86% of students earned A or B grades (see Figure 6).

Figure 6. Final Grades Distribution in the Assessment Period

Note: Grades recorded as "incomplete" were not included.

Assessment Methods

Student work samples were requested from all included course sections taught in the assessment period. Faculty were asked to submit samples that represented submissions completed in the final third part of the semester, and allowed students to demonstrate their critical thinking skills. Samples were selected using randomized course enrollment lists to insure the best possible representative sample.

It should be noted that the Capstone presents a challenge to a fully representative sample for this particular assessment. As the Capstone is meant to be the final academic experience in the major, many programs seek to prepare students for a team-based professional environment. Thus, many Capstones—especially in Business, Engineering, and Performing Arts—are designed as immersive collaborative experiences. Indeed, 36% of the work samples received for this assessment were collaborative projects. Because this assessment was designed to assess individual work, the collaborative samples were excluded. Efforts are underway to address assessment of collaborative work.

The **AAC&U Critical Thinking VALUE Rubric** was used for this assessment. The VALUE Rubric was adopted by a faculty committee in 2010, and has been used in three previous

assessments—in 2010, 2012, and 2014 (George Mason University, 2016). The VALUE rubric is a tool to assess student work on five learning tasks or outcomes (explanation of issues, evidence, influence of context and assumptions, student's position, and conclusion and related outcomes). The rubric uses four performance descriptors: Benchmark, Emerging Milestone, Advanced Milestone, and Capstone, and an option on the scoring form for "no evidence." The performance descriptors are developmental, identifying student performance levels in a context of learning and growth. The rubric is intended to be used across all of the years of a student's college experience, and is not limited to a single course, assignment, or student class level. The VALUE Rubric has been used in a national assessment (McConnell & Rhodes, 2017) of undergraduate work and allows for comparison of results to a national sample.

Using a process modeled after the VALUE Institute reviewer calibration[3], faculty reviewers were trained to use the rubric to assess student work. Reviews were normed to produce consistent ratings across reviewers. Reviewers met for an in-person, one-day training and review session and completed the reviews of student work by the end of the day. A second review was completed in August 2019 with a small set of samples that were received after the first review session. Reviewers were faculty members who have taught Synthesis and Capstone courses and represented a diversity of academic units. Reviewers earned a small stipend for their efforts.

Each student work sample was assessed twice. Results were analyzed for interrater reliability and discrepant reviews were resolved using a third review.

Learning Outcomes Assessment Results

Figures 7 and 8 display results from 500 ratings. A rating of "no evidence" was used when there was no evidence of the learning outcome; this could mean that either the assignment did not require application of the outcome, or that the student did not demonstrate it. A "no evidence" rating provides important information in aggregate but is given no value for an individual sample.

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[3] The VALUE Institute trains volunteer reviewers to read and rate student work using the VALUE rubrics. The extensive training and calibration process promotes high levels of interrater reliability for scoring.

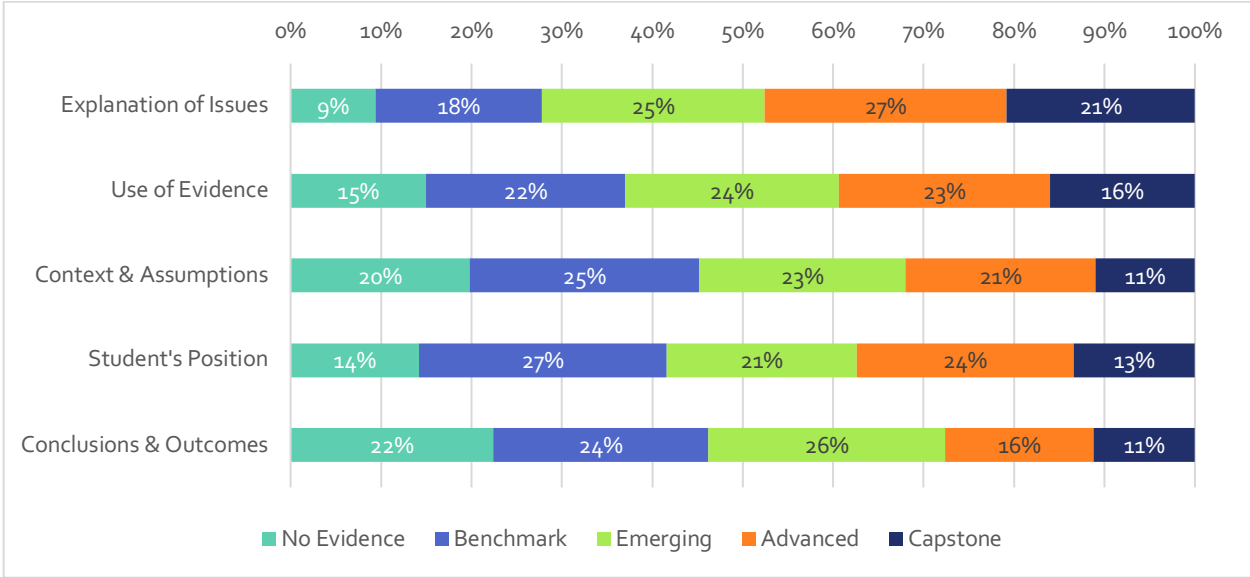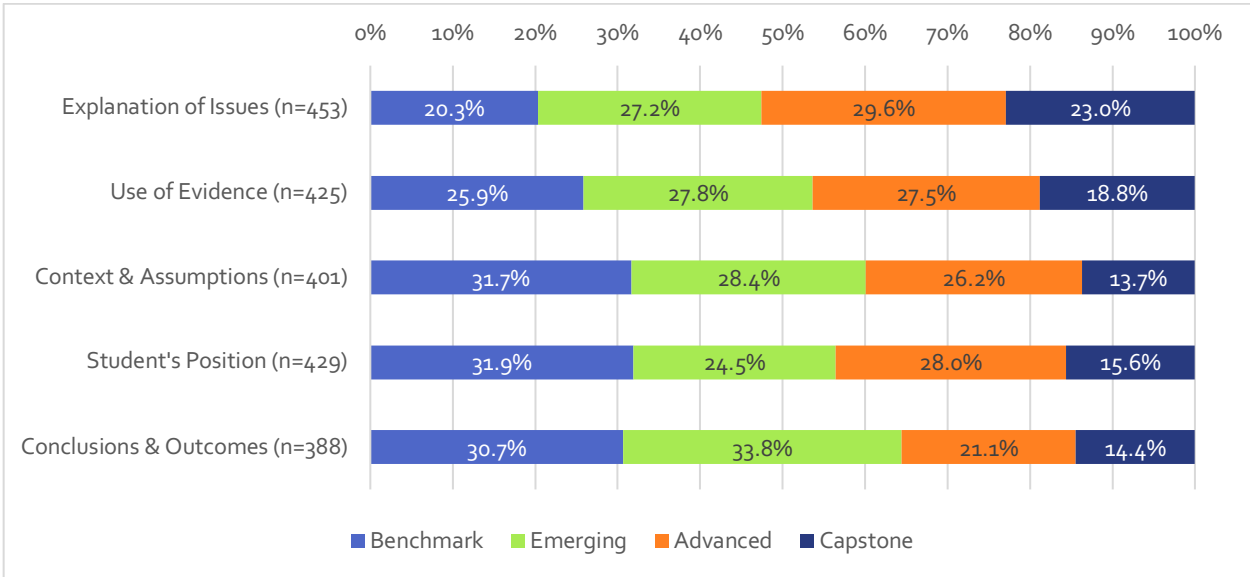*Figure 7. Assessment Results, Aggregated, including "No Evidence" Ratings*

	No Evidence	Benchmark	Emerging	Advanced	Capstone
Explanation of Issues	9%	18%	25%	27%	21%
Use of Evidence	15%	22%	24%	23%	16%
Context & Assumptions	20%	25%	23%	21%	11%
Student's Position	14%	27%	21%	24%	13%
Conclusions & Outcomes	22%	24%	26%	16%	11%

Figure 8. Assessment Results, Aggregated, excluding "No Evidence" Ratings

	Benchmark	Emerging	Advanced	Capstone
Explanation of Issues (n=453)	20.3%	27.2%	29.6%	23.0%
Use of Evidence (n=425)	25.9%	27.8%	27.5%	18.8%
Context & Assumptions (n=401)	31.7%	28.4%	26.2%	13.7%
Student's Position (n=429)	31.9%	24.5%	28.0%	15.6%
Conclusions & Outcomes (n=388)	30.7%	33.8%	21.1%	14.4%

Highlights from Analysis of Results

Results were analyzed to ascertain differences between certain demographic groups (i.e. gender and transfer status). Comparison tests were conducted using nonparametric statistics because rubric data are ordinal; Independent-Samples Mann-Whitney U, ($p <.05$) was used when analyzing differences between two groups, and Kruskal–Wallis H test was used when

analyzing differences among three or more groups. Significant findings are noted below and in tables 6-9.

- 22% of samples were rated as "no evidence" for the outcome **Conclusions & Outcomes**, meaning that students did not perform this outcome in their sample, or the assignment did not require it. While this seems like a high number, it should be noted that not all forms of scholarly writing require drawing conclusions (e.g. creative writing) (see Figure 7).

- Work samples performed highest overall on **Explanation of Issues** and **Use of Evidence** (see Figure 8).

- There were significant differences in student performance between Synthesis and Capstone courses on the first two outcomes. Capstone samples were rated higher than Synthesis samples on **Explanation of Issues** and **Use of Evidence** (see Table 6).

- Students who started at Mason as freshmen performed equally well as transfer students on all five critical thinking outcomes (see Table 7).

- Students identified as female performed significantly better than students identified as male on three outcomes: **Explanation of Issues, Use of Evidence,** and **Conclusions & Outcomes** (see Table 8).

How do Mason Students Compare?

In comparing results from a 2017 national study (McConnell & Rhodes, 2017) using samples of student work from seniors at 4-year institutions, this assessment suggests that Mason students perform somewhat better than their peers on combined ratings of Advanced + Capstone. It is instructive to note the similarity in patterns between the Mason results and the national data; while results for each outcome differ, the consistent pattern in the comparison is remarkable. Similar to Mason, national data revealed that students were most likely to show strength in **Explanation of Issues** and least likely to show strength in **Conclusions and Outcomes**. Note that this is an observational comparison; the raw data from the national study was not available to perform a statistical comparison. See Figure 9.

Figure 9. Mason Student Results Compared to National Results from 4-year Institutions
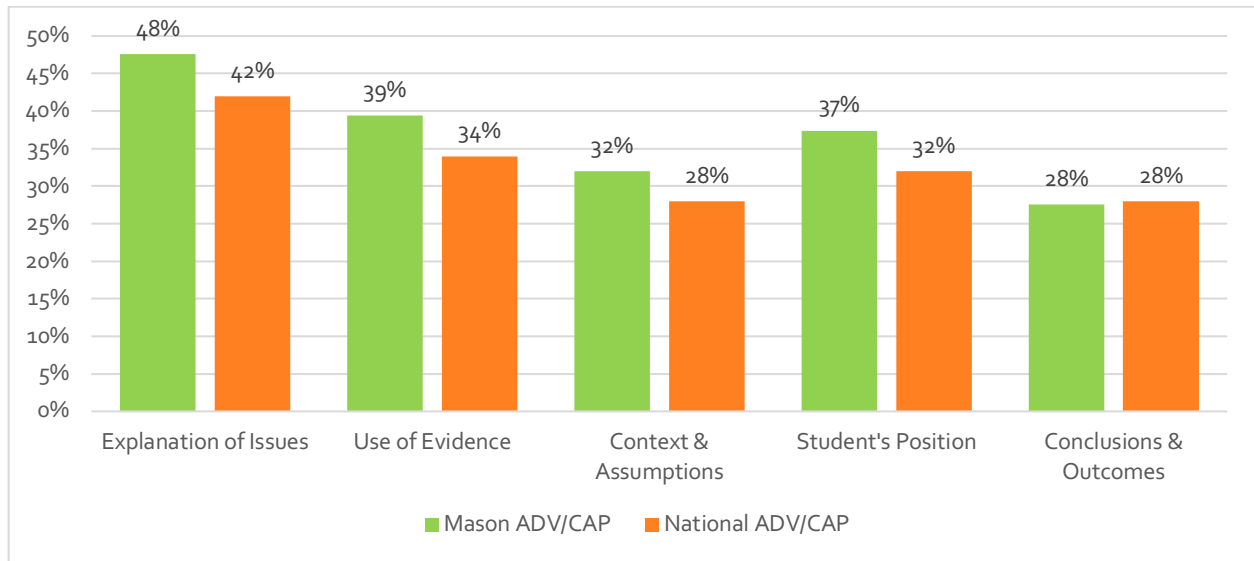
Student Self-Assessment

All students who were enrolled in a Synthesis or HNRS 353 course during the assessment period received an online retrospective pre-post self-assessment at the end of the semester. The survey asked students to rate their knowledge and skills on the five critical thinking learning outcomes at the beginning of the semester (pre), and then again at the end of the semester (post). In total, 297 students completed both the pre and post items, resulting in a 13.6% response rate. A t-test pairwise comparison showed significant perceived learning gains on all five outcomes (see Figure 10).

Figure 10. Mean Scores on Student Learning Self-Assessment for Synthesis Courses
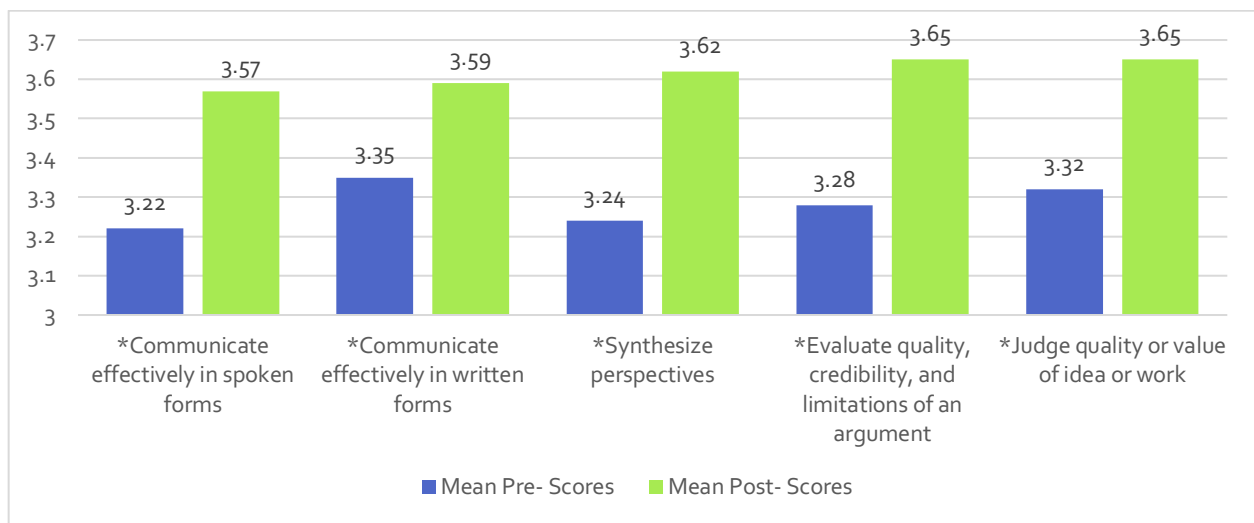
Mean scores, self-reported on a scale of 1-4, n=297, * $p < .05$

How do the Results Meet Expectations?

This is the fourth critical thinking assessment using the same method, and the only institution-wide assessment for Mason Core learning outcomes to-date that has been repeated. Thus, there is sufficient data for comparison. A Kruskal–Wallis *H* test used to analyze differences among the four assessment years (2010, 2012, 2014, and 2018) found significant differences among the years for **Explanation of Issues**, **Use of Evidence**, and **Student's Position.** It appeared that students in 2018 performed best overall (see Table 9). Further analysis revealed significant improvement in 2018 over 2010 and 2012, but not over 2014 for the three outcomes. There were no significant differences for the remaining two outcomes.

How are Results Being Used to Improve Students' Educational Experience?

A series of open meetings (including an online option) were held in fall 2018 to share results. Faculty are consistently interested in the development of critical thinking skills and what these kinds of assessments can tell us about student learning. Mason's current focus is on faculty professional development activities to improve course and assignment design. The Stearns Center for Teaching and Learning offers evidence-based programs such as the Course ReDesign Academy, faculty learning communities, and classroom observations[4] to improve instruction for student learning.

Limitations and Conclusions

It is important to note the data issues and limitations to the results contained in this report. These limitations are related to the generalizability of the evidence for students' critical thinking skills. First, scores provided in this report reflect student performance on one assignment, at one point in time. Critical thinking abilities are complex, situational, and continually developing. This report is useful in presenting a standardized assessment of student work on assignments across five domains of critical thinking; caution should be taken in interpreting these results as evidence of general or even situational critical thinking skills. Development of critical thinking skills is a process that cannot be sufficiently inferred from a single assignment.

Also, it is important to acknowledge that all of the work used in this assessment was in written form. Other modes of demonstration (i.e. oral, interpersonal) may be more illustrative of critical thinking ability, especially in particular disciplines or situations. Our reviewers often struggled with sorting out the critical thinking competency from the ability of the student to adequately express ideas through writing.

Second, assignments for each course were identified by the course instructor, so student performance was constrained by the requirements of the assignment. Many faculty members have been exposed to the rubric over the years and have had opportunity to create course

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[4] https://stearnscenter.gmu.edu/programs/stearns-center-opportunities/

assignments or activities to specifically address the learning outcomes identified in the rubric; however, they were not required to design an assignment to address the rubric. The mismatch of assignment design to student product for the assessment may not have allowed a student to demonstrate critical thinking skills on all parts of the rubric. At this point, however, the substantial size of aggregated results does allow us to see patterns in student performance. In addition, we can interpret the findings to suggest that improved instruction is necessary for certain outcomes, specifically **Context and Assumptions** and **Conclusions and Related Outcomes**.

In consideration of the data limitations, it is essential that we understand the results in context with other institutions with similar student characteristics and academic programs. The McConnell & Rhodes (2017) study allows us to identify Mason students' competencies and needs for development in comparison with other institutions. Faculty and programs can use these results to improve assignment and course design to emphasize the development of critical thinking in Synthesis and Capstone courses and throughout the curriculum. Faculty should adapt the tool to terms and processes used in their own disciplinary and interdisciplinary contexts.

Assessment Rubric(s)

AAC&U Critical Thinking VALUE Rubric is reprinted with permission from *"VALUE: Valid Assessment of Learning in Undergraduate Education."* Copyright 2019 by the Association of American Colleges and Universities. http://www.aacu.org/value/index.cfm.

Synthesis and Capstone Courses Approved for the Assessment Period

Synthesis

ANTH 400 Engaging the World: Anthropological Perspectives
ARTH 394 The Museum
AVT 385 EcoArt
AVT 497 Senior Project
AVT 498 Senior Design Project
BENG 492 Senior Advanced Design Project I
BENG 493 RS: Senior Advanced Design Project II
BINF 354 Foundations in Mathematical Biology
BIOL 301 Biology and Society
BIS 490 RS: Senior Project
CEIE 490 Senior Design Project
COMM 326 Rhetoric of Social Movements and Political Controversy
COMM 362 Argument and Public Policy
COMM 454 Free Speech and Ethics
CONF 490 RS: Integration
CONS 490 RS: Integrated Conservation Strategies
CONS 491 RS: Conservation Management Planning
CRIM 495 Capstone in Criminology, Law and Society
CS 306 Synthesis of Ethics and Law for the Computing Professional
DANC 490 Senior Dance Seminar
ECE 492 Senior Advanced Design Project I
ECE 493 RS: Senior Advanced Design Project II
ECON 309 Economic Problems and Public Policies
EDCI 490 Student Teaching in Education
EVPP 480 Sustainability in Action
FAVS 352 Ethics of Film and Video
FRLN 385 Multilingualism, Identity, and Power
GAME 490 Senior Game Design Capstone
GEOL 420 Earth Science and Policy
GGS 303 Geography of Resource Conservation

GGS 304 Population Geography
GOVT 490 Synthesis Seminar
GOVT 491 Honors Seminar
HAP 465 Integration of Professional Skills and Issues
HDFS 400 Advanced Family Processes
HIST 300 Introduction to Historical Method
HIST 499 RS: Senior Seminar in History
HNRS 353 Technology in the Contemporary World (Topic Varies)
INTS 308 American Landscapes in Fiction, Film, and History
IT 492 Senior Design Project I
LAS 499 Research Seminar in Latin American Studies
MATH 400 History of Math (Topic Varies)
NURS 465 Examination and Integration of Professional and Health Care Issues
PHIL 309 Bioethics
PHIL 343 Topics in Environmental Philosophy
PHIL 377 Darwin: Biology and Beyond
PHIL 378 Reason, Science and Faith in the Modern Age
PHIL 379 Perspectives on Time
PHYS 346 Quarks to Strings
PROV 342 The George Mason Debates in Current Affairs
PSYC 405 Mystery, Madness, and Murder
PSYC 406 Psychology of Communication
PSYC 427 Community Engagement for Social Change
RELI 490 Comparative Study of Religions
RUSS 353 Russian Civilization
SOCI 377 Art and Society
SOCI 483 The Sociology of Higher Education
SOCW 375 Human Behavior and the Family Life Course
SPAN 388 Introduction to Latina/o Studies
SYST 495 Senior Design Project II
THR 440 Advanced Studies in Directing/Dramaturgy

THR 496 Text in Production

Capstone

ARAB 351 Media Arabic II (Spoken Media)
ARAB 440 Topics in Arabic Religious Thought and Texts
ASTR 402 RS: Methods of Observational Astronomy
ATEP 441 Senior Seminar in Athletic Training
AVT 497 Senior Project
AVT 498 Senior Design Project
BAS 491 Applied Sciences Capstone
BENG 492 Senior Advanced Design Project I
BENG 493 RS: Senior Advanced Design Project II
BIOL 379 RS: Ecological Sustainability
BUS 498 Capstone Course: Advanced Business Models
CEIE 490 Senior Design Project
CHIN 318 Introduction to Classical Chinese
CHIN 355 Readings in Chinese Poetry and Poetics
CHIN 475 Chinese Popular Culture
CYSE 493 Senior Advanced Design Project II
ECE 492 Senior Advanced Design Project I
ECE 493 RS: Senior Advanced Design Project II
ENGH 401 RS: Honors Thesis Writing Seminar
ENGH 417 RS: Topics in Folklore Research
ENGH 458 RS: Topics in Literary Research
ENGH 470 RS: Topics in Film/Media History
ENGH 484 RS: Writing Ethnography
ENGH 486 RS: Writing Nonfiction for Publication
ENGH 495 Capstone and Thesis
EVPP 378 RS: Ecological Sustainability
FAVS 496 Advanced Visual Storytelling
FAVS 497 Senior Film Practicum
FAVS 499 Senior Project
GAME 490 Senior Game Design Capstone

GCH 465 Community Health Capstone
GLOA 400 Global Affairs Capstone
HAP 489 Pre-Internship Seminar
HAP 498 Health Administration Internship
IT 492 Senior Design Project I
IT 493 Senior Design Project II
KINE 490 Kinesiology Internship III
ME 444 Mechanical Design II
MUSI 324 Junior Recital
MUSI 424 Senior Recital
MUSI 490 RS: Musical Communication in Context
MUSI 491 Musical Communication in Performance
MUSI 495 Internship in Music Education
PHED 415 Student Teaching in Physical Education
PHIL 421 Seminar
PHIL 422 Honors Seminar
PHYS 407 Senior Laboratory in Modern Physics
PRLS 490 Recreation Management Internship
RHBS 499 Senior Capstone in Rehabilitation Science
SOCI 485 RS: Sociological Analysis and Practice
SOCW 472 RS: Integrative Methods in Social Action and Social
    Change
SPMT 490 Internship
STAT 490 Capstone in Statistics
SYST 495 Senior Design Project II
TOUR 490 Hospitality, Tourism, and Events Management
    Internship

Table 4. Enrollment in Synthesis Courses by College/School, AY2015-19

	AY2015		AY2016		AY2017		AY2018		AY2019	
	#Course Sections	Enroll	#Course Sections	Enroll	#Course Sections	Enroll	#Course Sections	Enroll	#Course Sections	Enroll
Business	23	791	25	828	25	863				
Conflict Analysis and Resolution	4	53	4	72	4	51	3	62	4	64
Education and Human Development	19	140	20	163	15	144	3	40	3	49
Health and Human Services	28	592	28	605	22	455	22	456	21	422
Humanities and Social Sciences	121	2,856	98	2,704	109	2,727	94	2,515	79	2,322
Provost	1	14	4	50	4	36	3	29	16	337
SCHAR	8	200	10	214	11	233	13	252	12	238
Science	17	520	19	509	20	492	21	495	23	466
Visual and Performing Arts	27	290	19	262	22	341	17	309	15	280
Volgenau	30	815	27	720	26	893	29	931	38	1,065
TOTAL	278	6,271	254	6,127	258	6,235	205	5,089	211	5,243

Figure 11. Enrollment Trends in Synthesis Courses by College/School, AY2015-19
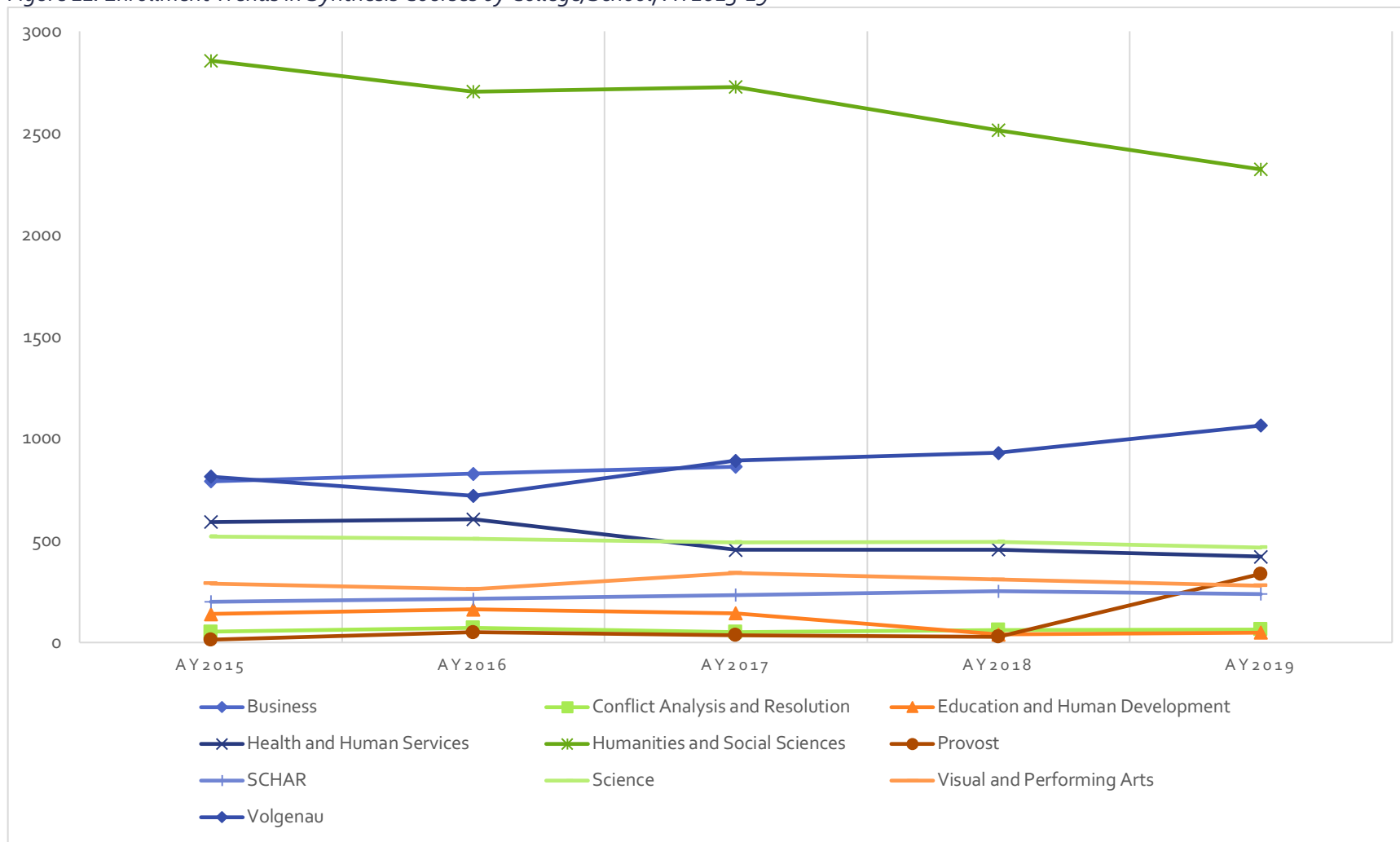
Legend:
- Business
- Conflict Analysis and Resolution
- Education and Human Development
- Health and Human Services
- Humanities and Social Sciences
- Provost
- SCHAR
- Science
- Visual and Performing Arts
- Volgenau

Table 5. Enrollment in Capstone Courses by College/School, AY2017-19

	AY2017		AY2018		AY2019	
	#Course Sections	Enroll	#Course Sections	Enroll	#Course Sections	Enroll
Business	21	732	31	1,027	30	1,012
Conflict Analysis and Resolution						
Education and Human Development	14	135	27	216	28	223
Health and Human Services	19	427	23	523	24	494
Humanities and Social Sciences	26	268	28	278	32	289
Provost	2	0	3	7	5	33
SCHAR						
Science	2	15	1	13		
Visual and Performing Arts	46	342	38	326	28	311
Volgenau	30	912	34	1,013	48	1,208
TOTAL	160	2,831	185	3,403	195	3,570

Figure 12. Enrollment Trends in Capstone Courses by College/School, AY2017-19

Legend:
- Business
- Conflict Analysis and Resolution
- Education and Human Development
- Health and Human Services
- Humanities and Social Sciences
- Provost
- SCHAR
- Science
- Visual and Performing Arts
- Volgenau
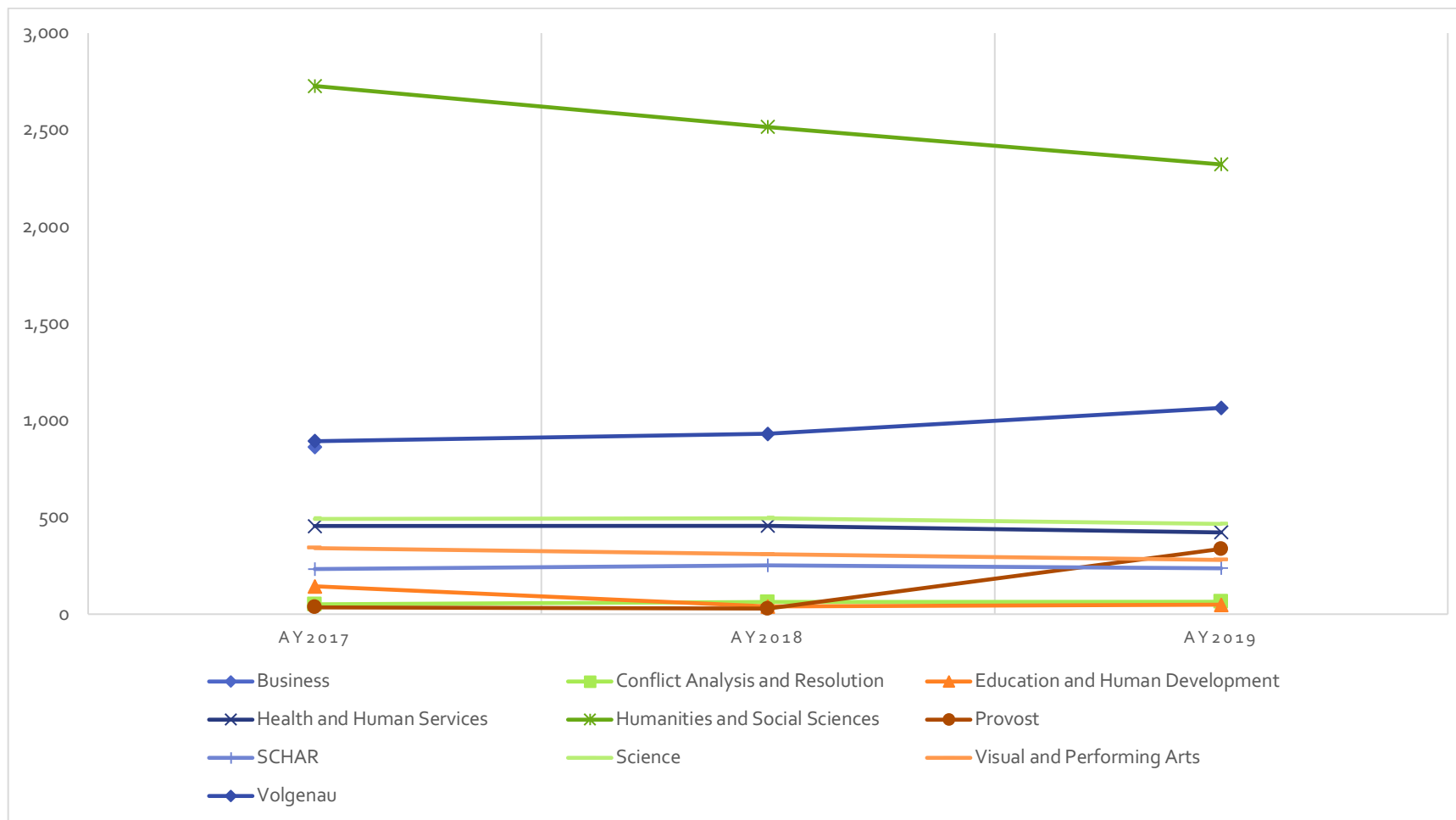
Table 6. Mann-Whitney U Test: Comparison by Category

	Mean Rank (n)					
	Capstone	Synthesis	*U*	Z	*p*	Sig.
Explanation of Issues	235.86 (107)	209.44 (324)	15208.5	-1.969	0.049	*
Use of Evidence	223.6 (90)	196.45 (314)	12231	-2.013	0.044	*
Context & Assumptions	194.61 (93)	189.84 (288)	13056.5	0.706	0.706	
Student's Position	221.71 (99)	198.31 (308)	13492	-1.789	0.074	
Conclusions & Outcomes	199.37 (92)	180.23 (277)	11420	-1.554	0.12	

Table 7. Mann-Whitney U Test: Comparison by Transfer Status

	Mean Rank (n)					
	Freshman	Transfer	*U*	Z	*p*	Sig.
Explanation of Issues	221.39 (207)	223.47 (237)	24759	0.176	0.860	
Use of Evidence	208.28 (195)	209.63 (222)	21785	0.118	0.906	
Context & Assumptions	194.08 (180)	198.55 (212)	19515	0.405	0.686	
Student's Position	206.12 (200)	214.48 (220)	22876	0.732	0.464	
Conclusions & Outcomes	186.86 (171)	193.48 (209)	18492	0.61	0.542	

Table 8. Mann-Whitney U Test: Comparison by Gender

	Mean Rank (n)					
	Female	Male	*U*	Z	*p*	Sig.
Explanation of Issues	240.39 (263)	208.46 (263)	21463	-2.651	0.008	*
Use of Evidence	227.84 (247)	192.40 (178)	18317	-3.037	0.002	*
Context & Assumptions	209.32 (236)	189.10 (165)	17506.5	-1.788	0.074	
Student's Position	224.21 (251)	202.02 (178)	20028.5	-1.897	0.058	
Conclusions & Outcomes	208.71 (222)	175.5 (166)	15272	-3.008	0.003	*

Table 9. Kruskal Wallis H Test: Comparison by Assessment Year

	2010		2012		2014		2018			
	Mean Rank	n	Mean Rank	n	Mean Rank	n	Mean Rank	n	*H*	Sig.
Explanation of Issues	585.07	245	522.95	245	603.55	266	652.45	446	24.862	0.000*
Use of Evidence	527.02	243	524.75	218	575.56	249	599.17	417	12.591	0.006*
Context & Assumptions	562.84	245	521.89	235	569.35	251	582.19	393	5.748	0.125
Student's Position	563.14	235	505.06	237	578.33	250	612.13	422	17.710	0.001*
Conclusions & Outcomes	526.22	240	531.23	237	558.32	247	578.58	380	5.881	0.118

Total N =1,202; df, 3; sig. p < .05

DEVELOPMENT OF CRITICAL THINKING RUBRIC

Overview

This rubric was adapted from the AAC&U VALUE rubric for critical thinking by an interdisciplinary team of Mason faculty participating in a Critical Thinking Across the Curriculum [CTAC] faculty learning community. The rubric articulates fundamental criteria for the development of critical thinking, with performance descriptors demonstrating progressively more sophisticated levels of attainment. It provides a vision for the kinds of graduates we want to send into the world; that is, where we want students to be when they leave Mason.

The rubric's uses are twofold. First, it is intended as a framework for faculty to use as they reflect on strategies and assignments they implement to develop students as critical thinkers in their classrooms. Faculty might reflect on the opportunities to set students on this developmental trajectory and to show improvement in the development of critical thinking at course, program, or institutional levels. It provides a macro-level view of how students grow, progress, and/or evolve in the development of their critical thinking during their academic careers. Secondly, the rubric is intended for institutional-level use in evaluating and discussing student learning. It may also afford the opportunity to examine the development of critical thinking competencies within and/or across units.

Scholars of critical thinking point to the key importance of dispositions, or habits of mind, in the development of students as critical thinkers. Thus, the rubric begins with the criterion, intellectual autonomy, *as a precondition* for the development of specific critical thinking competencies as articulated in the remainder of the rubric. The target, for those who teach critical thinking, is to talk with students about the dispositions or habits of mind of the critical thinker as the development of the cognitive skills proceeds and to encourage them to be reflective about themselves as critical thinkers.

Framing Language

This rubric is designed to be transdisciplinary, reflecting the recognition that success in all disciplines requires habits of inquiry and analysis that share common attributes. Further, research suggests that successful critical thinkers from all disciplines increasingly need to be able to apply those habits in various and changing situations encountered in all matters of personal and professional contexts, specifically, but not exclusively, the vocations, the professions, industry, and commerce.

Assessment of Work Samples

This rubric is designed for use with many different types of assignments and the suggestions here are not an exhaustive list of possibilities. The development of critical thinking can be demonstrated in assignments that require students to complete analyses of text, data, or issues. Research papers, lab reports, musical compositions, a mathematical equation that solves a problem, or a prototype design are all examples of work samples that could be assessed. Assignments that cut across presentation mode might be especially useful in some fields. If insight into the process components of critical thinking (e.g., how information sources were evaluated regardless of whether they were included in the product) is important, assignments focused on student reflection might be especially illuminating.

Definition: Critical thinking is a habit of mind characterized by the comprehensive exploration of issues, ideas, artifacts, and events before accepting or formulating an opinion or conclusion. The capacity to combine or synthesize existing ideas, images, or expertise in original ways; thinking innovatively; and intellectual risk taking – all components of creative thinking – is part of the development of critical thinking.

NOTE: *Not all outcomes will be applicable to all teaching situations.*

Developing the Critical Thinker

This criterion is best thought of as a precondition for the development of specific critical thinking competencies as articulated in the remainder of this rubric.

	Capstone	Advanced Milestone	Emerging Milestone	Benchmark
Intellectual Autonomy	Intellectual integrity is evidenced (e.g., search for counter-arguments, search for evidence); student grasps the contextual character of knowledge and that knowledge is constructed. Student demonstrates intellectual humility through realizing the evolving and temporary character of knowledge. There is realistic self-appraisal of one's strengths and limitations.	There is developing confidence in reasoning and argument where the student approaches knowledge questions analytically. Qualities include fair-mindedness and an opening up to others' viewpoints and arguments. Shows empathy with the situations of others (fellow- students, writers, artists). Developing definition of self as student through self-discipline (e.g.; punctual, taking pride in one's work, no procrastination).	Students begin to recognize multiple perspectives and demonstrate courage as they begin to take risks with ideas. There is a developing determination to succeed and perseverance. Developing self-knowledge, e.g., the acceptance one might be wrong, seeking out knowledge, learning skepticism. Early awareness of study skills and organization weaknesses.	Typically, a dualistic view of the world (black/white, right/ wrong) and is dependent on authority. There is reluctance to examine counter-argument. Student has unrealistic view of self as well as unfocused concern with work organization, study skills, and intellectual habits of mind.

DEVELOPMENT OF CRITICAL THINKING RUBRIC

	Capstone	Advanced Milestone	Emerging Milestone	Benchmark
1. Explanation of issues	Issue/problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	Issue/problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	Issue/problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/or backgrounds unstated.	Issue/problem to be considered critically is stated without clarification or description.
2. Evidence *Selecting and using information to investigate a point of view or conclusion*	Information is taken from source(s) with enough interpretation/ evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are explored in depth.	Information is taken from source(s) with enough interpretation/ evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are explored.	Information is taken from source(s) with some interpretation/ evaluation, but not enough to develop a coherent analysis or synthesis. Viewpoints of experts are taken as mostly fact, with little exploration.	Information is taken from source(s) without any interpretation/ evaluation. Viewpoints of experts are taken as fact, without question.
3. Influence of context and assumptions	Systematically and methodically analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	Identifies and examines own and others' assumptions and several relevant contexts when presenting a position.	Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.
4. Student's position (perspective, thesis/ hypothesis)	Specific position (perspective, thesis/ hypothesis) is imaginative, taking into account the complexities of an issue. Limits of position (perspective, thesis/ hypothesis) are acknowledged. Others' points of view are synthesized within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/ hypothesis).	Specific position (perspective, thesis/ hypothesis) acknowledges different sides of an issue.	Specific position (perspective, thesis/ hypothesis) is stated, but is simplistic and obvious.
5. Conclusions and related outcomes (implications and consequences)	Conclusions and related outcomes (consequences and implications) are logical and reflect student's informed evaluation and ability to place evidence and perspectives discussed in priority order.	Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.