General Education Curriculum Instructor Group for Category 2: Critical Thinking Assessment Report

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Introduction

The purpose of this report is to summarize assessment data for General Education Goal Area 2 – Critical Thinking – that had been collected in the past year and to comment on the process. This document responds to the purpose for General Education Assessment as described on the website for Institutional Research, Planning, and Assessment, and included here:

> State agencies, governmental bodies, disciplinary accrediting groups, and national and regional accrediting groups all require information about the learning outcomes of students at Minnesota State Mankato. More importantly, faculty in departments offering general education courses need to know if students are learning what is being taught in the general education courses. Additionally, the University needs to know if the general education program (not individual faculty or individual courses) is meeting its stated objectives. Finally, as with all assessment, the over-arching purpose is to improve student learning.
>
> The General Education program integrates a broad foundation of knowledge and skills with the study of contemporary concerns. The General Education curriculum goals are reflective of those capabilities essential for all college-educated adults facing the twenty-first century, including:
>
> Skills needed for effective understanding and communication of ideas through reading, listening, critical and integrative thinking, writing, speaking, and technological literacy;
>
> - Exploration of various ways of knowing through study of the content, methods of inquiry and creative modes of a broad spectrum of disciplines;

- Our common membership in the human community, coupled with awareness that we live in a diverse world;
- The interrelatedness of human society and the natural environment and the ethical dimensions of political, social, and personal life; and
- Development of responsibility for lifelong learning.

This report begins with background on Goal Area Two at Minnesota State Mankato, then moves to a literature review to provide broader context on the importance of critical thinking and the difficulty in assessing it. Then, we describe the assessment process, and the results that we gathered from it. We close with thoughts about teaching critical thinking but more importantly for consideration of both the onboarding of new faculty to teach general education classes overall and the assessment process. With the paucity of results, it is difficult to say anything of import. The university and the faculty would, we feel, appreciate being able to make more confident conclusions about whether our students are learning to think critically, but that would require more awareness of the assessment process and willingness to participate.

Description of Goal Area Two – Critical Thinking

The University articulates critical thinking curriculum goals in both the General Education (derived from the Minnesota Transfer) requirements of the 2017-2018 Undergraduate Catalog (www.mnsu.edu/supersite/academics/catalogs/undergraduate/2017-2018/generalinfo/generaleducation.pdf) and the university-specific SLOs. The catalog specifies that this goal area focuses on "skill development" that is "common to different disciplines." This document lists these learning objectives of Goal Area 2: Students are to be able to:

(a) gather and analyze information of various kinds, employing formal or informal tools to represent information in ways useful for solving problems;

(b) weigh evidence for and against hypotheses;

(c) recognize, construct, and evaluate arguments;

(d) apply appropriate critical and evaluative principles to texts, documents, or works–one's own or others'-in oral, visual, or written mediums.

The University has specific Student Learning Outcomes separate from those mandated by the state of Minnesota to facilitate transfer: [https://www.mnsu.edu/assessment/slo/slo.html]. The Critical Thinking outcome aims to make sure "Students will demonstrate the ability to analyze situations and problems in order to identify and test solutions."

Literature Review

The Importance of Critical Thinking

Critical thinking is pronounced important. “A relatively recent survey conducted by the Association of American Colleges and Universities (AAC&U, 2011), 95% of the chief academic officers from 433 institutions rated critical thinking *as one of the most important intellectual skills* for their students” (Liu, Frankel, & Roohr, 2014). One article catalogs the reasons it matters in real life “Mature or advanced forms of critical-analytic thinking include knowledge of the various factors that could contribute to claims being inaccurate; the ability to recognize flawed reasoning or flawed arguments derived from claims; avoid being persuaded via an argument chain into a state of belief that could lead to disastrous consequences; people have to not only

be on guard against potentially misleading evidence or unwarranted claims of others, but also be on guard against being guilty of the same tendencies themselves" (Byrnes & Dunbar, 2014). Byrnes & Dunbar then go on to argue that critical thinking is: metacognitive and reflective; evaluative; skeptical and moderately distrusting; analytic; unbiased and open-minded; effortful, potentially time-consuming, and mentally taxing*; and requires a sufficient amount of domain-specific expertise (Byrnes & Dunbar, 2014).* Employers highly value these skills in incoming employees. Moreover, in these times of "fake news," it seems clear we need to educate our students to be good critical thinkers.

Possible factors in poor critical thinking skills

Many studies point to a lack of strong critical thinking skills in incoming first year students, nor do students necessarily learn it in college. A variety of possible factors could be at play in terms of the accomplishment of critical thinking skill attainment, including background factors such as parental educational attainment, racial and class differences, as well as English language skills, and, of course, standardized testing issues. Is teacher training the issue? What about the lived experiences of the kids? Hunger, danger, illness, and complicated family situations may mean that kids are not in the ideal place to take advantage of a teachable moment. Are the tests themselves the problem? Does cultural bias in construct validity, content validity, or predictive validity have anything to do with it? Some blame the high-stakes testing that resulted from No Child Left Behind (NCLB) for teaching to the test. "Five years into NCLB, researchers found that 62 percent of a nationally representative sample of all districts in the United States—and 75 percent of districts with at least one school identified as needing improvement—increased the amount of time spent on language arts and math in elementary schools. These increases were

substantial: a 47 percent increase in language arts and a 37 percent increase in math. Correspondingly, these districts decreased time allotted to other subjects and activities, including science, social studies, art, music, physical education, and recess" (McMurrer, 2007, p.1). Since these other classes and activities might involve getting practice thinking, this might be part of the overall picture of low critical thinking skills seen in our students. "Initial Collegiate Learning Assessment) CLA performance tracks closely with family background: students from more educated families scored higher on the CLA when they entered college in the fall of 2005. The gaps across different racial/ethnic groups were even more pronounced. All racial/ethnic minority groups had lower levels of skill in critical thinking, complex reasoning, and writing as measured by the CLA" (Arum & Roksa 2011, p. 38).

Impact of a college experience

Dismay about critical thinking skills in our young people abounds. Arum and Roksa used the Collegiate Learning Assessment (CLA) tool and published the results in *Academically Adrift*. A large sample of 2300 students were found to have made "no statistically significant gains in critical thinking, complex reasoning and writing skills for at least 45 percent of the students in our study" (Arum & Roksa, 2011, p.36). Roohr, Liu & Liu used the Education Testing Center's EPP. They found "student learning gain in college across four different areas critical thinking, reading, writing, and mathematics …[were] small and insignificant …[but] moderate significant learning gains [were seen] after four or five years" (Roohr, Liu, & Liu, 2016, p. 2296). Another factor at play seems to be the negative impact of racism. "Negative diversity experiences explain a substantial portion of the inequality in the development of critical thinking skills between African American and White students. African American students are substantially more likely to

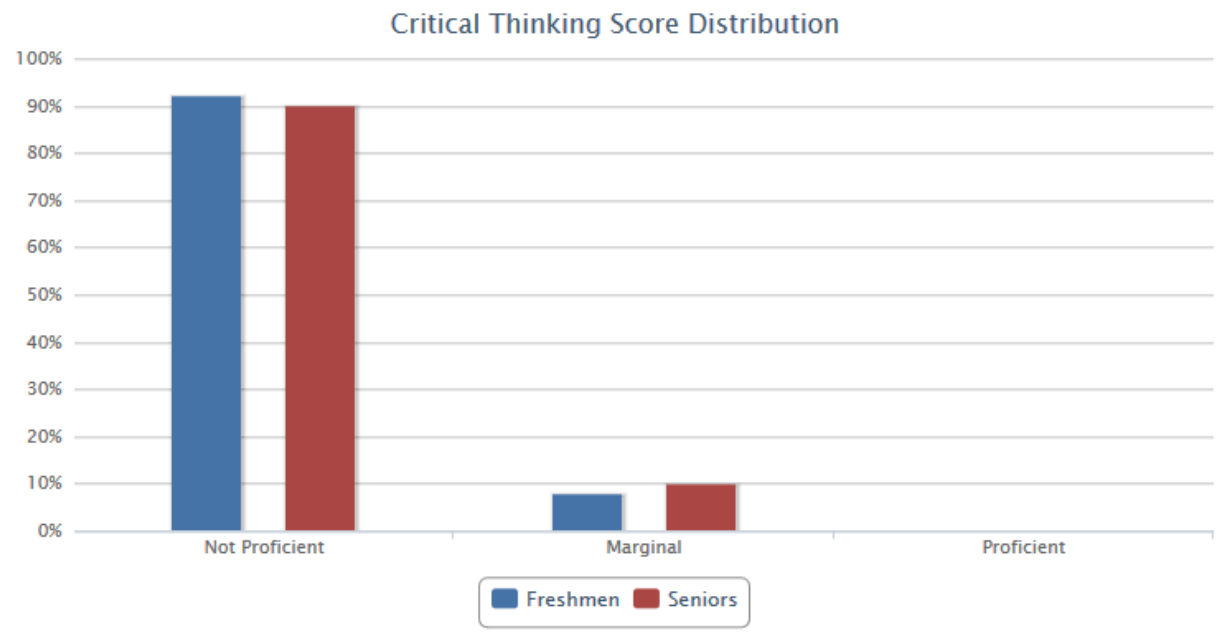
be exposed to negative diversity experiences, which contributes to the observed disparities in critical thinking" (Roksa, Trolian, Pascarella, Kilgo, Blaich, & Wise, 2017 p. 134).

We know that anecdotal evidence from MSU, Mankato would seem to indicate that many faculty are concerned about the incoming students' abilities to think critically.

Critical Thinking of Students at Minnesota State University, Mankato

The overall evaluation shown in the *College Portrait* reveals a dismal overall picture of both incoming and graduating student critical thinking. Minnesota State University, Mankato uses the ETS evaluation of 138 incoming first year students (recruited from First Year Seminars) and 134 graduating seniors (incentivized with gift cards), 6 and 3 percent respectively. The ETS Critical Thinking test measures students abilities to 1) distinguish between rhetoric and argumentation in a piece of nonfiction prose; 2) recognize assumptions; 3) recognize the best hypothesis to account for information presented; 4) infer and interpret a relationship between variables; and 5) draw valid conclusions based on information presented. Though results show some concern about our students' critical thinking skills, though there have been criticisms of the validity of college-level tests (Berrett, 2014). As such, results should be used in appropriate ways given the validity of the data.

The chart below shows the distribution of student scores on the ETS Proficiency Profile Critical Thinking test. Students are scored as Not Proficient, Marginal, or Proficient.



Critical Thinking in the Disciplines

When we assess critical thinking, we must caution against the urge to assume that all critical thinking skills apply across disciplines. Rather, when we consider critical thinking assessments we should narrow our focus into assessing domain specific critical thinking (Liu et al, 2014). Previously validated critical assessments distinguish critical thinking from other general, cognitive abilities (Kuncel, 2011). In addition, these previous assessments argue that critical thinking is best understood within those domain specific constructs. If we consider critical thinking as a domain specific construct, we would need to assess individual fields within each domain or area of specialization. Within these specific areas, critical thinking should be trainable and lead to improved long-term professional outcomes especially when compared to other domain specific skills (Kuncel 2011). This implies that within a specific domain, critical thinking skills would be a stronger indicator of success than other applicable skills.

For example, within psychology, the Psychological Critical Thinking Exam (Lawson, 2015) shows that psychology seniors possess a higher proficiency in critical thinking when compared to psychology juniors and senior biology majors. This is not to say that biology majors lack critical thinking, rather this indicates that the nature of the exam caters to psychological methodologies rather than biology specific methodologies. Lawson (Lawson, Jordan-Fleming, & Bodle, 2015) explicitly states that one of the major reasons students' display an increase in critical thinking proficiency is that the "… Senior Thesis course is designed to provide additional training and practice for developing PCT" (p. 251). Kuncel's data supports this statement by saying that the best method to increase critical thinking skills is to directly train students in domain specific critical thinking (2011). Otherwise, without *specific* instruction for critical thinking overall general assessments will produce low to zero net gain in critical thinking proficiency.

Description of the GECIG Assessment Process

According to the website for Institutional Research, Planning, and Assessment, "A GECIG is established for each General Education Curriculum goal being reviewed. Each GECIG will be comprised of five faculty members. The GECIGs primary function within the assessment process is to review and analyze the collected assessment results for each learning outcome for the General Education goal being reviewed. The GECIG is responsible for completing the General Education curriculum goal assessment process (review and analyze assessment results, provide interpretation of results, and establish recommendations) and submitting a report to the General Education and Diversity Committee."

(http://www.mnsu.edu/assessment/gened/GEAssessIntro.html)

A five-year assessment cycle is used to support the assessment of the general education curriculum goals within the general education program. Category 2 is unique in that students can take one of the many courses listed as a Category Two class OR it is assumed that, through completion of the rest of the general education program, that they will learn how to think critically. Faculty members who participate use the rubrics to assign scores to their students' accomplishment (See Appendix A). Very few participated, possibly due to lack of awareness.

Of the 305 students assessed, 244 were Chemistry students, the remainder Philosophy (25), Math (12), Gerontology (6), and English (18).

According to data from the registrar, the total enrollments in Goal Area 2 eligible classes in Fall 2016-Summer 2017 were 4,757 with 212 different eligible courses. Note that enrollments does not represent the number of students, since students may be enrolled in more than one course. Nevertheless, we had a total of 305 students' data included in this assessment, which represents, at most, 6.4% of the possible sample. In addition, the sample was heavily skewed towards chemistry. For each of the classes assessed, we only have one semester of assessment data. It would have been useful to have data representing all semesters from consistent courses.

Course Credits Title/Goal Area(s) AST 115 (2) Life in the Universe 2, 3 CHEM 111-L (5) Chemistry of Life Processes 2, 3 CHEM 191 (3) Chemistry Applications 2, 3 CHEM 201-L (5) General Chemistry I 2, 3 CMST 101W (4) Interpersonal Communication 2 CSP 110 (3) Decision Making for Career and Life 2 ECON 103WP (3) Economics of Women's Issues & Public Policy in the United States 2, 5 ECON 207 (4) Business Statistics 2, 4 ENG 201W (4) Intermediate Writing 2 ENG 271W (4) Technical Communication 2, 13 ENG 272W (4) Business Communication 2, 13 ENG 301W (4) Advanced Writing 2 GEOG 313 (4) Natural Disasters 2, 10 GERO 200G (4) Family Dynamics of Aging 2, 7 GERO 200WG (4) Family Dynamics of Aging 2, 7 GWS 230P (4) Gender, Race & Pop Culture 2, 6 HLTH 212 (3) Consumer Health 2 KSP 200G (3) Critical Issues in Public Ed Today 2, 9 MATH 290 (4) Foundations of Mathematics 2 MUSC 301W (3) Music History 1 2 MUSC 302W

(3) Music History 2 2 PHIL 110 (3) Logic and Critical Thinking 2, 4 PHIL 112W (3) Scientific Reasoning 2, 4 PHIL 311 (3) Symbolic Logic 2, 4 PHYS 211-L (4) Principles of Physics I 2, 3 PHYS 221-L (5) General Physics I 2, 3 POL 103W (3) Thinking About Politics 2 PSYC 103W (3) Psychology Today 2

We ran basic statistical analysis on the data set, such as percentages of scores. There is not sufficient data to draw statistically significant conclusions. Most of our data is from chemistry, based off rough calculations students have shown decent critical thinking in chemistry. However, this does not apply to all fields. While we do assess on an individual course basis, with limited buy-in we cannot sufficiently measure critical thinking outside of the largest sample. All conclusions from this information reflect chemistry critical thinking, which more than likely is not translatable to other fields. Nor should it translate – it should remain domain specific. Still, we can draw some conclusions about the data we did have.

Results

On average, the students included in this data set scored between level 2 (developing) and 3 (proficient) for all critical thinking outcomes.

Outcome 1: Gather and analyze information of various kinds, employing formal or informal tools to represent information in ways useful for solving problems

Faculty assessed their students' ability to gather and analyze information on a scale of 0 to 4, 4 representing advanced. The assignments used to assess this outcome ranged from annotated bibliographies in a writing course to lab reports in chemistry to quizzes in a philosophy course. On average, students in this data set were rated at 2.87 out of 4, showing generally proficient ability. Figure 1 shows the breakdown of scores by discipline. Instructor comments provided

additional context to support this overall positive finding, such as "Most of my students understand how to formulate a solution to a problem by doing primary and secondary research" and "With about 60% proficiency at the second week of the term, we are providing solid concept development and directions for data collection of an unknown using a standard calibration curve approach."

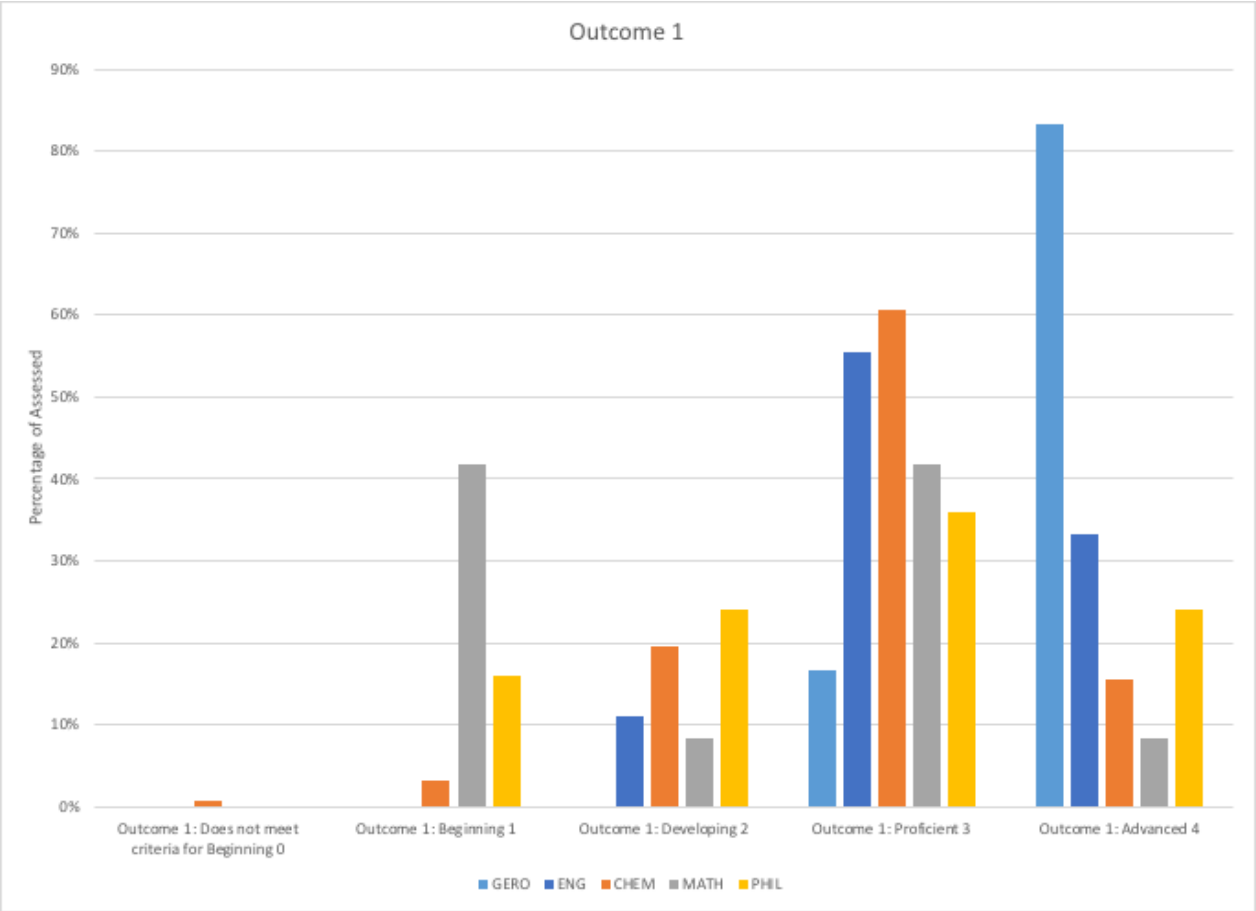


Figure 1: Student scores for Outcome 1 by discipline

Outcome 2: Formulate and weigh evidence for and against hypotheses

Faculty assessed their students' ability to weigh evidence for and against hypotheses on a scale of 0 to 4, 4 representing advanced. The assignments used to assess this outcome included a structured analytical essay and outline, lab report, exam question, and quizzes. On average, students in this data set were rated at 1.99 out of 4, suggesting overall lower mastery compared to Outcome 1. Figure 2 shows the breakdown of scores. Instructor comments provided additional context. For the online course, the instructor noted the positive role of structured assignments in helping students gain skill working with evidence. Chemistry and math instructors noted median scores. As one instructor commented, "We need to develop strategies to improve this performance once we can identify whether it is the laboratory process or the communication (or both) that needs to be addressed better."

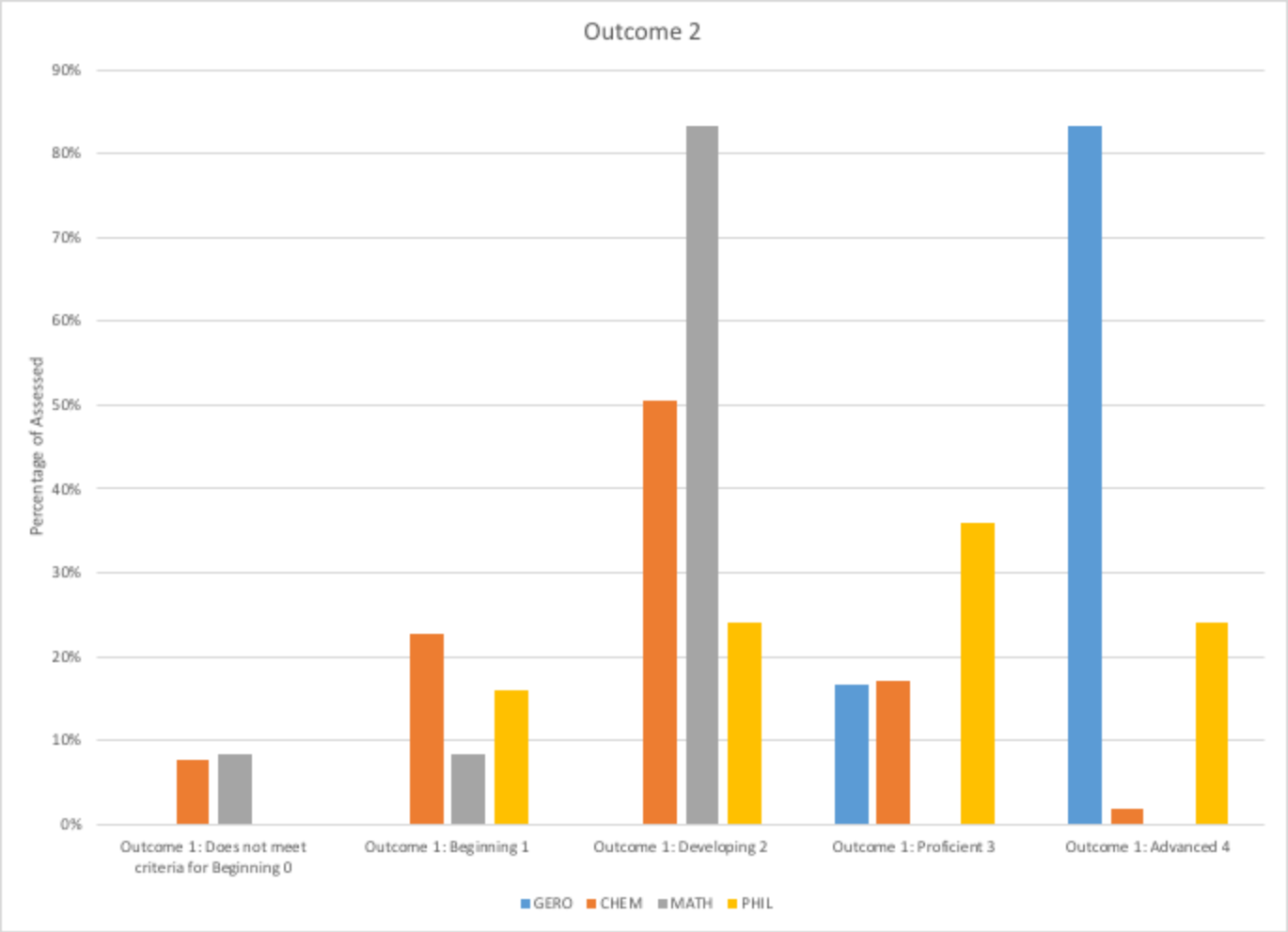


Figure 2: Student scores for Outcome 2 by discipline

Outcome 3: Recognize, construct, and evaluate arguments

Faculty assessed their students' ability to recognize, construct, and evaluate arguments. The assignments used to assess this outcome included a structured essay with thesis statement, lab report, exam question, and quizzes. On average, students in this data set were rated at 2.5 out of 4. Figure 3 shows the breakdown of scores. Chemistry students appeared to perform better for this outcome compared to Outcome 2. One instructor noted, "Most students struggle with the idea of finding evidence against their own thesis. Providing a well-rounded, 360 view of a

problem is not coming naturally to these students, but they adapt quickly if given the opportunity." This comment affirms the value in offering students dedicated practice in constructing and evaluating arguments critically.

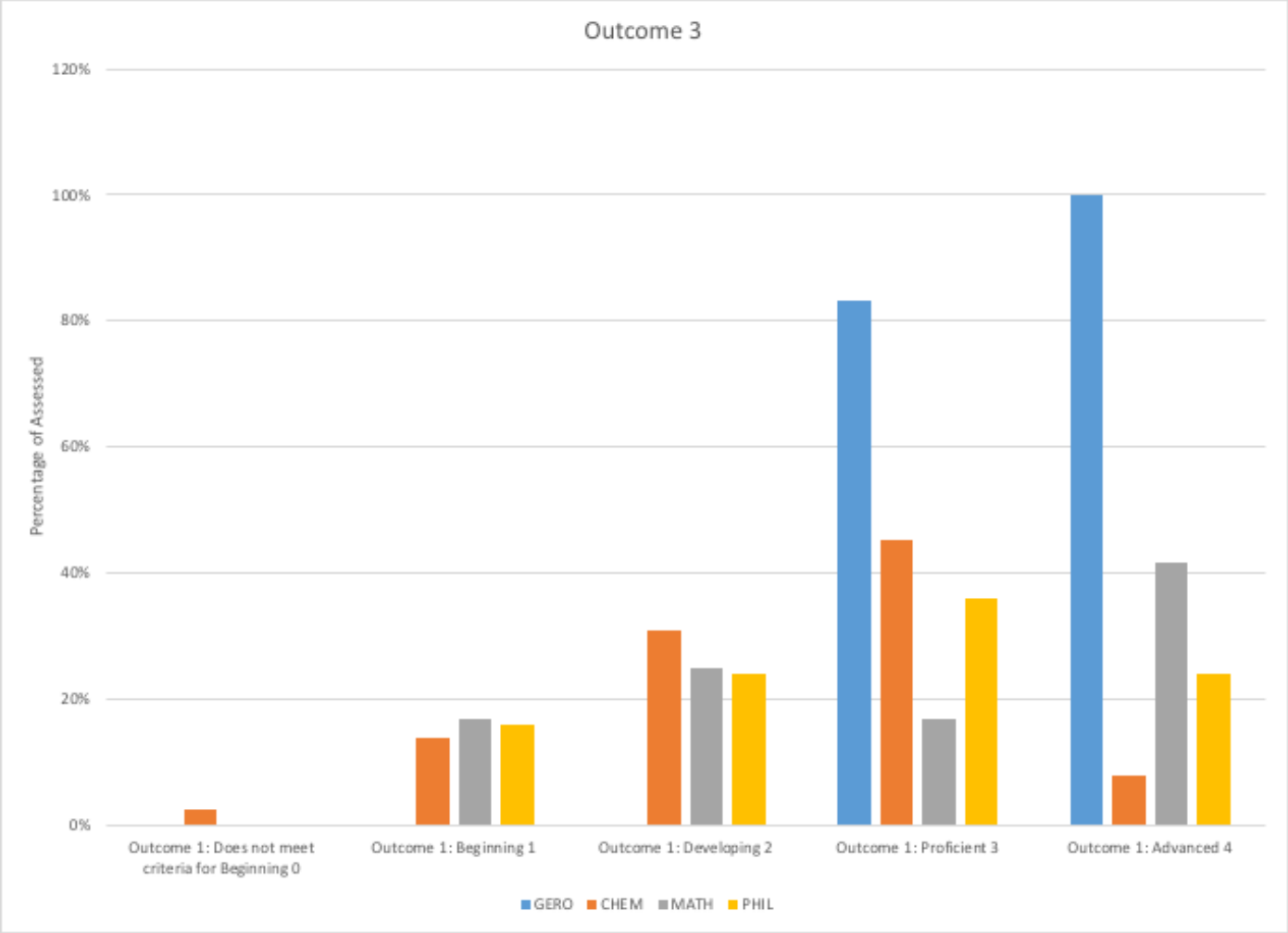


Figure 3: Student scores for Outcome 3 by discipline

Outcome 4: Apply appropriate critical and evaluative principles to texts, documents, or works in oral, auditory, visual or written mediums

Faculty assessed their students' ability to apply appropriate critical and evaluative principles to texts. The assignments used to assess this outcome included annotated bibliographies, outlines,

and essays; lab reports and questions; and quizzes. On average, students in this data set were rated at 2.52 out of 4. Figure 4 shows the breakdown of scores. One instructor commented that students were effectively applying critical elements to write a formal scientific essay; another instructor noted that most students were scoring at proficient or developing in applying the percent yield concept, which is considered "reasonable for mid-term of the first year in a university Chemistry lab."

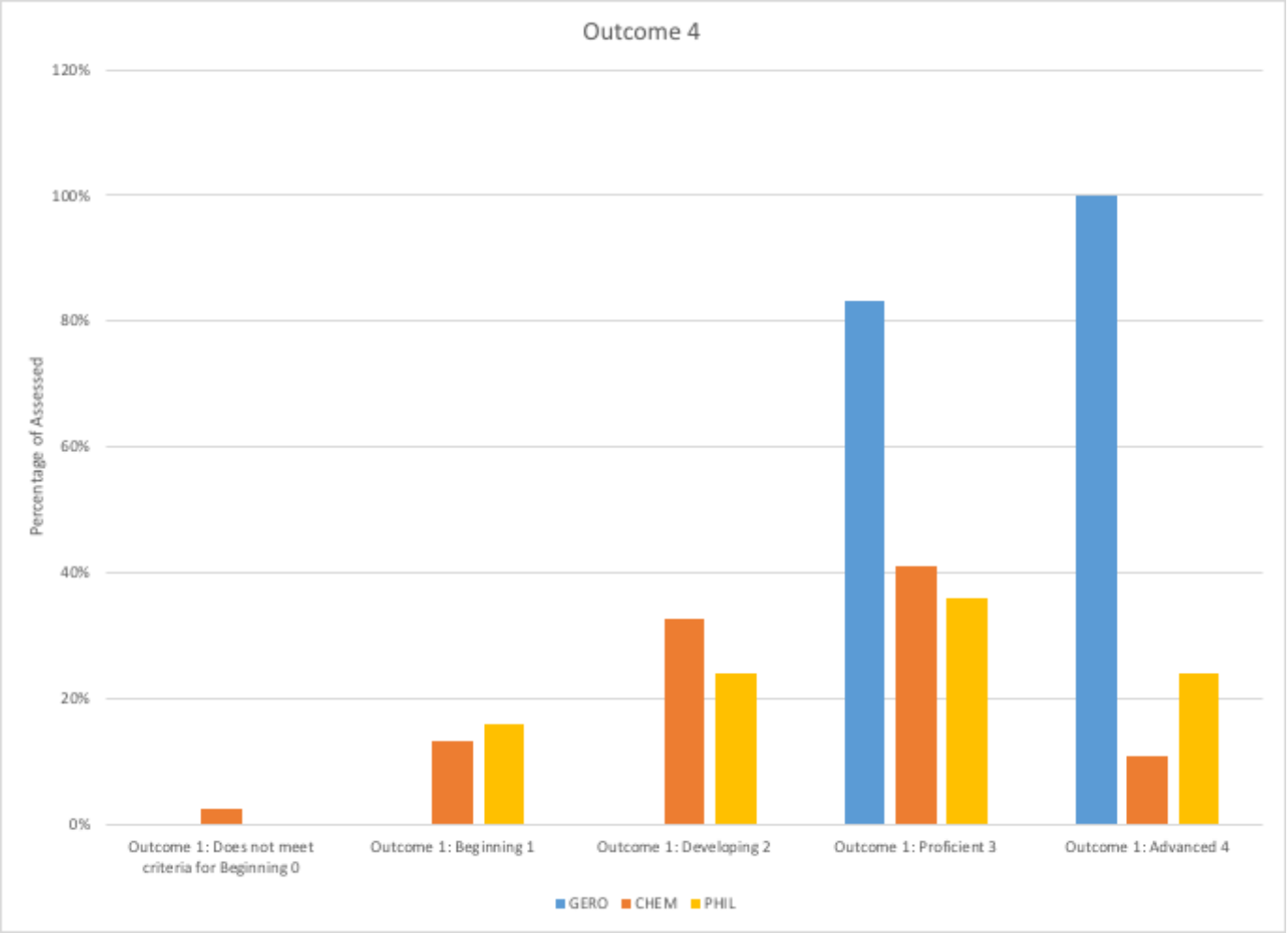


Figure 4: Student scores for Outcome 4 by discipline

Thoughts

As the above results show, due to limited data, we cannot generalize about critical thinking skills of students across campus. Therefore, our thoughts pertain to increasing faculty awareness and participation in assessment so that data is more useful in the future. We also think that, since critical thinking is done at the discipline level, it might be more helpful to assess there and report those results to the university.

Increasing awareness and participation in Gen Ed assessment

We really need to understand why so few participate in assessment, so we can improve promotion or add incentives, or just craft some way of having a better sense of the paucity of the results. We suspect this is due to lack of awareness. As an example, several authors of this report were unaware of the process altogether. Though we value critical thinking and consider the skills to be already reflected in our assignments and course design, we did not receive any training or direction about how to incorporate it or assess it within our classes. Information about the Gen Ed categories might be useful during the orientation process for faculty members and could be reintroduced at department meetings.

In addition, the authors of this report do not recall receiving an invitation to participate in General Education assessment by contributing data from their classes. If we did in fact receive an e-mail invitation, it possible we ignored it due to the abstract nature of the invitation; it is difficult, especially for a new faculty member, to understand how a request for assessment data fits in with the instructor's, department's, and university's goals. If department chairs communicate the information at the departmental level, it could increase faculty participation.

Finally, faculty members might be better persuaded to participate if they understand the time commitment and benefits to them. It would also be useful to designate an individual familiar with university assessment to be available for questions or workshops. This would also lower barriers to participation, because faculty members may need one-on-one guidance on designing and implementing an effective assessment in their classes.

Assessing critical thinking in the context of disciplines

While the College Portrait ETS assessment is interesting, it might be more helpful to the administration and the departments to understand each department/program's efforts to teach disciplinary-specific critical thinking and the results of that level assessment. A quick subject search of critical thinking and higher education in the library's discovery tool yielded these top results: Studies in the disciplines of corrections, pre-service teachers (SEVERAL), technical drawing, leadership, journalism, sustainability, activism, spirituality, Museumology, English majors, nursing, computer science, literary studies, technical education, mathematics, librarianship, industrial training, prison classrooms, diversity, legal education, business strategy, geography, TESL, environmental education, agribusiness, feminism, biology and chemistry. Different disciplines will have differing ways of teaching and assessing critical thinking, as well, of course, different ways that critical thinking might come into play in the workplace. Should program websites include a statement of how they increase students' critical thinking skills and how students will use those critical thinking skills on the job? Should their overall curriculum articulate it?

The Gen Ed undergraduate catalog does not call for critical thinking to be defined and taught at the disciplinary level, but rather taught as a skill that crosses disciplines. Since this is a MN

Transfer-based curriculum, that is that. However, the university's Student Learning Outcomes states the value of critical thinking, and that objective could perhaps be considered for teaching/learning/assessing at the departmental level? The SLO articulation of critical thinking makes it something that Mankato can formulate its own university vision for.

Given the concerns about the ability to define and teach critical thinking at a general level, we should consider other approaches. One common convergence in the assessments of critical thinking suggest that objectivism and openness predict higher critical thinking proficiencies. Objectiveness is defined as approaching a problem analytically without a predetermined conclusion. Openness is defined as a person's willingness to experience and understand change. These traits may serve as focal point in our future assessments especially when we compare across disciplines (Liu, Frankel, & Roohr, 2014; Snyder, Snyder, Snyder, & Snyder, 2008; Weiler, 2005; Lawson, 2015; Kuncel, 2011). Several techniques could be used to determine critical thinking and provide somewhat comparable data across domains. Weiler (2005) suggests that students craft analogies to explain the more complex subjects within a particular domain. Snyder outlines the IDEAL teaching method to evaluate critical thinking: I – Identify the problem; D – Define the context; E – Enumerate the Choices; A – Analyze the options; L – List the reason; S – Self correct. Perhaps the best solution is to adopt the process outlined in Halpern (Halpern, 2013):

(Adapted for critical thinking):

1. Multiple, varied measures for critical thinking are necessary because no single measure can capture its complexity.

2. Faculty involvement in all aspects of the measurement of critical thinking and the utilization of critical thinking outcomes is essential for success.
3. Departments should be rewarded for conducting meaningful assessments of critical thinking skills, even when the outcomes of that assessment demonstrate room for improvement.
4. Faculty members and institutions should use the outcomes of critical thinking assessments to improve their teaching and their students' learning, whether that involves curriculum changes, individual faculty changing pedagogical approaches if needed, and so on.
5. Departments should take a value-added approach to the measurement of critical thinking scores over time; that is, strive to understand the critical thinking growth within each student rather than a comparison of different groups of students. Using this approach, all students can demonstrate enhanced critical thinking skills over time.
6. Seek to utilize multiple sources of information about critical thinking from differing perspectives; by identifying overlapping efforts, a convergence of efforts through purposeful coordination may lead to richer sources of data as well as more complete and representative outcomes.

Teaching critical thinking

We present the following ideas for consideration by other groups who might delve into the critical thinking competencies of our graduates:

- Critical thinking teaching will necessitate a number of different strategies...for in-person classes and online classes, and hybrid classes. Especially as our university has increased its push for online courses, it will be valuable to consider ways to best teach and assess critical thinking in online environments.
- Students will enter with a range of critical thinking skills. Should we ascertain this and promote an understanding of our incoming students' spectrum of critical thinking proficiencies to our faculty? So they understand their audience better?
- Library instruction can include intentional critical thinking skill building, but not within a 50 minute period when other things students need to know are introduced. In addition, as technology changes and poor-quality information continues to proliferate online, students may need more specialized training in how to critically assess information sources.
- Faculty development is critical and the CETL will be a valuable resource as we try to improve critical thinking.
- It might be worth considering having an intentional discipline-specific critical thinking component be articulated in all introductory classes in a program. [this could relate to discipline-specific assessment somehow]
- The Common Curriculum Committee often sends course proposals back to the authors, suggesting that faculty can be more intentional about incorporating critical thinking into their syllabi prior to submission. College Curriculum Committees may benefit from an increased understanding of our incoming students' Critical Thinking Skills and how critical it is to improve them whilst they are in college.

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Organizations:

Foundation for Critical Thinking: https://www.criticalthinking.org/

National Center for Case Study Teaching in Science: http://sciencecases.lib.buffalo.edu/cs/

Center of Inquiry http://www.liberalarts.wabash.edu/

Appendix A

The rubric faculty used to report their findings from their student population.

General Education Goal Area 2 – Critical Thinking

Rubric

	Does not meet criteria for Beginning 0	Beginning 1	Developing 2	Proficient 3	Advanced 4
Gather and analyze various kinds of information, deploying appropriate strategies to solve problems.	---	Student can gather and/or analyze information so as to formulate a problem.	Student can identify appropriate strategies for solving the problem.	Student can apply appropriate strategies to solve the problem.	Student can develop an informed, detailed and plausible solution to the problem.
Formulate and weigh evidence for and against hypotheses.	---	Student can formulate an hypothesis or conjecture and identify evidence or argument for or against it.	Student can make a case for the relevance of the evidence for, or against, the hypothesis or conjecture.	Student can make a case for the relevance of the evidence or argument for, and against the hypothesis or conjecture.	Student can make a detailed, coherent and plausible case that the hypothesis or conjecture is confirmed, or that it is refuted.
Recognize, construct and evaluate arguments	---	Student can clearly identify arguments.	Student can construct effective arguments.	Student can articulate reasons why an argument is effective.	Student can defend the assessment of the quality of an argument.
Apply appropriate critical and evaluative principles to texts, documents, or works in oral, auditory, visual or written mediums.	---	Student can identify appropriate critical and evaluative principles.	Student can articulate why a critical and/or evaluative principle is appropriate.	Student can apply the principle to an appropriate text, document or work.	Student can defend application of principles as appropriate to a critical/evaluative assessment of the text, document or work.