

Assessment of Critical Thinking
Institutional Student Learning Outcome #4
Report to the Campus
2007-08

Prepared
By
The Executive Committee of the Assessment Commission

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Executive Summary

During the 2007-08 academic year, the OIT Assessment Commission conducted an assessment of critical thinking at institution and program levels. The assessment was based on critical thinking performance criteria, accompanied by a rubric. The performance criteria included the ability to: 1) identify and explain the problem/question/issue; 2) recognize stakeholders and contexts; 3) formulate personal responses and/or acknowledge other perspectives; 4) identify and evaluate assumptions; 5) identify and evaluate evidence; and 6) identify and evaluate implications, conclusions, and consequences.

At the institution level, a trained group of faculty assessed 175 student papers from classes emphasizing critical thinking—HUM 125 Introduction to Technology, Society and Values; PHIL 331 Ethics: Moral Issues in the Professions; and WRI 122 English Composition. At the program level, faculty assessed a wide variety of upper-division student work samples, such as issues papers, lab exercises, and case studies.

The institution results indicate that students in HUM 125, PHIL 331, and WRI 122 have developed some proficiency, but not mastery, in critical thinking. Approximately half of the students demonstrated proficiency or high proficiency in identifying or explaining the problem, recognizing stakeholders and contexts, examining perspectives, and summarizing implications. Less than half were able to identify and evaluate underlying assumptions and evaluate associated evidence. Only 21% of the students were able to demonstrate proficiency or high proficiency for all performance criteria. The faculty reflections at the end of this assessment supported these quantitative results.

While a direct comparison of the program activities cannot be made to the assessment of the critical thinking papers at the institution level, the data for the program assessments appear to echo the institutional results. In general, upper-division OIT students have developed some proficiency, but not mastery, in critical thinking, as defined by the performance criteria. The results were uneven and weaker than expected overall.

The Executive Committee explored a variety of accompanying data, including an indirect survey on the Petition to Graduate, the IDEA Center faculty evaluation data on critical thinking, and cross tabulations of the data for the critical thinking papers with class level, course, age, SAT scores, and high school GPA data. These data, although of interest, did not provide any substantive conclusions beyond the overall findings listed above.

The Executive Committee, after reviewing the results of the assessment on critical thinking, recommends:

- That instructors for HUM 125 and WRI 122 classes place more specific emphasis on the performance criteria used for critical thinking, in particular those for identifying and evaluating assumptions, and identifying and evaluating evidence. Further, after having done so, the committee recommends that OIT re-assess student performance in these classes.
- That the Executive Commission collaborate with volunteer instructors from each area of the college (arts and sciences, engineering, health, management) to more carefully assess upper-division performance in critical thinking, using a similar writing assignment, prompt, and assessment method.
- That the Executive Committee of the Assessment Commission lead a faculty discussion about the results from this assessment and solicit suggestions for improvement of student performance in critical thinking at both lower- and upper-division levels.
- That the Commission on College Teaching offer interested faculty a workshop focusing on the incorporation of critical thinking in instructional methods.
- That the Executive Committee provide additional training on the performance criteria for instructors of the 2008-09 classes to be re-assessed, and for those involved in the re-assessment of these classes.

Description of assessment

During the 2007-08 academic year, OIT assessed critical thinking by examining 175 final papers in several classes that specifically emphasize critical thinking. These classes were selected because they are required in many curricula and therefore have a broad representation of majors. They are:

- WRI 122 English Composition, second term. Although this course is normally taught at the freshman level, for many students the course may be the last one they will take that emphasizes critical thinking, and in particular, the performance criteria defined by the institution's faculty.
- HUM 125 Introduction to Technology, Society and Values. This course, requiring no prerequisite, specifically emphasizes critical thinking.
- PHIL 331 Ethics: Moral Issues in the Professions. This course, generally taken at the junior or senior level, has a prerequisite of WRI 123 or WRI 227 and emphasizes critical thinking.

It was decided that externships, senior projects and capstone courses vary broadly and would not therefore serve well as comparable student learning situations for institutional-level assessment of critical thinking. The Assessment Commission provided assessment tools to departments for the purpose of assessing critical thinking at the upper-division level as described in the Program Level Assessment section below. These tools included the same rubric and performance criteria used for the critical thinking papers.

Critical thinking definition and performance criteria

The Executive Committee of the Assessment Commission approved the following definition and performance criteria for critical thinking:

The development of critical thinking and problem solving skills is an expected outcome of a four-year university education. Skills in these areas allow students to become knowledgeable thinkers and users of information as well as responsible participants in decision making at personal, community, and professional levels. Critical thinking and problem solving skills allow students to take charge of their own thinking.

Expectation: Graduates will be able to find information, evaluate its merits, and apply it appropriately to understand, evaluate, resolve, and act. These expectations may be developed and met in a variety of courses across the general education and program specific curricula. Knowledge and skill in scientific and mathematical reasoning, understanding research methods of science and social science, evaluation and critiquing works of literature, art, and music all develop skills in critical thinking.

Criteria for Assessment: Students will be able to

1. Identify and explain the problem/question/issue.
2. Recognize stakeholders and contexts (e.g., cultural/social, educational, technological, political, scientific, economic, ethical, personal experience).
3. Frame personal responses and/or acknowledge other perspectives.
4. Identify and evaluate assumptions.
5. Identify and evaluate evidence.
6. Identify and evaluate implications, conclusions, and consequences.

As noted above, these performance criteria were used for both the institution and program assessment activities described in this report.

Collection of student work samples

The Executive Committee of the Assessment Commission worked with the instructors of HUM 125, PHIL 331 and WRI 122 to collect ungraded, final student papers at the end of winter term 2008. These papers were assessed during the early part of the spring 2008 term. The Commission provided the instructors with information flyers and the critical thinking rubric for distribution to students, as shown in Appendices A and B respectively.

Data scoring

A cadre of trained faculty members scored all of the student papers using the rubric shown in Appendix B, which was selected by the Executive Committee of the Assessment Commission. Training for faculty was provided by two faculty members from the Executive Committee. The trainers provided exemplars of student work at various proficiency levels on the rubric. Approximately 25 percent of the papers from each course were scored by two faculty members to ensure inter-rater reliability. Those papers with significantly different ratings by two readers were read a third time by the trainers for a final decision on scoring. In each case, the trainers decided which of the two scores to include for data analysis purposes.

Data elements

The data elements collected in this assessment process included:

- Student ID
- Student Name
- Major
- Subject, course number, and section number (e.g., WRI 122-1)
- Course reference number (CRN)
- Criteria one score, criteria two score, etc.
- For 25% of papers in each course, second rater criteria one score, second rater criteria two score, etc.

Assessment results for critical thinking papers

Overall results

The Executive Committee recognized that assessment of critical thinking through a writing task may affect the measurement of critical thinking in a pure sense. Although the faculty who assessed the student papers were cautioned to only assess critical thinking skills, and not writing skills, the faculty found this to be a challenge in some cases. Assessment of critical thinking is commonly accomplished through writing tasks, however, and writing is generally considered appropriate for examining this broad learning outcome. The weaknesses in student performance identified in this assessment are quite clear, from both the quantitative results and the faculty reflections after reading the papers.

In this assessment, 76% of the 194 students assessed were freshmen and sophomores. There were juniors and seniors in all of the classes involved, but they were most concentrated in PHIL 331. Class level is determined by total credit hours earned, rather than the student's progress in a particular curriculum.

As expected, the results indicate that students in HUM 125, PHIL 331, and WRI 122 have developed some proficiency, but not mastery, in critical thinking. As shown in Table 1 below, approximately half of the 194

students demonstrated proficiency or high proficiency in identifying or explaining the problem, recognizing stakeholders and contexts, examining perspectives, and summarizing implications. Less than half were able to identify underlying assumptions and evaluate associated evidence. Only 21% of the students were able to demonstrate proficiency or high proficiency for all performance criteria.

Proficiency Level	Problem	Context	Perspective	Assumptions	Evidence	Implications	Overall*
Percent with proficiency	46.9%	42.3%	34.5%	27.8%	29.9%	39.7%	
Percent with high proficiency	20.1%	8.2%	14.9%	5.7%	12.9%	9.3%	
Percent with proficiency or high proficiency	67%	51%	49%	34%	43%	49%	21%*

Table 1. Overall proficiency levels in critical thinking.

*Percent of students performing at proficiency or high proficiency for all criteria.

Faculty reflections on critical thinking papers

The faculty who assessed these student papers echoed the results above in their reflections at the end of the assessment. These reflections are included in Appendix C and are discussed below.

Faculty felt students were generally able to identify the problem or issue, but needed to do so with a higher level of quality and clarity, and with less superficiality. One faculty member commented that “Most students were able to focus on important issues and to discuss the issues in some detail. Fewer were able to identify embedded or implicit issues.” Another faculty member noted that students had a “strong ability to articulate [the] problem, usually in [the] first paragraph. Sometimes students only identified a superficial problem, clearly blinded by their own biased point of view (i.e., immigration, guns).”

The faculty observed that students had difficulty in recognizing and acknowledging multiple stakeholders and contexts. One faculty member stated that “Students struggled with identifying stakeholders and placing those stakeholders in a context. Most students wanted to see issues as black and white.” A second faculty member added that “when stakeholder or context provided, link to problem often implied rather than explicit.”

As to recognizing perspectives, one faculty member commented that “Students seemed to have some difficulty effectively addressing other perspectives. I think this concept of fairly balancing your own perspective with those of others is an important one. Some students had difficulty making their own perspective clear.” Another faculty member noted that “if they could place stakeholders in context, they could generally articulate a point of view and address concerns from others with differing view points.”

Recognizing that assumptions exist, and then identifying and evaluating underlying assumptions proved to be the most difficult area for the students in the sample. One faculty member noticed that “. . . a lot of students make assumptions without evaluating them. They just use them as a basis for their argument. Example: ‘Genetically engineered foods are bad.’ ” Another faculty member added that “using personal opinions without evaluation of plausibility or clarity was [a] problem for some.”

With regard to citing evidence, one faculty member wrote that “Many times evidence is given haphazardly and without an evaluation. Students seemed to give a lot of evidence, but did not seem to compare evidence on

opposite sides of an argument. I most often saw just a list of evidence and citations.” A second faculty member noticed that “most authors presented evidence, but often they failed to evaluate it rigorously. Some assumed that being published meant being valid. Many didn’t cite their evidence very well, so the reader wasn’t able to evaluate the support either.”

Finally, numerous faculty members commented on the tendency of students in the sample to “run out of gas” when it came time to evaluate implications, conclusion, and consequences. One faculty member commented that “Many authors gave brief conclusions or implications, but few thoroughly discussed implications, conclusions, and consequences considering contexts, data, and evidence.”

Analysis by course

PHIL 331 students performed at a higher level of proficiency than both HUM 125 and WRI 122 students, as shown in Table 2 below. The students in PHIL 331, however, were primarily juniors and seniors, while those in HUM 125 and WRI 122 were primarily freshmen and sophomores. It also should be noted that students in PHIL 331 work in groups and have the opportunity to submit their papers for evaluation and feedback one or more times before the final version is submitted. This is not the case for HUM 125 and WRI 122 classes.

Proficiency Level	Problem	Context	Perspective	Assumptions	Evidence	Implications	Overall*
HUM 125							
Percent with proficiency	42.6%	38.3%	44.7%	21.3%	17.0%	38.3%	
Percent with high proficiency	19.1%	10.6%	8.5%	12.8%	21.3%	6.4%	
Percent with proficiency or high proficiency	61.7%	48.9%	53.2%	34.1%	38.3%	44.7%	14.9%*
PHIL 331							
Percent with proficiency	60.0%	84.0%	48.0%	60.0%	76.0%	68.0%	
Percent with high proficiency	40.0%	16.0%	32.0%	0.0%	24.0%	32.0%	
Percent with proficiency or high proficiency	100%	100%	80.0%	60.0%	100.0%	100.0%	60.0%*
WRI 122							
Percent with proficiency	45.9%	35.2%	27.9%	23.8%	25.4%	34.4%	
Percent with high proficiency	16.4%	5.7%	13.9%	4.1%	7.4%	5.7%	
Percent with proficiency or high proficiency	62.3%	40.9%	41.8%	27.9%	32.8%	40.1%	15.6%*

Table 2. Proficiency levels by course.

*Percent of students performing at proficiency or high proficiency for all criteria.

Analysis by class level

The Executive Committee examined results by class level, both with and without the data for PHIL 331 included. Table 3 below shows the results with PHIL 331 scores excluded.

Level	Problem	Context	Perspective	Assumptions	Evidence	Implications	Overall*
Freshmen, % at proficiency or high proficiency, n=112	64.3%	40.2%	41.9%	22.4%	27.7%	34.0%	12.5%
Sophomore, % at proficiency or high proficiency, n=34	50.0%	44.1%	47.0%	35.3%	35.3%	53.0%	14.7%
Junior, % at proficiency or high proficiency, n=12	83.3%	50.0%	66.7%	58.3%	66.7%	58.3%	33.3%
Senior, % at proficiency or high proficiency, n=11	54.6%	63.7%	45.5%	54.6%	63.7%	63.6%	27.3%

Table 3. Proficiency levels by class, excluding PHIL 331.

*Percent of students performing at proficiency or high proficiency for all criteria.

As expected, juniors and seniors performed more strongly than freshmen and sophomores in either case. The committee determined that additional study of student performance at the upper-division level is needed, however, due to process issues in the study. As noted above, the upper-division students in PHIL 331 completed the writing assignment under different circumstances than the HUM 125 and WRI 122 students did. Also, it is unusual for juniors and seniors to take HUM 125 and WRI 122, so their results may not be representative for all upper-division students. In addition, the assessment done for upper-division students at the program level, discussed below, was also dissimilar. The committee plans to conduct a second assessment in 2008-09 using the same assignment, student prompt, and trained faculty assessors, in order to look at upper-division performance in a more comparable manner.

Analysis by major

This study of critical thinking included a broad representation of student majors. Because of small sample sizes for each major, however, the Executive Committee was reluctant to draw conclusions about differences between majors. This was also the case when the committee clustered the majors into four broad areas—arts and sciences, health technologies, engineering, and management.

Analysis by high school grade point average, SAT scores, and age

The Executive Committee examined levels of significance for the performance criteria versus several independent variables, as shown in Table 4 below.

Independent Variables	Problem	Context	Perspective	Assumptions	Evidence	Implications	Overall*
High school grade point average	.807	.557	.670	.022	.155	.278	.512
SAT writing	.006	.121	.010	.144	.159	.013	.261
SAT math	.085	.413	.245	.110	.058	.100	.298
SAT verbal	.001	.437	.104	.433	.244	.005	.434
Age	.506	.162	.357	.023	.085	.024	.024

Table 4. *p* values for performance criteria cross tabulated with independent variables.

The shaded cells indicate that, in some cases, an independent variable was a good predictor of performance on a particular performance criteria ($\alpha = .05$). For example, SAT writing and verbal scores are good predictors of the student's ability to formulate or identify the problem or issue in the assigned essay. While the committee noted these predictors, they did not draw significant conclusions from the data in terms of action steps for the future.

Petition to Graduate data on critical thinking

As an indirect measure of critical thinking, the Executive Committee collected data from graduating seniors on their level of learning on the institutional student learning outcomes (ISLOs), one of which is critical thinking. On a scale of 5 (1 being "none" and 5 being "exceptional"), graduating seniors rate their level of learning in critical thinking at 4.2, or "substantial." The 4.2 rating is highest among all of the ISLO ratings for 2007-08, equaled only by two other ISLOs—professionalism and lifelong learning. It should be noted, however, that these graduating seniors were not provided with a definition of the performance criteria used in this study of critical thinking when they completed the survey, nor were they likely to have completed assignments using these new criteria. The data for the Petition to Graduate ISLO Survey are included in the Assessment Office records of this study, for future reference.

IDEA Center data on critical thinking

As a second indirect measure of critical thinking, the Executive Committee examined IDEA Center evaluations on critical thinking for fall 2007 and winter 2008 terms. Since this new faculty evaluation system was just implemented this year, the Executive Committee felt that our general understanding and use of this new system is not yet mature. Therefore, our ability to draw meaningful conclusions from the summary data is limited. The data from these evaluations are included in the Assessment Office records of this study, for future reference.

Program level assessment

Description of assessment

In addition to the institutional level assessment described above, the Assessment Commission provided tools to departments for assessment of critical thinking at the program level. These tools included:

- The definition of critical thinking
- The critical thinking rubric
- Instructions on selecting the activity and conducting the assessment.
- An assessment score sheet
- An assessment summary sheet

The Assessment Commission asked assessment coordinators to report their program summary results using the six performance criteria listed in the Critical Thinking Definition and Performance Criteria section above. Assessment coordinators listed the percent of students performing at proficiency or high proficiency on each of the six criteria, as well as the percent of students performing at proficiency or higher *overall* on all six criteria. The coordinators selected a wide variety of critical thinking activities, such as issues papers, lab exercises, and case studies. The data are summarized in Appendix D. Detailed records on program assessment of critical thinking, including a description of the student activity, score sheets, and program summaries, can be viewed in the Assessment Office records for this study.

Discussion of results

The assessment of critical thinking at the program level involved a wide variety of student work at the upper-division level. While a direct comparison of these activities cannot be made to the assessment of the critical thinking papers at the institutional level, the data for the program assessments appear to echo the institutional results. In general, upper-division OIT students have developed some proficiency, but not mastery, in critical thinking, as defined by the performance criteria. The results were uneven and weaker than expected overall.

As noted in the Assessment Results for Critical Thinking Papers section, the Executive Committee would like to explore further the performance of upper-division students using a similar writing task, assignment prompt, and assessment by trained faculty. In this way, a more direct comparison can be obtained.

Recommendations from the Executive Committee

The Executive Committee, after reviewing the results of the assessment on critical thinking, recommends that:

- Instructors for HUM 125 and WRI 122 classes place more specific emphasis on the performance criteria used for critical thinking, in particular those for identifying and evaluating assumptions, and identifying and evaluating evidence. Further, after having done so, the committee recommends that OIT re-assess student performance in these classes.
- The Executive Commission collaborate with volunteer instructors from each area of the college (arts and sciences, engineering, health, management) to more carefully assess upper-division performance in critical thinking, using a similar writing assignment, prompt, and assessment method.
- The Executive Committee of the Assessment Commission lead a faculty discussion about the results from this assessment and solicit suggestions for improvement of student performance in critical thinking at both lower- and upper-division levels.
- The Commission on College Teaching offer interested faculty a workshop focusing on the incorporation of critical thinking in instructional methods.
- The Executive Committee provide additional training on the performance criteria for both the instructors of the classes to be re-assessed in 2008-09 and the faculty who will perform the assessment of the student work in these classes.

Appendix A
Student Information for Critical Thinking Assessment

OIT Assessment Commission
Assessment of Critical Thinking
2007-08



In order for OIT to assess and improve its academic programs, regular measurements of students' perceptions and intellectual growth must be obtained. During the winter and spring 2008 terms, the OIT Assessment Commission will examine final papers in several OIT classes to assess student learning in the area of critical thinking.

The OIT Assessment Commission requests that you submit two copies of your paper to your instructor. One copy will be submitted to be graded by your instructor for your class assignment, and the second copy will be submitted to be assessed separately by the commission. It is not necessary to submit the second copy in a report binder; simply staple the report together.

As detailed in the rubric on the back of this page, the following critical thinking criteria will be used by the commission to evaluate your paper:

- Did you identify and explain the problem/question/issue?
- Did you recognize stakeholders and contexts (e.g., cultural, social, educational, technological, political, scientific, economic, ethical, personal experience)?
- Did you frame your personal response and/or acknowledge other perspectives?
- Did you identify and evaluate assumptions?
- Did you identify and evaluate evidence?
- Did you identify and evaluate implications, conclusions, and consequences?

The Assessment Commission will use your paper for assessment purposes only and will hold it in strict confidentiality. The commission's evaluation of your paper will not affect the grade you receive for the paper. Reports from this assessment activity will use summary data only and will not identify individual student names or work.

Appendix B:
ISLO #4 Critical Thinking Rubric (adapted from NE Ill University): Approved 11-02-07

Criteria/Quality	No/Limited Proficiency (1)	Some Proficiency (2)	Proficiency (3)	High Proficiency (4)	Rating (1, 2, 3, 4 pts)
1. Identifies and explains problem/question/issue	Fails to identify, summarize, or explain the main problem or question. Represents the issues inaccurately or inappropriately.	Identifies main issues but does not summarize or explain them clearly or sufficiently.	Successfully identifies and summarizes the main issues, but does not explain why/how they are problems or create questions.	Clearly identifies and summarizes main issues and successfully explains why/how they are problems or questions; and identifies embedded or implicit issues, addressing their relationships to each other.	
2. Recognizes stakeholders and contexts (i.e., cultural, social, educational, technological, political, scientific, economic, ethical, personal experience)	Fails accurately to identify and explain any empirical or theoretical contexts for the issues. Presents problems as having no connections to other conditions or contexts.	Shows some general understanding of the influences of empirical and theoretical contexts on stakeholders, but does not identify any specific ones relevant to situation at hand.	Correctly identifies all the empirical and most of the theoretical contexts relevant to all the main stakeholders in the situation.	Not only correctly identifies all the empirical and theoretical contexts relevant to all the main stakeholders, but also finds minor stakeholders and contexts and shows the tension or conflicts of interest among them.	
3. Frames personal responses and/or acknowledges other perspectives	Fails to formulate and clearly express own point of view, (or) fails to anticipate objections to his/her point of view, (or) fails to consider other perspectives and position.	Formulates a vague and indecisive point of view, or anticipates minor but not major objections to his/her point of view, or considers weak but not strong alternative positions.	Formulates clear and precise personal point of view concerning the issue, and seriously discusses its weaknesses as well as its strengths.	Not only formulates a clear and precise personal point of view, but also acknowledges objections and rival positions and provides convincing replies to these.	
4. Evaluates assumptions	Fails to identify and evaluate any of the important assumptions behind the claims and recommendations made.	Identifies some of the most important assumptions, but does not evaluate them for plausibility or clarity.	Identifies and evaluates all the important assumptions, but not the ones deeper in the background—the more abstract ones.	Not only identifies and evaluates all the important assumptions, but also some of the more hidden, more abstract ones.	
5. Evaluates evidence	Fails to identify data and information that counts as evidence for truth-claims and fails to evaluate its credibility.	Successfully identifies data and information that counts as evidence but fails to thoroughly evaluate its credibility.	Identifies all important evidence and rigorously evaluates it.	Not only identifies and rigorously evaluates all important evidence offered, but also provides new data or information for consideration.	
6. Evaluates implications , conclusions, and consequences.	Fails to identify implications, conclusions, and consequences of the issue, or the key relationships between the other elements of the problem, such as context, assumptions, or data and evidence.	Suggests some implications, conclusions, and consequences, but without clear reference to context, assumptions, data, and evidence.	Identifies and briefly discusses implications, conclusions, and consequences considering most but not all the relevant assumptions, contexts, data, and evidence.	Identifies and thoroughly discusses implications, conclusions, and consequences, considering all relevant assumptions, contexts, data, and evidence.	

Appendix C

Faculty Reflections on Critical Thinking Papers

The faculty who assessed critical thinking papers on 4/5/08 offered the following reflections on student learning, grouped by performance criteria for critical thinking:

1. Identifies and explains problem/question/issue

- Most students were able to focus on important issues and to discuss the issues in some detail. Fewer were able to identify embedded or implicit issues.
- This and “#5 evaluates evidence” are the strongest qualities among the essays I read.
- Most papers—general problem/topic identified—usually not well developed. When identifying main issues, usually listed rather than explained.
- Not direct enough. Many papers try to cover too many sides and have difficulty landing on a single issue.
- Strengths: most did identify a problem/issue. Weakness: some could not clearly isolate or identify the issue.
- OIT seems to be doing this well. Students were generally able to identify and explain the problem or issue.
- Strong ability to articulate problem, usually in first paragraph. Sometimes students only identified a superficial problem, clearly blinded by their own biased point of view (i.e., immigration, guns).
- Few students had a clear, concise problem statement. Good rubric.
- Most papers seem to explain the problem quite well. I think that it would be better for some students if they had stated the problem at the beginning and a little more concisely.

2. Recognizes stakeholders and contexts

- Some papers spent more time on background and context than on the main arguments. Few discussed minor stakeholders or theoretical contexts.
- The concept of stakeholders is important but often under-recognized by students. I would like to further emphasize stakeholders in my future writing classes. I still find contexts to be a little slippery as a concept. We want students to consider different approaches to an issue but many will not apply (maybe critical thinking requires figuring which do).
- Usually identify 1 or 2 stakeholders, but generally lacking empirical or theoretical context. When stakeholder or context provided, link to problem often implied rather than explicit.
- Many authors did not consider opposing arguments when framing the problem or issue.
- Can be difficult to see all contexts.
- Students struggled with identifying stakeholders and placing those stakeholders in a context. Most students wanted to see issues as black and white.
- It was much more difficult for some students to see multiple perspectives clearly. Students who were able to fully provide context were clearly hardworking and had done their homework. Those who couldn't were perhaps submitting a first draft.
- In general, students had some degree of proficiency in this metric. Rating 4 is unrealistic for most undergrad work.
- The students usually recognize the important stakeholders.

3. Frames personal responses and/or acknowledges other perspectives

- Most authors framed a clear personal response and acknowledged other perspectives. Frequently, however, the other perspectives were given short shrift. Some recognized opposing views but didn't provide adequate rebuttals to them.
- Students seemed to have some difficulty effectively addressing other perspectives. I think this concept of fairly balancing your own perspective with those of others is an important one. Some students had difficulty making their own perspective clear.
- Generally included statement of own perspective. Most fail to successfully present other perspectives. No discussion of strengths and weaknesses of P.O.V.
- Few papers were direct and to the point. Sometimes had to read several times to infer perspective. Seemed that many times the perspective was not supported by assumptions and evidence.
- Acknowledging others' perspectives seemed to be difficult for many.
- Seemed to be a correlation with #2. If they could place stakeholders in context, they could generally articulate a point of view and address concerns from others with differing view points.
- Some students defined the problem so abstractly that it was hard to see what their personal point of view was. Perhaps they had too global a perspective.
- Good rubric.
- Other perspectives are acknowledged and often explained. I would like to see more discussion about the pros and cons of each side. The way that many papers are written seems to lack much confrontation between two points of view. The evidence is often listed for both sides and it is left at that.

4. Evaluates assumptions

- The authors I read tended to have trouble recognizing or evaluating underlying assumptions.
- As we discussed in the training, this is a difficult one for students to get. It might help to explicitly ask for it more in assignments.
- Generally, do not clearly identify assumptions as such. Implied assumptions presented—not necessarily evaluated. Or presented inaccurately or superficially (“straw men”).
- Using personal opinions without evaluation of plausibility or clarity was problem for some.
- Difficult to assess and difficult for students to grasp. Maybe something we should work on more.
- Very difficult to evaluate.
- Noticed that a lot of students make assumptions without evaluating them. They just use them as a basis for their argument. Example: “Genetically engineered foods are bad.”

5. Evaluates evidence

- Most authors presented evidence, but often they failed to evaluate it rigorously. Some assumed that being published meant being valid. Many didn't cite their evidence very well, so the reader wasn't able to evaluate the support either.
- Most of the evaluation of evidence came from comparing one source to another, which is a good way to do it, but I would like to see a little more questioning of sources individually.
- Generally do not address credibility of sources—left to reader/do not discuss influence of bias in source. Even when using evidence—still make lots of statements without supporting evidence.
- Most did good job of citing sources. Some just gave personal opinions with no support.
- Seems to be either really good or really horrible. Need more evaluative skills.
- Rating 4 is not appropriate in most undergrad cases.

- Many times evidence is given haphazardly and without an evaluation. Students seemed to give a lot of evidence, but did not seem to compare evidence on opposite sides of an argument. I most often saw just a list of evidence and citations.

6. Evaluates implications, conclusions, and consequences

- Many authors gave brief conclusions or implications, but few thoroughly discussed implications, conclusions, consequences considering contexts, data, and evidence.
- Sometimes students ran out of gas at the end.
- Most papers include clear statement of conclusion. Some reiterate the main points of papers. Few extend discussion into areas of implications and consequences.
- Generally good—some “ran out of steam.”
- Students seem to run out of steam.
- OK
- The conclusions that I read were fairly good, but sometimes they still show lack of real support for their position. Again, many of the papers seem to be about “two ships passing in the night.”

Appendix D
Program Assessment Results on Critical Thinking
Percent of students performing at proficiency level or higher in critical thinking

Program	<i>n</i>	Problem	Context	Perspective	Assumptions	Evidence	Implications	Overall
Biology (critical thinking paper)	7	86%	86%	71%	71%	57%	86%	43%
Civil Engineering (critical thinking paper)	14	43%	57%	50%	36%	21%	36%	7%
Communication Studies (final theory paper)	10	80%	100%	70%	70%	70%	80%	70%
Computer Engineering Technology (Engineering lab exercise)	7	100%	71%	71%	86%	71%	86%	57%
Dental Hygiene-B.S. Degree (Controversial paper)	24	75%	83%	42%	54%	38%	29%	8%
Diagnostic Medical Sonography (Case study)	14	100%	88%	88%	100%	100%	94%	78%
Echo Degree Completion (Case study)	10	90%	90%	80%	80%	80%	90%	80%
Electronics Engineering Technology (Engineering lab exercise-EET 368)	6	100%	100%	60%	80%	20%	100%	20%
(Engineering quiz-EET 331)	8	75%	88%	75%	88%	75%	63%	50%
Environmental Sciences (Bioregion assessment)	8	100%	88%	n/a	88%	75%	88%	63%
General Education Science (Poster presentation)	36	75%	47%	42%	42%	22%	72%	8%
Social Science (paper)	15	47%	60%	53%	33%	20%	40%	7%
Geomatics-GIS (Boundary project-GIS 316)	6	83%	100%	n/a	100%	n/a	100%	83%
Geomatics-Surveying (Controversial paper-GIS 434)	10	100%	80%	70%	70%	60%	80%	60%
(Critical thinking paper-GIS 466)	11	100%	91%	91%	82%	82%	73%	73%
Management-Marketing, Small Bus & Operations Management (Senior project report)	8	100%	100%	n/a	88%	100%	100%	100%
(Business research paper)	12	100%	100%	n/a	0%	0%	100%	0%
(Business research paper-online)	11	73%	91%	n/a	64%	18%	73%	9%

Program	<i>n</i>	Problem	Context	Perspective	Assumptions	Evidence	Implications	Overall
Nuclear Medicine Technology (Lab practical)	15	100%	100%	100%	93%	100%	73%	67%
Respiratory Care AAS (Critical thinking paper)	17	76%	41%	53%	35%	12%	24%	6%
Software Engineering Technology (Critical thinking paper)	15	80%	93%	80%	73%	53%	80%	40%
Vascular Degree Completion (Case study)	7	100%	71%	86%	86%	100%	100%	57%
Vascular Technology (case study)	21	57%	52%	n/a	57%	29%	33%	29%