Chemistry
FELO Data for 1d and 1e: FA2020-SP2021

Learning Outcome: FELO 1d. Critical Thinking
Students will be able to examine, critique and synthesize information in order to arrive at reasoned conclusions.

Outcome Measure: This outcome will be measured yearly via direct, summative assessment using CHE 1002 Signature Assignment: "Eggs & Critical Thinking Assessment".

Students are assessed on their ability to:
1. Explain: When presented with a problem / issue, are you able to clearly explain the problem, delivering the relevant information necessary to reflect your understanding of the problem?
2. Investigate: When working with the problem / issue, are you able to select and interpret / evaluate the information and develop an analysis or synthesis?
3. Evaluate: As you work with the problem / issue, are you able to methodically analyze your own assumptions, and the information provided by others, to present an informed position / analysis on the problem / issue?
4. Hypothesize: When asked to form a hypothesis, do you consider the complexities of the issue, acknowledge given facts, and present a perspective for further investigation?
5. Draw Conclusions: Are you able to place evidence and perspective to the problem / issue and your investigation of the situation and present logical consequences / implications / conclusions?

Criteria for Success: At least 70% of the students will score at an average of level 3 or higher on the AACU critical thinking rubric (in each of the 5 categories).

Longitudinal Data:

	3 or higher on the AACU critical thinking rubric	
	Summer 2020	**Spring 2021**
Number of students	n=26	n=17
category 1 (Explain)	89%	56%
category 2 (Investigate)	100%	61%
category 3 (Evaluate)	81%	44%
category 4 (Hypothesis)	69%	78%
category 5 (Draw Conclusions)	93%	89%

Conclusions Drawn from Data: We have now used this assessment tool for the second time since this course has been offered (we switched from assessing FELO 1e to FELO 1d since the content is not quantitative in nature). The students in CHE 1002 met the criteria for critical thinking in all 5 categories except for the 4th category (hypothesis) in summer 2020 but did not meet the criteria in explain, investigate and evaluate for the Spring 2021. Since this was

assessed towards the end of the semester through an online quiz and right before finals week, it is likely that some students did not take it very seriously thus explaining the low percentages.

Changes to be Made Based on Data: We will continue to use these questions for summative assessment and try to collect more data before trying to make changes because it is quite challenging to draw reliable conclusion from only two data points. However, one change we hope to make it make sure this is offered at a time that allows for students to perform well.

Rubric Used: The following critical thinking value rubric was used.

Criteria	Ratings					Pts
1- Explanation of issues	**4.0 pts** **Capstone** Issue/problem to be considered critically is stated clearly and described comprehensively, delivering all relevant information necessary for full understanding.	**3.0 pts** **Milestone 3** Issue/problem to be considered critically is stated, described, and clarified so that understanding is not seriously impeded by omissions.	**2.0 pts** **Milestone 2** Issue/problem to be considered critically is stated but description leaves some terms undefined, ambiguities unexplored, boundaries undetermined, and/or backgrounds unknown.	**1.0 pts** **Benchmark** Issue/problem to be considered critically is stated without clarification or description.	**0.0 pts** **No Marks**	4.0 pts
2-Evidence/ Investigate	**4.0 pts** **Capstone** Information is taken from source(s) with enough interpretation/evaluation to develop a comprehensive analysis or synthesis. Viewpoints of experts are questioned thoroughly.	**3.0 pts** **Milestone 3** Information is taken from source(s) with enough interpretation/evaluation to develop a coherent analysis or synthesis. Viewpoints of experts are subject to questioning.	**2.0 pts** **Milestone 2** 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 questioning.	**1.0 pts** **Benchmark** Information is taken from source(s) without any interpretation/evaluation. Viewpoints of experts are taken as fact, without question.	**0.0 pts** **No Marks**	4.0 pts

3-Influence of context and assumptions/ Evaluate	**4.0 pts** **Capstone** Thoroughly (systematically and methodically) analyzes own and others' assumptions and carefully evaluates the relevance of contexts when presenting a position.	**3.0 pts** **Milestone 3** Identifies own and others' assumptions and several relevant contexts when presenting a position.	**2.0 pts** **Milestone 2** Questions some assumptions. Identifies several relevant contexts when presenting a position. May be more aware of others' assumptions than one's own (or vice versa).	**1.0 pts** **Benchmark** Shows an emerging awareness of present assumptions (sometimes labels assertions as assumptions). Begins to identify some contexts when presenting a position.	**0.0 pts** **No Marks**	4.0 pts
4-Student's position (perspective, thesis/hypothesis)/ Hypothesize	**4.0 pts** **Capstone** 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).	**3.0 pts** **Milestone 3** Specific position (perspective, thesis/hypothesis) takes into account the complexities of an issue. Others' points of view are acknowledged within position (perspective, thesis/hypothesis).	**2.0 pts** **Milestone 2** Specific position (perspective, thesis/hypothesis) acknowledges different sides of an issue.	**1.0 pts** **Benchmark** Specific position (perspective, thesis/hypothesis) is stated, but is simplistic and obvious.	**0.0 pts** **No Marks**	4.0 pts

5- Conclusions and related outcomes (implications and consequences)/ Draw conclusions	**4.0 pts** **Capstone** 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.	**3.0 pts** **Milestone 3** Conclusion is logically tied to a range of information, including opposing viewpoints; related outcomes (consequences and implications) are identified clearly.	**2.0 pts** **Milestone 2** Conclusion is logically tied to information (because information is chosen to fit the desired conclusion); some related outcomes (consequences and implications) are identified clearly.	**1.0 pts** **Benchmark** Conclusion is inconsistently tied to some of the information discussed; related outcomes (consequences and implications) are oversimplified.	**0.0 pts** **No Marks**	4.0 pts

Learning Outcome: FELO 1e. Quantitative Reasoning

Students will be able to solve problems that are quantitative in nature.

Outcome Measure: Problems on the final exam that are quantitative in nature.

CHE101 / 1001 Chemistry and Society
CHE103 / 1003 Introduction to General, Organic, and Biological Chemistry
CHE152 / 1052 General Chemistry I
PSC110 Physical Science (chemistry portion)
PSC111 / 1014 Physical Science for Teachers (chemistry portion)

Criteria for Success: At least 70% of students will score 3 or higher.

Longitudinal Data:

CHE1001 (formerly CHE101)

	Assessment Data for FELO 1e. Quantitative Reasoning							
	Spring 2017	**Spring 2018**	**Fall 2018**	**Spring 2019**	**Fall 2019**	**Spring 2020**	**Fall 2020**	**Spring 2021**
Number of students	n=17	n=19	n=20	n=20	n=19	n=20	n=18	n=19
Percentage	88.2%	57.9%	50.0%	55.0%	47.4%	75.0%	77.8%	55.0%

CHE1003 (formerly CHE103)

	Assessment Data for FELO 1e. Quantitative Reasoning								
	Spring 2017	**Fall 2017**	**Spring 2018**	**Fall 2018**	**Spring 2019**	**Fall 2019**	**Spring 2020**	**Fall 2020**	**Spring 2021**
Number of students	n=20	n=30	n=20	n=40	NA	n=29	n=20	n=33	n=19
Percentage	85.0%	86.7%	65.0%	90.0%	NA	89.7%	90.0	90.9%	47.4%

*No assessment data for FELO 1e in CHE103 Spring 2019, due to changes made to final exam.

CHE1052 (formerly CHE152)

	Assessment Data for FELO 1e. Quantitative Reasoning						
	Fall 2014	**Fall 2015**	**Fall 2016**	**Fall 2017**	**Fall 2018**	**Fall 2019**	**Fall 2020**
Number of students	n=40	n=48	n=55	n=51	n=52	n=48	n=47
Percentage	80.0%	79.2%	89.1%	84.3%	96.2%	83.0%	76.6%

PSC1014 (formerly PSC110 & PSC111)

	Assessment Data for FELO 1e. Quantitative Reasoning							
	Fall 2015	**Spring 2016**	**Fall 2016**	**Spring 2017**	**Fall 2017**	**Fall 2018**	**Fall 2019**	**Fall 2020**
Number of students	n=20	n=20	n=20	n=18	n=20	n=19	n=20	n=20
Percentage	55.0%	95.0%	95.0%	94.4%	90.0%	63.2%	85.0%	70.0%

Conclusions Drawn from Data: FELO 1e (quantitative reasoning) is assessed in 4 of our 5 chemistry FE courses. For General Chemistry I (CHE 1052), our criteria for success were met with ease (average 84% over 7 years) however, for Chemistry and Society (CHE 1001), the criteria for success (70%) were only met for only 3 out of 8 times. This is concerning and we believe that part of the lack of success can be attributed to the adjunct teaching the course and part of it could be due to the assessment tool we used. Regarding PSC 1014 and CHE 1003, the criteria for success were met 75% of the time which is fairly good but could be improved.

Changes to be Made Based on Data: The chemistry department will meet at the beginning of the Fall 2021 semester to discuss how we assess our FE courses and whether or not the tools we are using are appropriate.

Rubric Used: The following scale was used.

	4	**3**	**2**	**1**
% of points earned on quantitative problems	80 – 100%	60 – 79%	40 – 59%	39% or lower