Chemistry

FELO Data for 1d and 1e: FA2019-SP2020

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 an 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
Number of students	N=
category 1 (Explain)	89%
category 2 (Investigate)	100%
category 3 (Evaluate)	81%
category 4 (Hypothesis)	69%
category 5 (Draw Conclusions)	93%

Conclusions Drawn from Data: This is the first time this assignment has been used for this learning outcome. The students in CHE 1002 met the criteria for critical thinking in all 5 categories except for the 4th category (hypothesis) in summer 2020.

Changes to be Made Based on Data: This is the first year we have used this assessment tool, and we are quite pleased with the outcome. We will continue to use these questions for summative assessment in this course and we will work toward helping students develop a better understanding of how to formulate a scientific hypothesis.

Rubric Used: The following critical thinking value rubric will be 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

Criteria	Ratings					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

Criteria	Ratings					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:

Course	Semester	N	% students score = 4	% students score = 3	% students score = 2	% students score = 1
CHE101	Spring 2015	22	45.5%	31.8%	13.6%	9.1%
CHE101	Spring 2016	20	45.0%	35.0%	0.0%	20.0%
CHE101	Spring 2017	17	52.9%	35.3%	5.9%	5.9%
CHE101	Spring 2018	19	15.8%	42.1%	31.6%	10.5%
CHE101	Fall 2018	20	10.0%	40.0%	20.0%	30.0%
CHE101	Spring 2019	20	25.0%	30.0%	15.0%	30.0%
CHE1001	Fall 2019	19	21.1%	26.3%	21.1%	31.6%
CHE1001	Spring 2020	20	55.0%	20.0%	15.0%	5.0%
CHE103	Fall 2014	26	73.1%	23.1%	3.8%	0%
CHE103	Spring 2015	16	50.0%	18.8%	25.0%	6.3%
CHE103	Fall 2015	24	80.8%	11.5%	3.8%	3.8%
CHE103	Spring 2016	19	63.2%	10.5%	15.8%	10.5%
CHE103	Fall 2016	34	73.5%	23.5%	0.0%	0.0%
CHE103	Spring 2017	20	50.0%	35.0%	15.0%	0.0%
CHE103	Fall 2017	30	80.0%	6.7%	13.3%	0.0%
CHE103	Spring 2018	20	45.0%	20.0%	25.0%	10.0%
CHE103	Fall 2018	40	82.5%	7.5%	2.5%	7.5%
CHE1003	Fall 2019	29	69.0%	20.7%	6.9%	3.5%

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CHE1003	Spring 2020	20	80.0%	10.0%	5.0%	0.0%
CHE152	Fall 2014	40	50.0%	30.0%	12.5%	7.5%
CHE152	Fall 2015	48	56.3%	22.9%	18.8%	2.1%
CHE152	Fall 2016	55	69.1%	20.0%	1.8%	9.1%
CHE152	Fall 2017	51	70.6%	13.7%	11.8%	3.9%
CHE152	Fall 2018	52	69.2%	26.9%	1.9%	1.9%
CHE1052	Fall 2019	48	61.7%	21.3%	14.9%	2.1%
PSC110	Fall 2014	22	40.9%	22.7%	13.6%	22.7%
PSC110	Spring 2015	22	45.5%	22.7%	22.7%	9.1%
PSC110	Fall 2015	20	40.0%	15.0%	25.0%	20.0%
PSC110	Spring 2016	20	80.0%	15.0%	0.0%	5.0%
PSC110	Fall 2016	20	65.0%	30.0%	5.0%	0.0%
PSC110	Spring 2017	18	88.9%	5.6%	5.6%	0.0%
PSC111	Fall 2017	20	65.0%	25.0%	10.0%	0.0%
PSC111	Fall 2018	19	31.6%	31.6%	26.3%	10.5%
PSC1014	Fall 2019	20	50.0%	35.0%	10.0%	1.0%

Course	**Semester**	**N**	**% students score 3 or higher**
CHE101	Spring 2015	22	77.3%
CHE101	Spring 2016	20	80.0%
CHE101	Spring 2017	17	88.2%
CHE101	Spring 2018	19	57.9%
CHE101	Fall 2018	20	50.0%
CHE101	Spring 2019	20	55.0%
CHE1001	Fall 2019	19	47.4%
CHE1001	Spring 2020	20	75.0%
CHE103	Fall 2014	26	96.2%
CHE103	Spring 2015	16	68.8%
CHE103	Fall 2015	24	92.3%
CHE103	Spring 2016	19	73.7%
CHE103	Fall 2016	34	100.0%
CHE103	Spring 2017	20	85.0%
CHE103	Fall 2017	30	86.7%
CHE103	Spring 2018	20	65.0%
CHE103	Fall 2018	40	90.0%
CHE1003	Fall 2019	29	89.7%
CHE1003	Spring 2020	20	90.0%
CHE152	Fall 2014	40	80.0%

CHE152	Fall 2015	48	79.2%
CHE152	Fall 2016	55	89.1%
CHE152	Fall 2017	51	84.3%
CHE152	Fall 2018	52	96.2%
CHE1052	Fall 2019	48	83.0%
PSC110	Fall 2014	22	63.6%
PSC110	Spring 2015	22	68.2%
PSC110	Fall 2015	20	55.0%
PSC110	Spring 2016	20	95.0%
PSC110	Fall 2016	20	95.0%
PSC110	Spring 2017	18	94.4%
PSC111	Fall 2017	20	90.0%
PSC111	Fall 2018	19	63.2%
PSC1014	Fall 2019	20	85.0%

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

Conclusions Drawn from Data: The criteria for success was met in 24 out of 34 of our FE courses during the 2014-2015 through 2019-2020 academic years. CHE101/1001 was above from 2015 – 2017, fell below in 2018 – 2019, and met the criteria for success again in Spring 2020. CHE103/1003 was lower for two semesters out of the last ten semesters with no directional trend. CHE152/1052 has met the criteria every semester. PSC110 was below the criteria for three semesters but has been much higher than the criteria for the last three semesters. PSC111/1014 has only been offered three times and two of those times have met the criteria.

Changes to be Made Based on Data: We will continue to keep an eye on the performance in these courses to determine if quantitative reasoning needs to be further developed.

Rubric Used: The following scale will be used.

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