Applying Critical Thinking to Chemistry Capstone CH4500 by using Controversial Topics

TANIA HOUJEIRY, PH.D.
SENIOR LECTURER
DEPARTMENT OF CHEMISTRY, COLLEGE OF SCIENCE
The main objectives for this course is to introduce students to the tools that help them:

1. Synthesize knowledge of all of their experiences in the chemistry curriculum;
2. Develop critical thinking to improve their creativity and problem solving skills; and
3. Develop literacy in some of the major scientific and technological challenges of the 21st century.

“Throughout this course I learned about the different research topics in Chemistry Department. I also learned to critically think. I think this was a great time in my college life to learn this” ~ Elyse (spring 2018)

“Thanks for a great semester of lecturers and thought-provoking projects!” ~ Luke (Spring 2019)
Course Syllabus

CHEMISTRY CAPSTONE
CH4500 – SPRING 2019

DR. TANIA HOUJERY
Email: TaHo@ResU.edu
Office hours: M, 7:00 am – 11:30 am and by appointment
Office: 307 Butler Hall

COURSE INFORMATION

MEETING TIME
1. This class meets every Monday and Wednesday from 3:00 pm to 4:25 pm.
2. The class is 2 hours and 45 minutes long.

COURSE OBJECTIVES

1. CH4500 is the Chemistry Capstone course intended for Chemistry majors in their final year of study. This course is part of the design "tracks" (CT) quality enhancement plan that focuses on critical thinking, a skill very real for your success in college and after your graduation. The main objective for the course is to integrate and synthesize the knowledge and skills acquired through the Chemistry curriculum. Students will critically evaluate the content and develop problem-solving skills, and defend their thesis in some of the major scientific and technological challenges of the 21st century.

LEARNING OUTCOMES

1. Students completing this course will be able to:
   1. Explain the basic principles of chemistry.
   2. Demonstrate knowledge of the chemical reactions.
   3. Apply this knowledge to solve real-world problems.
   4. Communicate effectively both orally and in writing.

CLASS ACTIVITIES

1. Attendance is required for each class session. Class participation and active participation in class discussions are required for each week. Participation in class discussions is a significant part of the course grade. The purpose of class discussions is to enhance critical thinking and problem-solving skills, and develop effective communication skills.

INDIVIDUAL JOURNALS:
   Each student is required to keep a journal during the term. The journal is meant to be a personal account of the course and should represent a continuing account of what interests, concerns, or otherwise provides you with insight into your thinking about course material. Journal entries should address the topics of the reading material. You are encouraged to include your own experiences and reactions to the course material. Each journal entry should:
   - Reflect critical thinking about the course material and the discussions held in class.
   - Show how well you understand the content.
   - Demonstrate a critical thinking about the topics covered.

RECOMMENDATIONS:
- Assignments for each week will be available the week before.
- Group presentations' rubric and guidelines will be available 2 weeks before they are due.
- Journals are generally due one week after the end of the week of the activity, exceptions will apply.

There are total of four individual journals assigned throughout the semester, each worth 20 points.
Course Activities

- Reading Papers
- Group Discussions
- Group Presentations
- Visiting Lecturers
- HW
- CV
Course Assessments

- personal journals
- Peer Evaluations
- Tests
- Guest Evaluations
Applying Critical Thinking

Applying Critical thinking in CH4500 was mainly through group presentations about controversial Topics
Spring 2018:

Clear expectations of the presentations

Introduction

Objective

Students evaluated their peer’s presentations:

Few comments:

• *Almost convinced*
• *10/10 solid arguments*
• *Great engagement*
• *Very well researched*
• *Awesome!!*

Grading rubric

<table>
<thead>
<tr>
<th>Grading Rubric</th>
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<tbody>
<tr>
<td><strong>Capstone</strong></td>
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<tr>
<td><strong>Milestone</strong></td>
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<tr>
<td><strong>Benchmark</strong></td>
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| Organization (specific introduction and conclusion, sequenced material within the body) | Excellent Clear and consistently observable, content is cohesive | Very good Clear and consistently observable | Is not observable in the presentation |
| Language                      | Compelling, imaginative, and memorable. Enhances the effectiveness of the presentation | Thoughtful and supports the effectiveness of the presentation | Unclear and minimally supports the effectiveness of the presentation |
| Supporting material (examples, explanations, statistics, analogies, illustrations, quotations) | Variety of types, make appropriate reference to information or analysis that supports the presentation | Two to three supporting material to establish the credibility of the presentation | Insufficient supporting material that minimally supports the presentation |
| Delivery (posture, eye contact, gesture, vocal expressiveness) | Compelling presentation and speakers appear polished and confident | Interesting presentation speakers appear confident | Detract from the understanding of the topic, speakers appear uncomfortable |

Total 35 25 15

Critical Thinking Assignment (April 11 2018)

Anti-vaccination movement has increased in the United States towards the end of the 19th century. Despite scientific agreement that vaccinations are safe and healthy, many people (including some scientists) believe that vaccinations (some or all) are unnecessary. People also believe vaccinations should not be mandatory and such laws violate civil rights and some religious rights.

(https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1123944/).

As a final project each group will present to the rest of the class (15-20 min presentation) a very compelling presentation about either the benefits of vaccination (you can pick any vaccination(s) you want to support) or the dangers of vaccinations (you can pick any example(s) you find). Both presentations should be supported by evidence (statistics, reports, YouTube videos, scientific articles, journal articles, and pseudoscience papers… anything you can logically use to defend your argument). Every presentation (10-15 slides) should use a critical thinking approach as prompted below:

- Gather, analyze and interpret relevant data presented in your resources to support your argument (vaccinations are important or not).
- Identify key problems (associated with using vaccines or not using vaccines).
- The possible alternatives.

The objective of this project is to establish a healthy discussion about a widely controversial topic as vaccination.
Spring 2019:

Introduction

Introducing the Dilemma

Clear expectations of the presentations

Objective

Critical Thinking Assignment (April 17, 2019)

Prescription drug prices in the United States are exceptionally higher than the drugs in most of the countries of the world. Furthermore, the United States government does not regulate or negotiate the prescription drug prices when they come into market. However, if the United States started regulating the prices of drugs, medications would become cheaper, which means Americans have more access to drugs but would also result in a decline in research and development of new drugs, since less money will be invested in drug discovery.

Here is the dilemma: Are you with lowering the prices of drugs knowing the risk of losing more of our innovation? or are you willing to keep the drug prices high for the sake of drug discovery and innovation?

As a final project each group will present to the rest of the class (15–20 min presentation) a very compelling presentation about either the benefits of keeping the prices of the drugs high and the freedom companies have over those prices or benefits of lowering the prescription drug prices, and the importance of the government control over those prices.

Both presentations should be supported by evidence (statistics, reports, YouTube videos, scientific articles, journal articles, and pseudoscience papers… anything you can logically use to defend your argument).

Every presentation (10-15 slides) should use a critical thinking approach as prompted below:

- Gather, analyze and interpret relevant data presented in your resources to support your argument.
- Identify key problems (associated with either increasing or lowering the prices).
- The possible alternatives.

The objective of this project is to establish a healthy discussion about a controversial topic.

Dr. Dominy (Guest) evaluated the presentations.
Sample of 2018 Presentations

ANTI
HTTPS://WWW.YOUTUBE.COM/WATCH?V=U8LVMTYHNL4&FEATURE=YOUTUBE

PRO
HTTPS://WWW.YOUTUBE.COM/WATCH?V=NNCPTXLCPE

Say No to Vaccines

James Scheuer, Javier Martinez, Shelby Hill, Mia Bowman

Vaccinations 101: "Debunking the Antivax Movement"
Matt Case (Vaccinated), James Rider, (Vaccinated),
Yuxuan Li (Vaccinated), and Kristopher Gross (Vaccinated)
Sample of 2019 Presentations

WITH KEEPING PRICES HIGH

WITH LOWERING PRICES

Global Impact from Lowering Drug Prices

Why do companies charge so much?

“The price of medicines is not determined by their research costs. Instead, it is determined by their value in preventing and treating disease.”

- Raymond Gilmartin, former CEO of Merck

- Make profit
  - Excuses:
    - Cost of research and development
    - Advertisement
    - Subsidize pharmaceutical costs in other countries