

Jesuit Education and Ignatian Pedagogy in Chemistry

Jesuit Education is a multi-faceted approach to forming students “intellectually, morally and spiritually, with rigor and compassion, toward lives of solidarity, service, and success.” (From the Xavier University Mission statement)

Jesuit Education has a number of goals that help fulfill the Mission of Xavier University:

- Develop the whole student – mind, body and spirit
- Values academic excellence
- Encourages lifelong learning
- Explores values and ethical issues, and examines the connection between faith and culture
- Encourages development of moral character
- Prepares and develops students for responsible living in a rapidly changing and diverse society
- Encourages critical, analytical and creative approaches to solving problems
- Incorporates global and international dimensions for growth and learning
- Inspires students to change society and the world for the better.

The goal of Ignatian Pedagogy is three-fold:

1. Ignatian pedagogy seeks to develop students of compassion.
2. Ignatian pedagogy seeks to develop students of competence.
3. Ignatian pedagogy seeks to develop students of conscience.

These three goals are implemented by teaching in a style that does the following:

1. realizes that each student is unique.
2. presents material in a way that is personally relevant and personally appropriated
3. employs a teaching plan that is systematic, sequential, and purposeful
4. encourages students to think for themselves and think about what is good for society, then make decisions that are wise and productive
5. contains challenging and rigorous course material
6. utilizes novel teaching methods
7. includes other disciplines as appropriate
8. sees the instructor as a role model
9. makes use of clear and specific methods of evaluation (assessment)
10. helps students speak and write well
11. views teaching as service.

As can be seen, the Ignatian model of education is far more than teaching the “3-R’s” and just passing students through a system. Ignatian education is student-centered, and is concerned with individual growth and development, not just academic success. Students who are exposed to a good college experience that is centered on the principles outlined above will be a force for good in a world that desperately needs young people who can make a difference. That is my goal as an educator.

Plan for Implementing Ignatian Teaching Strategies

For the 2005-2006 academic year, my goal has been to implement as many of the Ignatian pedagogical strategies as possible into my Chemistry in Society 2 course (taught in Spring semester). This outline was developed for that purpose:

Chemistry in Society 2 is an "Ethics, Religion in Society" (ERS) course, so there is much potential for implementing teaching strategies that allow students to contemplate how their decisions and actions affect not only themselves, but the community of which they are a part, and possibly beyond that community.

This course deals with several over-arching and inter-related topics: Energy, the Environment, Health (Diet and Exercise), poisons, pharmaceuticals (OTC and otherwise), and disposition of waste. During the course of the semester, several interactive research and brainstorming discussions will take place. These may include any of the following topics:

- What happens to your waste – the Mount Rumpke story
- How efficient is your car?
- How does the USA use the world's natural resources?
- What are birth and death rate patterns in various countries, and what are the causes and effects of these rates?
- How well do you eat- how does your intake of sugar, caffeine, nicotine and alcohol affect your study habits and your overall ability to do well in school?
- Examine your current pattern of food consumption over a week's period of time- then analyze it based on calories, fat intake, carbs etc...and see how well you eat. How does what you eat affect your moods?
- What happens to our waste? What do you throw out each day? How can we reduce the volume of waste we generate?
- Is consuming a lot of aspirin, Tylenol, ibuprofen and Aleve good for you?
- And other topics of interest to the students

For each of these topics, the class may be divided up into groups of 3 or 4, and given 10-15 minutes to brainstorm responses. Then each group will share their responses for 5 minutes. At the conclusion, we will examine responses for similarities and differences between groups, which may engender further discussions.

In addition, each student will be asked to write a paper on one of the following topics:

- A. The Use of radioisotopes in medicine
- B. Discuss the life of Enrico Fermi
- C. Discuss the development of polyethylene, and how it is manufactured today.
- D. Discuss the problems that exist because of asbestos in buildings.
- E. Contact the local office of EPA or the City of Cincinnati, and ask for the average and peak concentrations of common air pollutants, such as CO, NO_x, particulate matter, ozone, and SO_x. Are they within acceptable limits?
- F. Discuss fluoride that is added to drinking water. Why is it added? At what concentration is it added? What are the benefits and risks of adding fluoride to drinking water?

- G. Call your local utility office and obtain a chemical analysis of your drinking water. Present your findings in the paper, and the effects of these substances if they are above acceptable limits.
- H. Discuss the four primary sources of domestic heat: natural gas, coal, electricity, and fuel oil. What are the positive and negative aspects for each one? Which one is your choice?
- I. Discuss the issue of cloning. For what purposes do scientists want to create clones? What are the pros and cons of cloning? Where do you stand on the issue?
- J. Keep a food diary for one week. Analyze your consumption in terms of total calories, and then break the foods down to calories from fat, carbohydrates, and protein. Is your "diet" a good one? Why or why not?
- K. Discuss the pros and cons of using chemical pesticides and fertilizers in a flower or vegetable garden.
- L. Examine the labels on 5 different clothes washing detergents. What are the ingredients? What are they used for? What kind of detergents are they? What form are they in? Which one(s) do you think will work better and why?
- M. Many people take vitamin and mineral supplements. Why do they do this? Look up information on three popular supplements, and discuss their ingredients. What is each ingredient supposed to do for the person who consumes it?
- N. Discuss the history of aspirin and what it is used for. How is it manufactured today (be specific)?
- O. Discuss the use of caffeine in so many beverages and foods. Why is it present or added? How does it affect the body?
- P. There is a controversy raging over the use of mercury in tooth filling amalgams. Find information about this controversy and present both sides of the argument.

The students may prepare a poster on their paper, and present the posters on the last day of class. The poster session will allow all students to see the results of everyone's research.

Summary of Activities that integrated Ignatian Teaching Strategies in Chemistry in Society 2 Class, Spring semester 2006

1. Research Papers assigned to all students.
Each student selected a topic of interest and is currently finalizing a research paper on that topic, which will be submitted in late April. These topics are listed above. Sample papers from last semester are available for review.
2. In- class discussions occurred that encouraged students to share their views, and to consider how their actions affected themselves, their families and friends, and society in general.
Class discussions were centered around these topics:
 - a. Green Chemistry – did you know such an initiative existed? What were your impressions? (A video was shown, illustrating three examples of successful green chemistry initiatives by national companies and universities).
 - b. Polymers – students examined several varieties of common and experimental polymers and discussed how they are used or how they can be used.
 - c. Sick Building Syndrome – The class discussed how indoor air becomes unhealthy, and steps they can take to clean up the air they (and we) breathe.
 - d. Waste generation and disposal – Significant discussion took place regarding how much domestic waste is produced per person per year. Students were amazed at how much waste they generate, and where it ends up (in landfills). Students were challenged to keep a “waste diary” and to determine how to reduce the amount of waste they generate.
 - e. Population growth and effects on the earth and it’s resources – An entire class period was devoted to answering several questions dealing with population growth, birth rates, death rates, use of resources and effects of resource use on the environment. These questions included:

1. What factors can result in the lowering of birthrates in More Developed Countries (MDC’s)?
2. What factors can raise AND lower birthrates in Lesser Developed Countries (LDC’s)
3. What factors can lead to a longer life expectancy in MDC’s?
4. What factors can shorten life expectancy in LDC’s?
5. What factors can cause MDC’s to use large amounts of natural resources?
6. What is the effect of the use of large amounts of natural resources on our environment?

Some factors to consider:

Socio-economic factors
Religious factors
Political factors
Cultural factors
Science/medical factors

Students had very insightful responses to these questions, and began realizing the effect a wealthy population has on the world’s resources.

- f. Personal Energy use – Students discussed how they each use energy every day, from driving, to electric use to water use. They were encouraged to use energy more wisely.
- g. Food intake and exercise – Students examined their food intake and composition. Based on FDA guidelines, the students evaluated a week’s worth of food consumption to determine the amount of carbohydrates, fats and proteins they consumed during the week, and also kept a diary of activities. At the end of the week, the students compared calories consumed vs. calories expended, as well as the nutritional value of what they ate. This was an eye-opening exercise for many students!!
- h. Genetic engineering and cloning – Students had an animated discussion about the ethics of cloning and even having children to provide blood or organs to save a sibling’s life. A discussion of the movie “The Island” ensued about the creation of a group of cloned individuals.

* At this time, the semester is not yet concluded, so other discussions are likely on topics of diet, exercise, drugs and household chemicals. *

Student Responses

The students in the class were surveyed to obtain feedback on the success of the Ignatian strategies that were implemented in the course. Four questions were asked, and the students responded anonymously. Responses to the four questions included:

1. Have there been topics that have been of special interest to you? If so, which ones?

- *Global warming*
- *Landfills*
- *Food*
- *Energy and energy efficiency*
- *Organic chemistry – how antifreeze is made*
- *Polymers and plastics and their uses.*
- *I enjoyed the topic of esters, it was interesting to know where odors come from*
- *Dieting!*
- *Proteins and enzymes*
- *I have enjoyed learning about the “do’s and don’ts” of health.*
- *The earth and food chapters.*
- *Genetic engineering*
- *Environmental issues, especially the class discussion on MDC’s and LDC’s and the availability of resources*

2. Have you made any personal lifestyle changes based on anything you have learned so far? If so, what are they?

- *I definitely think more about what I throw away, and there was an article about the greenhouse effect that I normally would pass over but instead I read it to see what was new in that theory. (several students responded in this manner)*
- *Greater conservation of gas and oil*
- *Made a conscious effort to recycle all plastic water bottles, and to use “green” plastic bags.*
- *I have looked carefully at the chemicals I keep in my home and room.*
- *I have told everyone about landfills and water pollution.*
- *I am moving to a new house because of what I learned about indoor air pollution.*

- *I am deciding to quit smoking and drink less alcohol, and to exercise and lift more.*
- *I want to learn about personal changes I can make to lessen air pollution.*
- *I am watching what I am eating more.*
- *I have convinced my parents to use more fluorescent lighting*
- *I have discussed the issues we covered in class with my family and friends to try to inspire them to make changes as well.*

3. Are there any topics that you wish to learn more about in the future? If so, which ones?

- *Global warming theories*
- *Nuclear energy*
- *Green chemistry*
- *Energy and coal*
- *The body and the reactions that occur in the body*
- *Water- how water appeared on our planet*
- *How to lose weight and how the body reacts when weight is lost*
- *Poisons – how the body deals with them*

4. Any other thoughts on the topics covered so far?

- *Good topics so far!*
- *I have really enjoyed this course (more than CIS 1). Everything covered seems cool!*
- *This course has been very helpful and interesting, because everything is related to real life.*
- *Great course so far!!*
- *I am learning much!*
- *I have really enjoyed the class discussions*
- *I have really appreciated the course and how it has addressed issues that are important to us as individuals and as a society.*