Incorporating Indigenous Knowledge and Open Pedagogy into a New Chemistry of Food and Cooking Course for Non-Science Majors

Dr. Stephen Cheng, University of Regina
Dr. Vincent Ziffle, First Nations University of Canada
Outline

• Background
• Course design
• Innovative laboratory
• Incorporation of Indigenous knowledge
• Application of open pedagogy
• Conclusions
Chemistry of Food and Cooking

• Different formats and versions of the course have been offered in the past few decades.
• Mostly designed specifically to meet the liberal arts curriculum for arts, humanities, and social science students.
• The subject is expected to motivate non-science students.
What have been done?

• Educational television course
• Lab and non-lab courses
• Chemistry laboratory focusing on chemical analysis of food ingredients
• A few textbooks emphasizing the chemistry of food
Our Philosophy

• Designed for non-science students but also for underrepresented students in Saskatchewan.

• Broaden the scope and job opportunities for non-science and science students.

• Help first-year students build a strong science foundation for higher-level chemistry courses.
Course Design

- The topics are structured following the university-level general chemistry curriculum.
- Both chemistry, food, and cooking are equally emphasized.
- Students are engaged through the cooking of food.
One-of-a-kind laboratory

• Each laboratory starts with a chemistry experiment that covers a chemical principle found in general chemistry curriculum using food ingredients.

• Following the experiment, students will make a simple, tasty, and easily reproducible dish that is created based on the chemical principle of the experiment.
Objectives of the Lab

• Strengthen chemistry laboratory skills.
• Develop better understanding of chemical principles.
• Apply chemical principles in food and cooking.
• Teach students how they can easily prepare healthy meals.
## Sample Laboratories

<table>
<thead>
<tr>
<th>Chemistry Experiment</th>
<th>Food Dish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy and precision of measurements</td>
<td>Simple oven-roasted chicken</td>
</tr>
<tr>
<td>Stoichiometry and limiting reagent</td>
<td>Healthy hummus</td>
</tr>
<tr>
<td>Synthesis of gluten and percent yield</td>
<td>Perfect white bread</td>
</tr>
<tr>
<td>Acids and bases</td>
<td>Homemade ramen</td>
</tr>
<tr>
<td>Chemistry of eggs</td>
<td>Perfect poached eggs</td>
</tr>
</tbody>
</table>
Example – Accuracy and Precision

• Students are often uncertain what method gives higher accuracy of measurements in chemistry laboratory.

• Measurement of flour by measuring cups is used to illustrate the concept of accuracy and precision.

• Students will then use simple statistics to analyze the data.
Example – Accuracy and Precision

• To help students understand more about what measurement is important, a real cooking example is used.

• Students will make a roasted chicken and they will learn that the internal temperature of the meat rather than the cooking time is the parameter they should focus on.
Incorporating Indigenous Knowledge

• Being offered at the First Nations University of Canada, Elders and Indigenous chefs will be involved in the everyday classroom.

• The interdisciplinary hands-on approach of the course will include a number of Indigenous pedagogies including storytelling and experiential learning.
Elders in the Classroom

• First Nations Elders will take part.
• Traditional Indigenous foods and their preparation will be discussed.
• In some cases, cooking demonstrations will be offered.
• The examples will be tied to chemistry principles such as caloric content of pemmican and heat capacity of stone.
Indigenous Chefs in the Classroom

• Chef Dickie Yuzicapi (Sioux Chef Catering) and others will take part in lectures and flipped classroom activities.
• Traditional (sometimes “pre-contact”) and contemporary Indigenous cuisine will be discussed.
• Open pedagogy will be well-served by opportunities discussed by chefs.
Storytelling

• Examples of Indigenous cooking methods and ingredient uses will often begin with a story.

• Elders and other Indigenous Knowledge holders pass recipes to future generations through spoken language.

• This form of indirect Experiential Learning helps retain traditions.
Experiential Learning

• Students learn best from practical experiences—this is offered in the kitchen lab!

• Hands-on learning of chemistry concepts and cooking is a novel approach.

• This should provide an immersive, fun experience in science for non-science majors and underrepresented students.
Application of Open Pedagogy

• Several concepts of open pedagogy will be used in the course.
• Open pedagogy will be used to make contemporary and traditional Indigenous recipes widely available.
• Open pedagogy will engage students to work together to develop new cuisine.
• Open pedagogy will be used to identify and improve newly developed recipes.
Indigenous Recipes

• Documented recipes of preparing Indigenous cuisine are uncommon. Open pedagogy will provide students and the public access to Indigenous dishes.

• The small number of contemporary Indigenous cookbooks and other resources will be supplemented by students’ mastery of CHEM 101.
5-page Term Paper

• Students are required to write a term paper applying a chemical principle to an original or modified recipe.
• The original or modified recipe will be made available to students and eventually the public through open pedagogy.
• The recipe can be tested and improved through open pedagogy.
Food Lab – Final Project

• Students are required to do a group project in the laboratory.
• They need to make a complete dish using a list of food ingredients available.
• Open pedagogy will engage students from different backgrounds and cultures to create innovative cuisine together.
Conclusions

• The unique design of the course opens up opportunities to all students.
• The approach will strengthen the science background of underrepresented students.
• The course will support a vibrant culture of science education, indigenization and open pedagogy.