Food and cooking as context for science teaching

Taking both science and food seriously

Erik Fooladi

ef@hivolda.no
Presentation

Volda university college

– Science teacher education
– Home economics teacher education
  • (Ernährung und Haushalt?)

Norwegian Centre for Science Education (Univ. of Oslo)

– Teaching resources
– Development work
– Research
– Courses
– Policy contributions
Outline

1. Issues and challenges
2. Context-based teaching, inquiry and argumentation
3. Examples
4. Justification for the choice of context; outlook

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Cp^*Ir(Me_2SO)Me_2 \rightarrow \pm e^- \rightarrow Cp^*Ir(Me_2SO)Me_2^{\pm} 

C_2H_4 (+ CH_4) by 2nd order pathway 

CH_4 by 1st order pathway
The majority of the students in school will *not* pursue a future career in science/technology

Has consequences for

- Content
- Teaching perspective/approach
- Methods

Issues (II) – Context and knowledge transfer

Student teacher “Karen” (home economics)

“When we cook food together my friends say I have started to speak so strangely/differently”

A model of science vs. society

$\text{Ag}^+_{(aq)} + \text{Cl}^-_{(aq)} \rightarrow \text{AgCl}_{(s)}$

Experiment & inquiry

Reasons & argumentation

Everyday choices
(socioscientific issues)

"What does this have to do with me?"

("I’m not going to work with science…")
Example 1 – pH, context and argumentation

The classic: red cabbage indicator
Application in science education

Plantefergar som indikatorar

Du kan lage ei «raudklokke» av ei blåklokke ved å setje henne i ein vase med fortyna eiddiksyreløysning. Dersom du i staden har fortyna ammoniakkloëysning i vasen, blir blåkloka til ei «grønklukke».

Saft frå både blomar, bær og grønsaker kan fungere som syre-base-indikatorar. Tabelen viser dei forskjellige fargenyerande av raudkålsaft, og kva dei fortel om pH-verdien i løysinga.

<table>
<thead>
<tr>
<th>Indikatorfarge raudkål</th>
<th>raud</th>
<th>lyseraud</th>
<th>fiolett</th>
<th>blågrøn</th>
<th>grøn</th>
<th>gul</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH-område</td>
<td>0-3</td>
<td>3-4</td>
<td>4-6</td>
<td>7-8</td>
<td>9-12</td>
<td>12-14</td>
</tr>
</tbody>
</table>

Raudkålsaft er ein flott indikator!

Kjemien stemmer Kjemi 1 (Cappelen)
Blueberries (bilberries) are indicators

Egg white foam w/blueberries (pH in eggs increase w/age → pH = 9)

Cream w/ yoghurt/sour cream, lemon and blueberries

Blueberries

pH, indicators and argumentation

- Students should make *justified* decisions about these claims:
  1. In a basic environment the blueberry juice appears red
  2. Blueberry juice makes the yoghurt acidic
  3. Lemon juice is more acidic than yoghurt

- Support
  - *Textbooks, ingredients, pH paper, etc.*
    - Both first-hand and second-hand investigations
Example 2 – Kitchen stories

Read more: http://www.fooducation.org/search/label/kitchen%20stories
The general idea

- Students collect culinary claims ("Kitchen stories")
  - “you can’t make jelly with fresh kiwi because it will not set”
  - “if you store cucumbers together with tomatoes, the cucumbers will decay/rot faster”
  - “meat should be tempered before cooking”

- Analyse the kitchen stories
  - Argumentation: “what lies behind this claim?”
    - Deconstruct and retrace someone’s argument/reasoning¹
  - Inquiry: “can it be tested?”

- Test the claim experimentally (and publish)

Example (argumentation)

**CLAIM**

Cucumbers decay/rot more quickly if stored together with tomatoes.

**DATA**

Tomatoes produce ethene gas.

**WARRANT**

Etene gas promote ripening in fruit and vegetables.

**BACKING**

Decay (rotting) can be defined as ripening gone too far.

**QUALIFIER**

Since

If tightly wrapped, they can be stored with tomatoes without being affected.

**RESERVATION**

Stored at room temperature

Science vs. society revisited

A dream: Kitchen stories international network

- Multidisciplinary
- International
- Informal & fun
  - ...but still serious
- Multi-level
  - Academics
  - Chefs
  - Teachers
  - Journalists
  - Students
  - Food devotees
  - Whoever...

Example 3 – Cooking eggs

Koking av egg

Martin Lersch (http://blog.khymos.org/2009/04/09/towards-the-perfect-soft-boiled-egg/)

Uses the laws from physics for heat penetration.
White coagulates before yolk
→ egg cooking calculator possible

Dept. of Chemistry, Univ. of Oslo (www.mn.uio.no/kjemi/tjenester/kunnskap/egg)
Do eggs behave as meat?

- Egg composition is similar to meat; water, fat and denaturing proteins

- Core temperatures for meat
  - ca. 52 °C - raw/red
  - ca. 56 °C - medium raw
  - ca. 60 °C - medium
  - ca. 64 °C - well done

- According to literature (Hervé This)
  - White start coagulating at ca. 62 °C
  - Yolk coagulates at ca. 68 °C
  - ...!!!
Eggs – temperature, time, …or both? (2006)

Read more: http://www.fooducation.org/search/label/eggs
**Table 1** Viscosity at 10 s\(^{-1}\) of a series of thick edible fluids at 25 °C

<table>
<thead>
<tr>
<th>Food</th>
<th>Viscosity at 10 s(^{-1}) (Pa s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whipping cream</td>
<td>0.02</td>
</tr>
<tr>
<td>Raw egg yolk</td>
<td>0.09</td>
</tr>
<tr>
<td>Pancake syrup</td>
<td>0.96</td>
</tr>
<tr>
<td>Chocolate syrup</td>
<td>1.4</td>
</tr>
<tr>
<td>Sour cream (17% fat)</td>
<td>2.9</td>
</tr>
<tr>
<td>Greek-style yogurt</td>
<td>3.0</td>
</tr>
<tr>
<td>Molasses</td>
<td>3.3</td>
</tr>
<tr>
<td>Sweetened condensed milk</td>
<td>6.8</td>
</tr>
<tr>
<td>Mayonnaise</td>
<td>12.1</td>
</tr>
<tr>
<td>Ready-to-eat chocolate pudding</td>
<td>13.8</td>
</tr>
<tr>
<td>Honey</td>
<td>18.3</td>
</tr>
<tr>
<td>Nutella®</td>
<td>28.1</td>
</tr>
<tr>
<td>Cookie icing (fresh)</td>
<td>29.3</td>
</tr>
<tr>
<td>Toothpaste</td>
<td>43.8</td>
</tr>
<tr>
<td>Marmite®</td>
<td>43.9</td>
</tr>
</tbody>
</table>
Applications
What you need to replicate Vega et al.
Conclusion

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Only for food geeks?
Thank you

ef@hivolda.no
- fooducation.org
- naturfag.no/mat

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Cooking meat to core temperature

Meat, science and society

Anu Hopia, prof. food science
University of Turku

Monthly open “Molecular gastronomy club” with chef / culinary teacher Tatu Lehtovaara
Claim:

"Meat must be tempered before cooking"
Professori tyrmää vanhat opit – liha kannattaa heittää pannulle suoraan jäääkaapista

Elintarvikekehityksen tutkimusprofessori Anu Hopia esittelee blogissaan tutkimustuloksia, joiden mukaan lihaa ei kannata nostaa huoneenlämpöön ennen paistamista. Kylmänä kypsennetty liha koettiin testissä selvästi mehevampana kuin huonelämpöisenä kypsennetty.

Suosittelee 2 918 henkilöä suosittelee tätä. Ole kavereistasi ensimmäinen.
Molecular gastronomy club – activities, scientific- and epistemic practices

Ongoing project

Legend
- Modelled by scientist/chef
- Participants actively engaged

1st hand = first hand investigation
2nd hand = second hand investigation