Using student feedback to design a more effective Clinical Biochemistry course component

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Situated in downtown Kitchener, 7 km from rest of UW campus

First graduating class 2011
~ 115 students/year
Integrated Patient Focused Care 1-9

- Students begin IPFC courses starting in their second year
- IPFC 1 - fundamental content
- IPFC 2 to 9 – integrate concepts of therapeutics, pharmacology, pathophysiology, medicinal chemistry, pharmacokinetics and toxicology into a systems-based format
Objectives

- Create a blended Clinical Biochemistry module based on student feedback

- Assess if the introduction of multi-media based teaching module using virtual field trips, self-assessments and face-to-face tutorial
  1. increases student understanding of the connections between the results from lab measurements and patient assessment
  2. enhances student engagement
Why Blend?

- I felt comfortable with using technology to build materials
- I liked the idea of the reusability of the online modules
- I felt that having a blended format would save me and the instructor (Angela Stark) time as well as allow students to learn difficult material at their own pace
- Had success with blended format in another section of the course (pharmacokinetics)
Based on the premise that blending was a good way to go in Clinical Biochemistry ….

Measures of engagement and understanding:

- Feedback from 2010 cohort on what would help them engage and make connections
- Comparison of common exam questions in 2010 and 2011 to examine connections between the results from lab measurements and patient assessment
What is your LEVEL OF ENTHUSIASM for introducing a blended format to the Clinical Biochemistry section of the course?

Level of Enthusiasm

- Very Enthusiastic
- Enthusiastic
- Neutral
- Unenthusiastic
- Very Unenthusiastic

n=53
Student Feedback - What *online* course activities would help you connect lab results with patient assessment?

- **Case studies**
- **Self-assessments**
- **Enthusiastic speakers/lecturers**
- **Interactive programs**
- **Online quizzes**

$n=34$
• Built around:
  1. incorporating one major case (little Billy) and several smaller cases
  2. self assessment pieces (mostly quizzes)
  3. a virtual field trip to clinical biochemistry lab (video in the field)
Development of the storyboard……..
Development of the outline...

1. Electrolyte Tests
   1. Learning Outcomes & Why check electrolytes? (read)
   2. Case Introduction – Billy (read)
   3. Volume assessment
      1. Link out to Skin Tenting Photo (we can reproduce this with acknowledgement)
      2. Link out to JVP and Hepatojugular reflux (video) (Andrea to get permission)
      3. Link out to edema picture (Andrea to get permission)
   4. Fluid status assessment (read)
   5. Virtual Lab Tour re: how electrolytes are tested in the lab (video) (Andrea)
   6. Billy’s lab result table with numerous link outs
      1. Sodium – narrated PowerPoint (Angela)
      2. Potassium - narrated PowerPoint (Angela)
      3. Chloride – read only
      4. CO2/HCO3 – Serum bicarbonate read followed by link out to Acid-base status which is read, followed by Billy’s results
      1. Self-assessment question on Billy’s values
      2. Magnesium, Calcium and Phosphate – narrated PowerPoint (Angela)
   7. Framework to interpret lab values (read)
      1. Link out to the narrated PowerPoint on this from the Basic skills module
   8. Self-assessment questions – must complete before moving on
Development of the modules...

This IPFC1 course module presents some of the fundamentals of Clinical Biochemistry and how laboratory test interpretation relates to patient assessment. Presentation of this material is in a multi-media format and it is expected that you complete this section on-line. Upon the completion of the online component, an in-class case-based discussion will help to solidify your understanding of how electrolyte testing and renal and hepatic function tests are used in patient assessment, and in some cases, drug dosing.

Module One: Basic Skills in Interpreting Laboratory Data

This course section focuses on the description of different kinds of laboratory tests as well as provides a general framework for the interpretation and management of abnormal laboratory values.

+ Module One Presentation | PDF (6.5MB)

Module Two: Electrolyte Tests
Face-to-face tutorial …

- Two cases presented and students could prepare for either. Working first with the group and then the instructor to analyze each of the cases.

### SouthCentral Medical

<table>
<thead>
<tr>
<th>Patient ID:</th>
<th>Encounter:</th>
<th>Date:</th>
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<tbody>
<tr>
<td>#58417</td>
<td>EMERGENCY ROOM</td>
<td>JAN 5</td>
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<table>
<thead>
<tr>
<th>Patient Name:</th>
<th>Age:</th>
<th>Sex:</th>
<th>Admitting Diagnosis:</th>
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<tbody>
<tr>
<td>PETER PRINCE</td>
<td>44 Y</td>
<td>M</td>
<td>EDEMA, FATIGUE</td>
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</tbody>
</table>

### RESULTS LIST

<table>
<thead>
<tr>
<th>Result Name</th>
<th>Results</th>
<th>Units:</th>
<th>Reference Range:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (Na)</td>
<td>135</td>
<td>mmol/L</td>
<td>135-145</td>
</tr>
<tr>
<td>Potassium (K)</td>
<td>3.4</td>
<td>mmol/L</td>
<td>3.5-5</td>
</tr>
<tr>
<td>Chloride (Cl)</td>
<td>98</td>
<td>mmol/L</td>
<td>100-108</td>
</tr>
<tr>
<td>Bicarbonate (HCO₃⁻)</td>
<td>22</td>
<td>mmol/L</td>
<td>24-30 (CO₂)</td>
</tr>
<tr>
<td>BUN</td>
<td>16.2</td>
<td>mmol/L</td>
<td>2.5-8</td>
</tr>
<tr>
<td>SCr</td>
<td>253</td>
<td>µmol/L</td>
<td>58-110</td>
</tr>
<tr>
<td>Calcium (Ca)</td>
<td>1.91</td>
<td>mmol/L</td>
<td>2.1-2.6</td>
</tr>
<tr>
<td>Albumin</td>
<td>29</td>
<td>g/L</td>
<td>35-50</td>
</tr>
</tbody>
</table>
Common questions on exam in 2010 and 2011 were used to compare the ability of students to make connections between the results from lab measurements and patient assessment.

- Measured changes in perceived gains on two course objectives
- Shifts in the survey questions that measure engagement
- Feedback on modules to tweak new course design
2010 and 2011 Comparison of Assessed Success

- Exam scores in the Clinical Biochemistry part:
  - 61.8% ± 17.8 (n=109) in 2010
  - 78.8% ± 11.7 (n=116) in 2011 (t = -8.46, p < 0.0001)

- Exam scores in the ‘Pharmacokinetics’ midterm:
  - 80.5% ± 7.8 (n=108) in 2010
  - 83.6% ± 7.3 (n=116) in 2011 (t = -3.03, p = .003)
2010 and 2011
Comparison of Course Value

- We asked 2 course value and 3 engagement questions in the 2010 and 2011 questionnaires'
- “This course will be important in my future” - no change
- “This component of IPFC1 increased my interest in the subject” - significant increase in course interest following the redesign
“This component of IPFC1 increased my interest in the subject”
2010 and 2011 Comparison of Course Engagement

- Non-significant increase in mean rank for the 3 engagement questions

State your level of agreement with:

“Students shared their ideas/knowledge in this component of IPFC1”

“This component of IPFC1 encourages questions and ideas”

“I felt very involved or engaged in this component of IPFC1”
"I felt very involved or engaged in this component of IPFC1"
2010 and 2011 Perceived Learning Gains

- Significant increase in mean rank for the 2 perceived learning gains questions

As a result of your work in this class what gains did you make in your understanding of

“The role of lab results in patient assessment”

“The development of a rational approach for interpreting laboratory data”
Role of lab results in patient assessment

- 2010: n=53
- 2011: n=49

Development of a rational approach for interpreting lab data
Most to least effective course components for achieving learning outcomes in 2011

Self-assessment Quizzes
Case Studies
Face-to-face Tutorial
Virtual Field Trip
Online Discussion
Open-ended questions...

How the **online course activities** helped them achieve learning outcomes...

- Provided situations for applied knowledge or problem solving
- Allowed learning at individual pace, time flexibility
- Case studies were helpful
- Having more tutorials would help
Open-ended questions…

How the **face-to-face tutorial** helped them achieve learning outcomes…

- Problem solving and cases clarified concepts
- Discussing and talking through cases very helpful
- Engaging with other students/group work valuable exercise

- Not enough tutorials
Summary

• Suggestions from the 2010 cohort improved the 2011 design
• The measured outcomes were increased perceived and actual learning gains in 2011
• Gained knowledge on the most effective to least effective online activities
• Students appreciated the flexibility of the blended format to learn at their own pace and to review or repeat as necessary
Lessons Learned

• For a 6 hour segment of IPFC1, this was ALOT of work

• Based on student feedback, this work was justified