Developing metacognitive skills through the use of blogs in an upper-level undergraduate anatomy course

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What is “metacognition?”

“Metacognition is “the ability to monitor one’s current level of understanding and decide when it is not adequate.”

Essentially, a person learns how to learn and becomes more perceptive of one’s learning.

*Bransford, JD, Brown, AL and Cocking, RR (eds) National Academy press, 2000
How can metacognitive techniques be incorporated in this classroom?

- Frequent, low-risk assessments
- Exam feedback/review
- Formative feedback
  - Muddiest point
  - Classroom learning techniques (CATs)
    - Angelo and Cross, 1993
- Reflective writing
  - Journals or blogs
Anatomy A480/580: Human Anatomy for Medical Imaging Evaluation

- 3 cr lecture/lab: Spring 2010
- Taught by VDO
- 22 students
- Systemic study of human anatomy
- Compare/contrast medical imaging techniques
  - Be able to determine which technique is most suitable in a given diagnostic situation

Assessments:
- 4 exams (400 pts total)
- 1 quiz (25 pts)
- 3 clinical vignettes (25 pts each, 75 pts total)
- 1 group case study (200 pts)
- 10 Blog Entries for each Aunt Minnie Case of the Day (10 pts each, 100 pts total)
10 separate cases over the course of the semester

Student writes a blog about his/her experience with the case
Blogs (e-journals) housed on Oncourse (classroom e-platform)

- Blog instructions:
  - Provide a summary of the patient problem
  - Describe your perceptions of the images – did you have an idea of what you were seeing? Did you have a better understanding of the case when all was said and done, or was it still unclear?
  - Evaluate your skill level at identifying the anatomy and determining the pathology in these images.

- Blogs graded on completeness of entry and thoughtfulness
What did a well-thought-out, reflective blog look like?

Case 6: Popliteal entrapment syndrome

March 10, 2010

Provide a brief summary (no more than 1 paragraph) of the patient problem.

A thirty-five year old man was suffering from claudication (indicate impairment in walking). An angiogram revealed that there was an occlusion of the above-the-knee popliteal artery with reconstitution of the below-the-knee popliteal artery due to collateralization as well as a continuous three vessel runoff. He was diagnosed with popliteal entrapment which is the intermittent claudication caused by compression of the popliteal artery by the popliteal musculature or deep fibrous bands, often by the gastrocnemius. An angioplasty was performed and a stent was placed in the artery and a post-op angiogram showed that there was good flow post angioplasty and stent of the affected popliteal artery occlusion. Three months later his symptoms returned and another angiogram revealed that there was a continued worsening of claudication symptoms and shows deformity in the stent. It also demonstrated tapering stenosis of the popliteal artery, which was most pronounced during plantar flexion of the foot.

Describe your perceptions of the images – did you have an idea of what you were looking at? Were the images easy to follow, or were they completely foreign to you? Did you have a better understanding of the case when all was said and done, or was it still unclear?

Since I first looked through the case before Wednesday’s lecture I was not sure exactly what I was looking at. Thus, I did not notice that there should have been a blood-filled artery in that region. However, after looking at it again, I was able to identify the major arteries in the image and it was clear which one was the popliteal artery. I initially did not have any idea what the object was in the images of the stent, but after learning about the stenting procedure in class it was obvious that a stent had been placed in the artery. I did find it odd that the stent appeared to be bent, but I wasn’t sure if this was common. After reading that the man’s symptoms had returned due to a deformity in the stent it was clear that there was indeed something wrong with the stent. As I side note, I thought the images of the stent were very interesting since I’ve never seen anything like that before.

Evaluate your skill level at locating the anatomy in these images and detecting what may be wrong – are you becoming more confident of your knowledge of anatomy, and in your interpretation of these images? What difficulties are you still encountering?

I was able to identify all the bones and bone features in the image very easily. However, I’m still fairly unfamiliar with the various cardiovascular features. After going through this case I’m now familiar with the popliteal artery, but I don’t know any of the other arteries of the knee or other areas of the body for that matter. However, I’m sure that after Friday’s lab I will be able to identify most of the important veins and arteries.

Edit entry | Remove entry | 1 comments | Leave a comment | Permalink

After the course ended, student consent was obtained and blogs were analyzed using a grounded theory approach.
What is ‘grounded theory’?

- Inductive data analysis
  - First described by Glaser and Strauss (1967)
- Grounded theory uses inductive analysis to determine what the data is saying (the theory is ‘grounded’ in the data)
- Researchers immerse themselves in the writing, determine themes, develop and test the codebook
  - Other literature reviewed only after grounded theory analysis complete

Grounded theory (inductive) analysis of blog entries

- IRB approval for study granted
  - Study # 1003001169
- Blogs de-identified by 3rd party
- Authors read blogs multiple times, determined ‘themes’ and subthemes that appeared multiple times in the blogs
- Codebook developed from these themes
  - Both authors tested codebook and codebook revised until themes were mutually exclusive
  - Cohen’s kappa (for interrater reliability) calculated at .69 – considered ‘substantial agreement’ by Landis and Koch (1977)
    - Levels near .7 or greater are considered strong values for interrater reliability
### Final Codebook used for this study

<table>
<thead>
<tr>
<th>Category</th>
<th>Theme</th>
<th>Subtheme</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Emotional State</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anxiety/helplessness/frustration</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Self-Confidence</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Enthusiasm</td>
<td>In the case itself</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In anatomy in general</td>
<td>4</td>
</tr>
<tr>
<td><strong>Thought process</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Statement of process</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Method of problem solving</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Guessing</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Combo guess and deduction</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Deduction</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td><strong>Use of External Sources</strong></td>
<td></td>
<td></td>
<td>9</td>
</tr>
</tbody>
</table>
### Final Codebook used for this study (continued)

<table>
<thead>
<tr>
<th>Category</th>
<th>Theme</th>
<th>Subtheme</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skill assessment</td>
<td>Evaluation of identifying anatomy and pathology</td>
<td>positive</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>negative</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Comparative assessment of mult. imaging techniques</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Recognized need for more info or training</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Forgiveness/justification for knowledge gap</td>
<td>14</td>
</tr>
<tr>
<td>Style</td>
<td>Informal vs. formal tone</td>
<td>15 for formal, 16 for informal</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Serious vs. humorous</td>
<td>17 for serious, 18 for humorous</td>
<td></td>
</tr>
</tbody>
</table>
How were blogs coded and analyzed?

- Blogs subdivided by random ID for student and number of blog
- Blogs coded by LG
  - Reviewed by VDO
- VDO calculated frequencies for each code for early semester vs. late semester blogs
  - Determined general trends in data
  - Approximately 1200 codes each for early semester and late semester
How did the early vs. late semester blogs compare?

<table>
<thead>
<tr>
<th>Code</th>
<th>Early semester %</th>
<th>Late semester %</th>
<th>Change over the semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anxiety/helplessness/frustration</td>
<td>3.9</td>
<td>3.6</td>
<td>Slight decrease</td>
</tr>
<tr>
<td>2. Self-Confidence</td>
<td>4.7</td>
<td>8.9</td>
<td>2X increase</td>
</tr>
<tr>
<td>3. Interest in the case itself</td>
<td>2.0</td>
<td>1.9</td>
<td>No change</td>
</tr>
<tr>
<td>4. Interest in anatomy in general</td>
<td>.4</td>
<td>1.1</td>
<td>Over 2X increase</td>
</tr>
<tr>
<td>5. Statement of process</td>
<td>9.3</td>
<td>7.2</td>
<td>Decrease</td>
</tr>
<tr>
<td>6. Method of problem solving: Guessing</td>
<td>1.1</td>
<td>1.2</td>
<td>similar</td>
</tr>
<tr>
<td>7. method: combo guess and deduction</td>
<td>1.6</td>
<td>1.0</td>
<td>Decrease</td>
</tr>
<tr>
<td>8. method: deduction</td>
<td>3.1</td>
<td>3.9</td>
<td>Increase</td>
</tr>
</tbody>
</table>
How did the early vs. late semester blogs compare? (continued)

<table>
<thead>
<tr>
<th>Code</th>
<th>Early semester %</th>
<th>Late semester %</th>
<th>Change over the semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>9. Use of External Sources</td>
<td>6.9</td>
<td>3.9</td>
<td>Almost 2X decrease</td>
</tr>
<tr>
<td>10. Positive evaluation of skill in anat and path</td>
<td>32.9</td>
<td>37.1</td>
<td>increase</td>
</tr>
<tr>
<td>11. Negative evaluation of skill in anat and path</td>
<td>27.2</td>
<td>23.4</td>
<td>decrease</td>
</tr>
<tr>
<td>12. Comparative assessment of 2 or more imaging techniques</td>
<td>1.6</td>
<td>4.5</td>
<td>3X increase</td>
</tr>
<tr>
<td>13. Recognized need for more info/training</td>
<td>5.0</td>
<td>2.3</td>
<td>2X decrease</td>
</tr>
<tr>
<td>14. Forgiveness/justification of knowledge gap</td>
<td>.3</td>
<td>.1</td>
<td>(too few responses to compare adequately)</td>
</tr>
</tbody>
</table>
### Early semester Blog entries

126.2: This was just a very hard case study for me to follow. I was not sure at all what to look for or what the questions were actually asking. This was just hard!!!!!

132.2: Although I can figure these cases out after doing some image comparisons, I usually confront them almost completely in the dark. I’m probably not ready to become a practicing radiologist quite yet.

### Late Semester Blog entries

133.6: It becomes easier to deduce (as oppose to guess) on differential diagnoses and such.

124.9: At the beginning of the class I didn’t know what was going on with some of the aunt Minnie cases. Now I sometimes still don’t, but I can at least orient myself in the images and go back and point out the anomalies after they’ve been discussed.
Early semester Blog entries

128.1: On a scale from 1-10, I would say that I am at a level 7 ability of identifying the anatomy, and probably a level 3 of identifying what is wrong.

Late Semester Blog entries

128.101: On a scale from one to ten, I would say I began this semester at a 2, and am finishing around a 7. I believe this is a significant increase and I am very pleased with my progress. I am pretty sure that further improvements will take many years of practice.
As the semester progressed, blogs became more informal and humorous.

<table>
<thead>
<tr>
<th>Style Code</th>
<th>Early semester %</th>
<th>Late semester %</th>
<th>Change over the semester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Style: Formal tone</td>
<td>51</td>
<td>39.6</td>
<td>decrease</td>
</tr>
<tr>
<td>Style: Informal Tone</td>
<td>49</td>
<td>60.4</td>
<td>increase</td>
</tr>
<tr>
<td>Style: Serious/no humor</td>
<td>92.9</td>
<td>77.1</td>
<td>decrease</td>
</tr>
<tr>
<td>Style: Humorous</td>
<td>7.1</td>
<td>22.9</td>
<td>4X increase</td>
</tr>
</tbody>
</table>

Students felt more at ease in the class and with the instructor. Students would use humor when they encountered difficulties instead of letting frustration take over.
IN THEIR OWN WORDS...
Late Semester Blog Entries

132.8: My observations – oh boy… in the sonograms… I felt like I was looking at a Matisse painting during his less famed "black and white pixelated" period.

130.101: Ultrasound images are the bane of my imaging existence. I see now how one needs a lot of experience in viewing these image to determine what they're looking at.
In Summary

- The use of blogs in A480/580 facilitated student reflection and development of metacognitive skills.
- Instructor was able to visualize progression from ‘novice’ learner to more experienced learner.
- Researchers used grounded theory analysis to methodically assess student development.
Future directions

- Evaluation of entire blogs as:
  - Nonreflective
  - Reflective
  - Critically reflective
  - Compare results to those of other researchers

- Collect additional data from future class offerings, increase sample size
Acknowledgments

- A480/A580 students
- Indiana University Internal Review Board
  - Study Protocol # 1003001169
- Jackie Cullison, Medical Sciences
  - Deidentified and organized blogs for writeups
- Kathryn Propst, Center for Innovative Teaching and Learning
  - Blog set up on Oncourse