A practical method to assess critical thinking and communication

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Ecology and Conservation

Lincoln University
The Tale of Two Teachers

- Less than 5 years teaching
- Motivated
- ConsEcol teaching at Lincoln University
  - Poor attendance
  - Lack of attention
  - Poor engagement
  - Academic standards
- Our approach:
  - common sense
  - scientific
- “Students learn more from their own mistakes, than by the correct things they are told.”

- Our courses
  - Final year undergraduate (UG) Ecology (9 students)
  - First semester Honours and Masters postgraduate (PG) Ecology (10 students)
Aims

1. Learn how best to teach and assess critical thinking
2. Get students reading and understanding the primary literature
3. Work out how to improve students’ science communication skills
4. Develop ways to maximise student engagement (and attendance)
5. Work out how to measure and reward student improvement as well as overall performance
Our Approach

- Different assessment methods
- Different teaching methods
- Monitor our teaching during semester
- Use student feedback for improvements
Methods: The Folder Method of Assessment

- How were students arriving at the ‘end product’?
- Very similar to a “Portfolio” (Huber and Freed 2000)
- Students use their folder as a:
  - Place for all course work (incl. assessments)
  - Reflective journal
  - Forum for communication with teachers
- Assessment events were approximately every two weeks
- Comprised a large % of the final grade
- Designed to:
  - Provide feedback on our teaching
  - Provide material to assess
  - Spread workload across the semester
  - “Encourage” student attendance and engagement
Folder Activities

- Write an abstract (UG)
- Written critique (both)
- Presentation critique (both)
- Essay (both)
- Practice exam question (UG)
- Lab report (UG)
- Questions on prescribed readings (PG)
- Problem solving (both)
- Verbal straw poll (UG)
- Quick written opinion (UG)
- Pop Quizzes (UG)
Additional Factors

- Small class sizes
- Used team teaching
- Creating a ‘safe’ learning environment
- Obtained feedback regularly
  - formal and informal
Rapid Formative Feedback Given in Four Ways

- General comments to the class (Fri-Mon)
- Detailed comments on student’s work
- Answers to student’s questions
- Formal marking sheet
<table>
<thead>
<tr>
<th>Criterion</th>
<th>Mark /5</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td></td>
<td>Did you understand the material?</td>
</tr>
<tr>
<td>Critical</td>
<td></td>
<td>Did you give your own opinion on the material?</td>
</tr>
<tr>
<td>Sources</td>
<td></td>
<td>Did you obtain and use sources appropriately?</td>
</tr>
<tr>
<td>Argument</td>
<td></td>
<td>Do your arguments make sense?</td>
</tr>
<tr>
<td>Structure</td>
<td></td>
<td>Is your work laid out in a way that makes sense?</td>
</tr>
<tr>
<td>Effort</td>
<td></td>
<td>Did you complete all the work?</td>
</tr>
</tbody>
</table>

Total /30
<table>
<thead>
<tr>
<th>Mark</th>
<th>Comprehension</th>
<th>Critical</th>
<th>Sources</th>
<th>Argument</th>
<th>Structure</th>
<th>Effort</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Little or no evidence of understanding content</td>
<td>Little or no evidence of critical evaluation of material</td>
<td>Sources not used to support substantive assertions or conclusions</td>
<td>Either no discernable, or seriously flawed</td>
<td>Unacceptable failings in structure and/or clarity of written expression</td>
<td>Little or no evidence of work completion, class attendance or project participation</td>
</tr>
<tr>
<td>2</td>
<td>Evidence that relevant content is broadly understood, but with significant gaps or misapprehensions</td>
<td>Evidence of limited critical evaluation in some areas, with some lost opportunities or misunderstandings</td>
<td>Limited &amp; uncritical use of a restricted range of resources</td>
<td>Argument is sometimes trivial, confused or flawed</td>
<td>Failings in structure and/or clarity of written expression, which impair the assignment's capacity to communicate</td>
<td>Minimal effort, attendance or participation or work mostly incomplete</td>
</tr>
<tr>
<td>3</td>
<td>Evidence that relevant content is adequately understood, but with some gaps or misapprehensions</td>
<td>Evidence of a general critical stance, although some material not evaluated</td>
<td>Use of a range of appropriate sources, but without critical evaluation, or missing some significant items</td>
<td>Argument is let down by occasional confusion or flaws</td>
<td>Some failings in structure and/or clarity of written expression, these do not impair the assignment's capacity to communicate</td>
<td>Participation in all class activities and work mostly completed</td>
</tr>
<tr>
<td>4</td>
<td>Evidence of good understanding of the relevant content, without major misapprehensions</td>
<td>Evidence of good critical appreciation and evaluation of relevant theory &amp; research &amp; an attempt to relate it to the topic</td>
<td>Use of a wide range of appropriate sources, indicating personal research and with a full critical awareness of their status &amp; relevance</td>
<td>Argument is sound &amp; substantial, although not original</td>
<td>Assignment whose clear structure &amp; expressed ideas are well-structured &amp; expressed, communicating clearly</td>
<td>Completion of all class activities following active participation</td>
</tr>
<tr>
<td>5</td>
<td>Evidence of comprehensive understanding of relevant content</td>
<td>Evidence of comprehensive understanding of relevant content with a systematic and creative attempt to relate it to the topic</td>
<td>Use of a wide range of appropriate sources, indicating personal research and with a full critical awareness of their status &amp; relevance</td>
<td>Argument is sound &amp; substantial, with significant elements of originality</td>
<td>Assignment whose clear structure &amp; expressed ideas are well-structured &amp; expressed, communicating clearly</td>
<td>Significant &amp; constructive participation in, and completion of, all class activities</td>
</tr>
</tbody>
</table>

Rubric

Based on Atherton 2005
**Hannah - Week 1**

<table>
<thead>
<tr>
<th>Category</th>
<th>Grade</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension</td>
<td>4</td>
<td>Good attempt at answering the question. Good job on the EcoBeaker.</td>
</tr>
<tr>
<td>Critical</td>
<td>2</td>
<td>I could see that you had some difficulty. It's not as difficult as it seems.</td>
</tr>
<tr>
<td>Sources</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Argument</td>
<td>2</td>
<td>This homework seems to me that you didn't explain in detail. It was hard to evaluate your work.</td>
</tr>
<tr>
<td>Structure</td>
<td>2</td>
<td>A few more headings and explanations would help.</td>
</tr>
<tr>
<td>Effort</td>
<td>4</td>
<td>Great effort! You clearly and concisely described your work.</td>
</tr>
</tbody>
</table>

**Final Mark / 25**

| Mark / 25 | 15 | An impressive start. I hope you find the lab work enjoyable. |
|           | 14 | Good job on Week 1. Keep up the good work. |
Measuring Improvement

Improvement score = the slope of the regression

Final folder grade (%) = Mean folder grade (%) + improvement score
Results:
Aspects that Worked

- Increased class attendance
- Increased class participation by motivating discussion
  - Student-student
  - Student-class-teacher
- Stimulated critical thinking and reflection
  - Students: higher quality work
  - Teachers: increased feedback
- Rewarding students for their improvement
  - Throughout the semester
  - End of course grades
Rewarding Improvement

Mean grade = 62.9%
Improvement = 8.3
Final mark = 71.2%

Mean grade = 78.1%
Improvement = 3.6
Final mark = 81.7%
How well was the marking system for the course explained?

Number of students:
- 1: very poorly
- 2: sometimes poorly
- 3: usually well
- 4: very well

Assessment requirements were made clear:
- 1: always
- 2: usually
- 3: sometimes
- 4: never
- 5: NA

“Sometimes assessment requirements were difficult to understand.”

“The assessment requirements (in particular: those in the folder) were not made clear from the start.”
Useful Formative Feedback

UG

The amount of feedback on my progress during the course was:

Number of students

<table>
<thead>
<tr>
<th>More than adequate</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

Assessment of my work was made in a constructive manner:

Number of students

<table>
<thead>
<tr>
<th>almost always</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>almost never</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

PG

“There was a lot of useful feedback from the lecturers and they always had time to help out.”

Student work was returned with useful, constructive feedback:

Number of students

<table>
<thead>
<tr>
<th>always</th>
<th>usually</th>
<th>sometimes</th>
<th>never</th>
<th>NA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>
Critical Thinking

How much did this course challenge you to think?

- 1: a great deal
- 2: very little

Number of students:

What helped your learning?

"Encouragement of independent thinking."

The lecturer encouraged independent thinking:

- 1: always
- 2: usually
- 3: sometimes
- 4: never
- 5: NA

Number of students:
How valuable do you consider this course has been to you?

<table>
<thead>
<tr>
<th>Value</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 extremely</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>5 not at all</td>
<td>0</td>
</tr>
</tbody>
</table>

“Thanks for an engaging and challenging semester.”

“To be honest, this is the hardest course I took last semester. but I should confess that I learned the most from this course too. it helped me a lot and prepared me better for my study in this semester. i really appreciated it!”
End of Semester Feedback

"The students said they thought they learned heaps but didn’t know exactly what they did know.

They were unsure if they could “put down in writing” what they had learned.

They felt that they were taught a lot of skills that weren’t easily assessed.”
Skill Improvement

UG

Did you improve your ability to solve problems in this field?

Did you improve your ability to carry out original research in this field?

Has this course encouraged you to develop original ideas?

Did you improve your ability to communicate clearly about this subject?
Further Work

- Communicating the assessment method to students
  - Giving students structure and reliable information while staying flexible
- Integrating with other people
- High teacher workload
  - How to increase the number of feedback opportunities without increasing teacher workload too much (self and peer assessment, marking drafts)
- Students’ perception that they were being made to work harder than in other classes
- Dealing with students who didn’t engage in the process
Acknowledgements

- Students in ECOL308 and ECOL630 during semester 1, 2008, Lincoln University
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