Improving Undergraduate Students’ Critical Thinking and Writing Skills: Team Designed Cognitive Apprenticeship

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Cognitive Apprenticeship

Progressive Component Skills

- Accurate Summarizing
- Critical reflection
- Synthesizing
- Translation
- Effective writing - genre and audience

Critical thinking
Application
Writing

Raised Level of Work

Conceptual Rationale

- Cognitive Apprenticeship
  - Goal: Think like a person informed by a field
  - Method: Make process visible along with results
  - Staged, scaffolded learning tasks to develop that thinking
  - Students are supported by peers and by experienced leaders
Conceptual Rationale

- Not a natural act
  - Needs a lot of exposure
  - Gradual shift to action
- Takes a long time in the best circumstances
  - Never works with one quick explanation
  - Didactic versions rarely effective alone
  - Experiential version needed

Team Design

- Modeled on work done by Patricia Ianuzzi and colleagues at University of California - Berkeley
  - Move libraries and writing into the design phase
- We worked on scalability and sustainability
  - Prepare graduate students for design consultation
  - Fellowships with library and writing center
Conceptual Rationale

Conventional Design:

Instructor Designs Course → Students Engage Assignments → Successful Students Proceed → Goals Achieved

Unsuccessful Students Receive help → Writing Center

Library Instruction

Progressive Design:

Instructor Designs Course → Library Instruction → Students Engage Assignments → Successful Students Proceed → Goals Achieved

Unsuccessful Students Receive Consultation → Writing Center
Conceptual Rationale

Collaborative Design:

Library Instruction
Instructor Leads Course Design
Writing Center

Students Engage Iterative Assignments
All Students Receive Iterative Consultation

Goals Achieved

Universal Design as Guide

Learning Objectives

- Academic skills
  - Critical reading
  - Integration
  - Synthesis
- Translational writing
  - Public purpose
  - Sustain depth and accuracy
Conceptual Rationale

- Enhance undergraduate students’ critical thinking and writing skills
- Develop a sustainable instructional team design
- Improve our assessment of student learning

| Anderson and Krathwohl also list specific verbs that can be used when writing objectives for each column of the cognitive process dimension. | **Remember**: Recognizing, Recalling |
| | **Understand**: Interpreting, exemplifying, classifying, summarizing, inferring, comparing, explaining |
| | **Apply**: Executing, implementing |
| | **Analyze**: Differentiating, organizing, attributing |
| | **Evaluate**: checking, critiquing |
| | **Create**: generating, planning, producing |

Our Collaborative Project: Specific Aims
Pilot Work in Two Courses

Political Science 170: *International Relations* (Prof. Weaver)
- Mid-sized to large (120 to 200 students)
- Introductory level

Psychology 430: *Cognitive Development* (Prof. Greenhoot)
- Mid-sized to large (100 students)
- Junior-senior level

Cognitive Development Capstone Assignment

5-page “Advice Column” for parents
E.g., Is it a good idea to have my child, who has a July birthday, wait an extra year before starting school?

- Information Literacy
- Reading and evaluating research
- Synthesizing diverse research findings
- Applying findings to real-world questions
- Writing clear, cohesive arguments
Evidence of Student Learning

- Article Selection
  - No student required individual assistance
- Peer review and analysis
- Final Papers
  - Grades
  - Comparisons of actual student work
Evidence: Sample Peer Review

cognitive ability using ordinary least squares and logit regression. For each of the 
indicators, they estimated, in addition to the usual between-family model, a within-family 
model to see whether differences in siblings’ outcomes are associated with differences in 
the siblings’ breastfeeding histories. In their findings, they found out that there was an 
insignificant measurement with the within-family model. All it really showed was that 
there was a positive correlation between breastfeeding and cognitive development. In the 
conclusion, they said that the study showed that there could be a connection between 
breastfeeding and intelligence. But, they go on to say that “it suggests that 
nonexperimental studies of breastfeeding overstate some of its other long-term benefits, 
even if controls are included for race, ethnicity, income, and education.”

"Brief, but good. Try to include more about methods & participants!"

Evidence: Distribution of Scores on Final Paper

Sample Previous Semester: Fall 2005

Pilot Semester: Spring 2007
Evidence:
Sample A Paper from Previous Semester

Both studies tried to determine whether or not a critical period exists for second language acquisition. DeKeyser’s study showed that the only critical period that exists involves learning processes. Hakuta, et al, demonstrated that there is no sharp decline to mark a critical period, only a declination in cognitive abilities across the life span which affect second language acquisition. Regardless of the differences, both studies give an optimistic view of learning a

Evidence:
Sample A Paper from Pilot Semester

In response to the mother who is questioning the benefits of breastfeeding her child, it is evident that breastfeeding does have an effect on cognitive ability. According to Quinn et al. (2001) if she even breastfeeds the child for up to seven weeks he or she will begin to show increased cognitive abilities later in life. The Evenhouse et al. (2005) study shows that the amplified cognitive ability due to breastfeeding will still be present in adolescence, therefore it is possible that breastfeeding affects adult cognizance as well. In light of the benefits of breastfeeding on cognitive ability, this mother should take the time
The Current Project: *Further enhancement, measurement, and sustainability*

**Intervention Courses:**
Instructional teams with KU Libraries, Writing Center, & Graduate Student Fellows (GSFs):
- Training by apprenticeship in Libraries and Writing Center
- Collaborate in course design and problem solving
- Develop and test rubrics
- Develop and test course-specific assessment of targeted skills
- Consult with students at each assignment stage

**Control Courses:**
Comparable Course Levels and Enrollment, without Intervention

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**The Current Project: Measurement**

1. What is impact of program on targeted skills in course?
   - Systematic application of rubrics each semester
   - Course-specific pre- and post-tests of target skills

2. What is impact of program on general skills not specific to course goals?
   - Application of a general intellectual skills rubric to samples of student work
   - General dimensions of learning, but in embedded student work

3. Do target skills generalize to new contexts?
   - Pre- and post-tests with Collegiate Learning Assessment (CLA)
PSYC 430 Redesign

Early Stages: Information Literacy Skills
- Literature Search Lab
- Article submission for approval, paragraph justifying submissions

Middle Stages: Reading, Evaluating Empirical Articles
- In-class modeling, guidance in reading and evaluating empirical articles
- Student preparation of article summaries
- In-class peer workshop: review of summaries

Late Stages: Synthesis, Applications, and Writing
- Peer workshop: group analysis of articles
- In-class Rubric discussion and application
- Writing consultations, rough drafts (optional)
- “Final” paper
- Rewrites (optional)

Pretest

PSYC 430 Redesign

Synthesize and apply 3 empirical articles on breastfeeding and CD that are already summarized: Framed as blog entry.

PSYC 430: APPLICATION ESSAY 1
Spring 2009

Overview:
Imagine the following scenario: you are surfing the internet and start reading an acquaintance’s blog on pregnancy and child-rearing. The acquaintance has recently posed a rant in response to recent “Breast is Best” advertising campaigns. The blogger is bright, CEO of a mid-sized company, and 7 months pregnant with her first child. Below is an excerpt of her blog:

I resent the fact that other people are trying to tell me how to feed my own baby. It is my choice. It is going to be hard enough to work and raise a child without having to worry about breastfeeding. My husband agreed that he would take an equal part in raising our child, and I don’t think I want to have to be the person who is responsible for producing her food when she is a infant. On top of that, I don’t believe all this hype about the breastfeeding making children “smarter”. My mother didn’t breastfeed me and I am no dummy! And my best friend was adopted as an infant by two fathers (and therefore not breastfed) and she just earned her PhD from Harvard! Can anyone really show that it makes a difference?

Given your educational background in cognitive development, you feel compelled to post on her blog. Your job is to construct a response that focuses on the effect of breastfeeding on intellectual development, using the three empirical studies described below to support your points.
Rubric: Sample Categories

<table>
<thead>
<tr>
<th></th>
<th>Exemplary</th>
<th>Good</th>
<th>Limited</th>
<th>Unsatisfactory</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Points:</strong></td>
<td>10</td>
<td>7</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td><strong>Study 3 Description</strong></td>
<td>Accurate, appropriate level of detail</td>
<td>Minor inaccuracies or unclear points, or too much detail</td>
<td>Substantial inaccuracies/unclear areas, or missing critical details</td>
<td>Missing or too little information to be useful, or inappropriate study</td>
</tr>
<tr>
<td>Synthesis</td>
<td>Sophisticated, insightful integration of findings of 3 studies; addresses limitations, alternative interpretations, and/or other between-study differences to draw final conclusions</td>
<td>Some attempt to evaluate and integrate across studies, conclusions are reasonable. But some inaccuracies or shallow comparisons; does not reconcile variations or show how findings fit together</td>
<td>Summarizes previously stated information with little attempt to evaluate research and integrate across studies or with substantial unclear or inaccurate points</td>
<td>Missing comparison/synthesis of 3 studies, limited or missing conclusions</td>
</tr>
<tr>
<td>Conclusion/Recommendations</td>
<td>Extends and connects ideas; insightful comments</td>
<td>Some application of research, but does not offer much insight, or has minor inaccuracies or minor inappropriate applications</td>
<td>Inappropriate, incorrect or unclear application</td>
<td>Missing application</td>
</tr>
<tr>
<td><strong>Points:</strong></td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Paragraph Order</strong></td>
<td>Contributes to effective arguments; reinforces content</td>
<td>Demonstrates a plan but could be more effective</td>
<td>Ineffective; difficulty following arguments</td>
<td>Random; interferes with coherence of arguments</td>
</tr>
<tr>
<td>Transitions</td>
<td>Effective and varied</td>
<td>Clear and functional</td>
<td>Mechanical</td>
<td>Absent</td>
</tr>
</tbody>
</table>

PSYC 430 Redesign

**Pretest**

Early Stages: Information Literacy Skills
- Literature Search Lab
- Article submission for approval, paragraph justifying submissions

Middle Stages: Reading, Evaluating Empirical Articles
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- “Final” paper
- Rewrites (optional)

**Posttest**
Evidence: Consultant Usage

- A minority of students took advantage, but those who did kept coming back

Evidence: Pre- and Post-test Mastery Levels on Application Essays

- Use of Research
- Synthesis
- Implications
- Organization
Excerpt from a “Typical” Pretest

…there is significant evidence pointing toward the importance of breastfeeding for the cognitive development in infants…. One study suggests that breastfeeding has no effect on cognitive development, but that it is biological characteristics that determine IQ. This study compared children who had been breastfed to those who were formula-fed (Batty 2006).

These studies do not focus on the long-term affects of breastfeeding, and it is this flaw that should encourage you to do more research on your own. In addition, there are other holes within these studies that should also persuade you to continue researching on this topic. In the Mortensen study, the researchers focused solely on Danish citizens. This cohort is not necessarily representative of the entire world, much less of United States’ citizens. There is also the potential for a history confound within this study. Something may have occurred in Denmark that affected the entire cohort. In addition, the Batty study focused on siblings who, when other things such as parental education are accounted for, are going to have more similar IQs than non-siblings regardless of whether they were breastfed or formula-fed. Within all of these studies there is the potential for a mortality confound (AKA the participants that dropped out in the study were different than those that remained).

Excerpt from a “Typical” Postest

…Thus far, only the distinct final decisions concerning risk-taking behavior have been assessed, Galvan et al. (2006) attempted to assess the actual decision making processes involved in adolescent risk taking. The experimenters suggested that anticipated positive consequences, or reward processing, plays a major role in adolescent gauging of risky behavior. …The results supported the experimenters’ suggestion that those who showed larger responses to the reward were more likely to engage in risk-taking behavior.

Although adolescents who showed larger responses reported more positive consequences of risky behavior, when correlated with Millstein et al. (2002) and Beyth-Marom (1993), these results make sense. As previously stated, adolescents report more positive social outcomes of risk-taking behavior. It can be suggested by combining these studies that an adolescent’s assessment of risk is not necessarily lacking, but the emphasis an adolescent places on maintaining a “normal” societal image can skew their otherwise rational assessment.
Evidence: Distribution of Scores on Final Paper

- Sample Previous Semester: Fall 2005
- Pilot Semester: Spring 2007
- Project Year 1: 2009

Evidence: Mastery of Paper Dimensions

- High
- Intermediate
- Limited
Excerpts from a sample paper: Gender and math

...What is especially important to note in this study is that the clear differences in gender scores occurs in elementary school, long before a child has the option to begin choosing which courses they would like to pursue. This supported the proposed concept that educational systems cannot be entirely responsible for provoking gender differences. If one were to conclude that there are obvious differences in girls and boys mathematical abilities the next step would be to question what measures can be taken to even up the scores.

One important aspect to take into consideration that is often overlooked when analyzing the competence that both genders exhibit in academic tasks is the individual child's awareness of their level of performance. In the Freedman-Doan study, the children's confidence in specific tasks was measured and then used to determine if the child's positive/negative perceptions would affect their chances of later improvement.

Excerpts from a sample paper: Gender and math

All three of these studies provide substantial evidence that young females continuously score lower than males in mathematics and it appears that the gender bias is not likely to be disputed in most academic, family and societal settings. The examined ages in each of these studies varies from kindergarten to seventh grade, highlighting a specific time in which positive influences would need to be presented to combat the female incentive to decline. These studies flow together nicely because they approach this dilemma in a sequential manner. The Updegraff study approaches the issue from a generalized society perspective by claiming that it appears that conventional roles from society have penetrated the family dynamic and caused daughters to unquestioningly adopt female associated roles; the Penner and Paret take this concept one step further by pointing out that these preferences appear long before the child is in an educational setting implying that the influential factors must be presented from a more invasive source; and finally the Freedman-Doan et al study concludes that not only do female students view themselves as less successful in male-dominated areas but that they cannot foresee a chance for them to improve.
Preliminary CLA Data: POLS 170

- Small sample \( n = 27 @ T1, n = 15 @ T2 \)
- Pre- to Post-test (5 weeks)
  - Essay- no change
  - Critique an argument- no change
  - Make an argument- no change
  - Performance score- significant improvement

Preliminary CLA Data: POLS 170

- Are CLA scores correlated with course-embedded measures?
- Pretest CLA scores
  - Critique an argument, Make an argument, Overall essay scores positively related to op-ed scores, critical review paper scores.
- Posttest CLA scores
  - Essay scores positively related to critical review paper scores
Project Timeline

Year 1
- Deliver Target and Control Courses: PSYC and POLS
- Measure Student Learning
- Prepare new faculty cohort for extended delivery

Year 2
- Deliver Target and Control Courses: PSYC, POLS and 4 other courses
- Measure Student Learning
- Prepare new faculty cohort for extended delivery

Year 3
- Deliver Target and Control Courses: PSYC, POLS and 4 other courses
- Measure Student Learning
- Prepare new faculty cohort for extended delivery

Insights

- Instruction team has been most valuable in design and problem solving

- We are identifying factors that may increase usage of consulting function and revision opportunities
  - Feedback timing seems to be critical-students need to realize they need help
  - Students as "economists"

- Our cognitive apprenticeship model leads to upgrades of student work while providing valuable training for future faculty (i.e., our graduate students)
Campus Buy-in -- Priorities

- Promoting evidence-based teaching
  - Standard for excellence in teaching
  - May or may not count as research
- How can this approach be more than a small pilot demonstration?
  - Alignment among conversations about quality of instruction and evidence of learning
  - Slow, step by step process

Faculty goal: deeper learning

- What do you want students to know/do?
- 5-year understanding
- Leads to backward design
- Benchmarking of student work
- Reflective practice
Danny Anderson, Spanish

- Language and Culture class
- Engaged students with Spanish speaking agency needs
- Documented changes in linguistic and cultural course goals

Guide to student work

Drawing Parallels Between Aesthetic Experience and Life Experience—Danny Anderson

Student Performance

One of the key elements in a second language class is motivation. The level of motivation in this course was dramatically different, far more intense than anything I have ever experienced in the undergraduate classroom. Students had commitments and personal missions that were driving their questions and desire to improve their Spanish.

Grading

Throughout the semester, I experienced ambivalence about how to make my grading criteria clear and ensure that I upheld the expectations of quality that I associate with a course at this level. At the end of the semester, my ambivalence was even stronger. All my students made As and Bs, which is not a typical grade distribution for one of my classes. But, when I looked at the quantity of work that the students had completed and especially the quality of their group presentations, I was profoundly impressed by their achievements. Service learning gave the students a genuine motivation to analyze literary texts and social situations and to express what they discovered through critical thinking. In terms of content, the group presentations were the best that I have ever seen in a course at this level; in terms of language mastery, their communicative success was dramatic and their grammatical accuracy was far above average. The effectiveness of their heuristic strategies for organizing ideas in a persuasive manner and the energy of their public speaking personalities were the best I have seen among Spanish majors.

It is hard to measure the quality of the service activity performed outside of class. From the reflection journals I had some sense of what took place each week. Getting supervisor evaluations back was not easy, which is negotiable, for their observations could have helped me understand what learning took place. But, this situation is also understandable and the supervisors in many cases accepted
Specific feedback on quality

Extended samples with comments
Seminars promote visibility

- Reading and searching
- Writing and sharing
- Product: Intentional plan
- Richer learning for students
- Engaging in reflective practice, not research

From benchmarks to inquiry – Michael Murray
Added worksheets into lecture

13. Rotation of a Rigid Body

13.1 Rotational Kinematics

1. The following figure shows a rotating wheel. Determine the sign (+ or -) of each vector:
   - Vector 1: __________
   - Vector 2: __________
   - Vector 3: __________
   - Vector 4: __________

2. The figure below shows a pulley with a mass of 2 kg. What is the tension in each of the following cords?
   - Cord A: __________
   - Cord B: __________

3. The figure below shows the angular acceleration vector $\alpha$, at four successive points on the trajectory of a particle moving in a circular path. At each point:
   - a. Is the tangential acceleration vector $a_t$ at point 2 and 3? Yes or no.
   - b. Is the particle's angular acceleration at point 3 and 4? Positive, negative, or zero.

Show shift in desired direction

- Exam scores better with worksheets
- Overall course grades better as well
- Design issues and classroom inquiry
Rich archive of student work

Transitioning from Lecture to Group Problem-Solving Activities — Michael Murray

Examples of good performance on midterm exam:
- Student 1
- Student 2
- Student 3

Examples of good performance on final exam:
- Student 1
- Student 2
- Student 3

Worksheets:
- Section 1:1-5
  - Good Quality
  - Fair Quality
  - Poor Quality

Section 2.5
- Good Quality
- Fair Quality
- Poor Quality

Section 3.5
- Excellent Quality
- Fair Quality
- Poor Quality

Final Exam Sample

- See problems and solutions
- With grading and criteria
- Students give permission
- Have option on name
Was this worth everyone’s time?

Transitioning from Lecture to Group Problem-Solving Activities — Michael Murray

Reflections

The main benefit these worksheets provided me as a teacher was that they allowed me to better assess gaps in student knowledge. Using mathematics-based exams makes it difficult to identify what students don’t understand. At the same time, just because a student can use the correct equation doesn’t mean (s)he understands the concept.

However, when students presented and discussed their answers in front of the class, I was able to hear their misconceptions. I could also listen as students discussed the problems among themselves to better understand their thought processes; this way, I could identify the reasons they didn’t arrive at the right answer. Consequently, I found that one major value to the worksheets was that they generated and prioritized topics for class discussion. During these discussions I was able to provide students with immediate feedback.

Need sophisticated readers

➢ Walt Whitman:

➢ “To have great poets there must be great audiences too.”
Build Community

- Convene conversations
- Use colleagues’ work as learning objects
- Develop reading of local work about teaching
- Connect with national sources, CASTL and VKP

Seminars to prepare project teams

- Within discipline
- Practical planning
- Local resources
- Reading of national sources for ideas
Definitions of excellence

KU faculty to be presented with distinguished teaching awards

LAWRENCE — Six faculty members will be recognized with distinguished teaching awards during commencement ceremonies May 18. Another award for outstanding teaching was also presented recently.

The Chancellor’s Awards for Outstanding Classroom Teaching honor faculty from the KU Medical Center. This year’s recipients are Martha Underwood Barnard, clinical professor of pediatrics; Alan R. Fleming, assistant professor of internal medicine; and Michael Moncur, associate professor of

Revised the Student Form --
No overall single item

Please enter only one response per item.

1. This instructor provided content and materials that were useful and organized.
   - Completely disagree
   - Disagree
   - Slightly disagree
   - Agree
   - Completely agree

2. This instructor set and met clear goals and objectives for the course.
   - Completely disagree
   - Disagree
   - Slightly disagree
   - Agree
   - Completely agree

3. What this instructor expected of me was well defined and fair.

4. What this instructor expected of me was appropriately challenging.

5. This instructor’s teaching was clear, understandable, and engaging.

6. This instructor was encouraging, supportive, and involved in my learning the course material.

7. This instructor was available, responsive, and helpful.

8. This instructor demonstrated respect for students and their points of view.

9. Compared with courses at a similar level, I would rate how much I learned as:
   - Much less
   - Less
   - The same
   - More
   - Much more
Peer Review based on inquiry

- All forms of scholarship include:
  - Clear goals
  - Adequate preparation
  - Appropriate methods
  - Significant results
  - Reflective critique
  - Effective presentation

Glassick, Huber, & Maeroff

Unit level Analysis

Reevaluating Undergraduate Learning in Art History - John Pultz & Amy McNair

Evaluation of Teaching & Learning

As a committee of four faculty members began reading and scoring each assignment using our rubric, we found that students received high marks, mostly scores of "2" or "3," for the first two skills in which they were asked to describe or analyze a visual culture or art object. We were pleased that courses were clearly exposing students to these skills, but when we looked for evidence of the other two skills, analyzing scholarly arguments and developing their own arguments, in general it wasn’t there. Students most often received scores of "1" or "not applicable."

This initially confused us, since we expected to find the best student work exhibiting all four skills. Gradually, we came to understand that different kinds of assignments might exhibit different skills, but that we needed to focus on where to find evidence of the last two especially. Since much of what we had was student work rather than the exam questions or term paper prompts, we did not always know if the professor might be targeting these skills without us recognizing them. For instance, an essay question from an exam might implicitly ask students to identify or analyze arguments from course readings, even if this is not apparent from the original question.
Target: Academic Program Review

Combining Live Performance and Traditional Assessments to Document Learning—School of Pharmacy

Background | Implementation | Student Performance | Reflections | Comments

Implementation

The practice-based portion of the Pharmacy School’s criterion assessment exam consists of standardized clients in 12 testing stations representing different clinical or management problems with the difficulty scaled to the student’s level of preparation. The cases that standardized clients represent are patterned from post-college pharmacy practice with the involvement of practicing pharmacists. It is constructed to be as authentic as can be accomplished in simulation, and also to be valid and reliable by the highest assessment standards. Workgroups of practicing pharmacists contribute to the writing cases used in the exam; standardized client performance and observation reliability are measured after administration of each four stations to one graduating class of students. Objective studies conducted of a 10% sample of video recordings compare both students’ and standardized clients’ performances with those of independent observers. Authenticity is also measured with post-exam student questionnaires and direct ratings of the videos.

Keys to buy-in at KU

- Evidence
- Inquiry
- Community
- Alignment
- Patience