ARTICLE
The Student as Teacher: Reflections on Collaborative Learning in a Senior Seminar

Jake Kurczek[1,2] & [3]Jacob Johnson

[1]Psychology Department, Coe College, Cedar Rapids, IA 52402; [2]Neuroscience Program, University of Iowa, Iowa City, IA 52242; [3]Biology Department, Coe College, Cedar Rapids, IA 52402.

A major influence on education since the 1950's has been Bloom's Taxonomy, a classification of learning objectives across multiple domains meant to educate the whole student (Anderson and Krathwohl, 2001). Although it has influenced educational pedagogy in primary education, higher education remains, in antiquity, heavily lecture based; viewing the instructor as an expert who professes their vast knowledge to their students. However, when students serve as instructor, it is difficult to apply this traditional view to the college classroom. Here we discuss the development, pedagogical approach, and experience of a senior level seminar course in which the students and instructor collaboratively explored an emerging field, embodied cognition, which combines research and theory from psychology and neuroscience among other disciplines, in which neither the students nor instructor were an expert. Students provided feedback and evaluations at three time points over the course of the semester, before class started, at midterm and at the end of the semester in order to address the experience and effectiveness of a collaborative seminar experience in which the instructor assumed a role closer to an equal of the students. Student responses revealed both high levels of satisfaction and degrees of perceived learning within the course at both the midterm and final evaluation. The approach of this seminar may be beneficial when applied to other seminars or course formats as students in this course felt as though they were learning more and appreciated being a more equal partner in their own learning process.

Key words: embodied cognition, seminar, collaborative learning, student-centered teaching, engaged learning

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The antiquated college lecture (Rüegg, 1992) has begun to be discussed with derision. Challenges from students wanting more out of their education and from educational progressives attempting to move education on-line (in the form of massive open on-line courses) are causing a shake up in the conventional method for instilling knowledge at the collegiate level. Traditionally, professors have been viewed as the "experts" who impart "truth" to students whose job is to sit back and listen passively (Karp and Yoels, 1976). However, Auster and MacRone (1994) suggested that students become less passive as the distance between student and instructor decreased. When there is little difference between the instructor and student in terms of age, experience, or knowledge of a topic, then applying the traditional lecture method would be difficult. This paper describes the benefits of collaborative learning, perceptions of professors that affect learning and the evaluation of a collaborative learning application to a senior-level seminar.

Increasingly, educators are looking towards more student-centered methods for instruction. Student-centered learning is an educational approach that focuses on the needs of the students and sees the instructor's role as more of a facilitator or collaborator in the learning process. The roots of this approach to teaching stretch back to the early 20th century with early developmental and educational psychologists including John Dewey (1938), Jean Piaget (1964) and Lev Vygotsky (1962), who saw learning as an active and interactive process that includes the individual but also extends beyond to rely on others. Today, this approach to education is demonstrated through a number of methods including problem-based learning (Dewey, 1897), inquiry based learning (Herron, 1971), experiential learning (Kolb, 1984) and collaborative learning (Dillenbourg, 1999). While there may be some resistance in higher education to incorporate collaborative learning, there has been a general increase towards incorporating aspects of collaborative learning into at least once per semester (Fink, 2004). In many grade school classrooms and curriculums, science in particular (Flick and Lederman, 2006), there has been a move toward a "learning by inquiry" ideal where they emphasize the scientific method and student centered questioning of the life around them (or whatever topic the standard is covering). It's possible that as students are indoctrinated in inquiry based projects that make up a large portion of their grade school education, it may encourage higher education to take this style of learning into consideration.

While many professors may continue to resist more active learning models to stick to the traditional lecture format (Ediger, 2001; Murry and Murry, 1992), there is emerging evidence that active learning demonstrates benefits to students. A meta-analysis of 168 studies between 1924 and 1997 have supported that collaborative learning is effective in higher education (Johnson et al., 1998). These benefits to student learning are not limited to certain disciplines and have been found effective from the humanities (Steffens, 1989) to the traditionally lecture heavy sciences (Michael, 2006). The benefits of collaborative learning extend to multiple domains of the classroom and learning experience including social (e.g., establish a positive atmosphere, and build diversity in

understanding), psychological (e.g., increase self-esteem and reduce anxiety), and academic (e.g., promote critical thinking; Johnson and Johnson, 1989; Laal and Ghodsi, 2011; Panitz, 1999). Indeed, the traditional lecture format may handicap a majority of students as lectures are targeted toward a certain "ideal" student, who is quiet, focused and learns best through auditory/visual means, depending on the formatting of lecture (Gardner, 2011). By varying the educational methodology, professors may be able to reach more students who learn in a non-traditional fashion.

In discussing the differences between student-centered and teacher-centered (i.e., collaborative learning) it is possible that the perception of instructors from the student's perspective may be drastically different between the two approaches. Previous research has indicated that students prefer psychology instructors with higher interpersonal skills (e.g., funny, self-improving) and who interacted with students in a positive manner and treated students with respect (Bukist et al., 2002; Kusto et al., 2010). Specifically related to teaching in a seminar setting, students prefer instructors who have good skills questioning, listening, reinforcing, reacting, summarizing and leading (Spruijt et al., 2012). Many instructor qualities that students found positive relate to the social interaction between student and teacher. As collaborative learning emphasizes the importance of connection and communication between learners, it appears as though it may be the best pedagogical model to emphasize these qualities in the classroom.

Previously, Casteel and Bridges (2007) described the use of a graduate seminar-style course in which the undergraduate students served as the main facilitators with the instructors serving a less active role and found that the students evaluated both the course and the instructors highly. They concluded that the style appealed to the students and emphasized an active role in learning. Building off the lessons of Casteel and Bridges (2007), the goal of the course described here was to fully immerse an upper level seminar course in collaborative and engaged learning. The topic of the seminar was embodied cognition which explores the dynamic between the mind in body from a number of different theoretical and disciplinary perspectives. In the course, after a brief introduction to the topic and format of the course, the students exclusively lead the in-course discussion, presentation and exploration for the rest of the semester. Three times over the course of the semester students provided feedback and evaluations, before class started, at midterm and at the end of the semester, in order to address their experience, their perception and the effectiveness of this collaborative learning seminar experience.

EMBODIED COGNITION
The instructor chose embodied cognition as the topic for the seminar because as a recently developed field in neuroscience, it was likely that the topic would be new to the students. Likewise, since the theory is under development, there are not many universally accepted core concepts, which could increase the amount of material available for discussion and analysis. While the interaction between the mind and body has been a central question to the study of mankind for hundreds of years, the number of answers to the question have been countless and continually developing. For many years, the best guess as to how the mind works was to say that the brain used some sort of "mentalese," or mental language, to process information from and interact with the body, analogous to the way a computer processes information (symbolic representation). Embodied cognition (EC), the view that the body plays a central role in shaping the mind, opposes the view of the mind as a computer, and is gaining considerable traction in cognitive science (Wilson, 2002). At the heart of EC is the idea that high-level cognitive processes (e.g., memory, decision-making, language) are influenced by sensory, motor, and affective information from the body. A typical claim of embodied theories is that many forms of cognition make use of perceptual/action systems; meaning that cognition is not something that is accomplished with abstract symbols; rather the body must interact with the world in order to function. The last ten years have seen a rapid spread of theory and research connected by the term "embodiment" and with that explosion has followed controversy. The goal of the seminar was to understand the embodied cognition hypothesis by examining evidence regarding the claim across multiple areas of psychology. What made this topic interesting to the instructor to propose as a seminar course was its "youth" in development and place in psychology and neuroscience, the controversy surrounding its theoretical claims and the inability to replicate many studies. These elements made the topic ripe for investigation both in terms of the theory itself and the broader investigation of the scientific process.

SEMINAR COURSE DEVELOPMENT
The first author taught the course in the Spring of 2013 with nine students (including the co-author). Before the semester, the instructor identified a number of areas of interest within embodied cognition after surveying two textbooks (Bergen, 2012; Shapiro, 2010) and dedicated each week (of 13) to one topic within embodied cognition (Figure 1). However, the course contained negotiated scaffolding where the class work rate and depth was up for negotiation, giving the student a deeper sense that they were in control.

For each class period, the instructor selected two articles to read that provided a mix of review and primary research. Since embodied cognition is such a broad field, composed of many different disciplines across science, it is difficult to become an expert of the entire field, but the hope in this course was to expose students to the basic concepts and theories from a wide variety of areas and disciplines and then become an expert in one small area through a semester long project (discussed later). Our class time and reflections were thus used to work through general aspects of embodied cognition using our own views and experiences to try to assimilate general views of the field into our existing experiences. The individual writing assignments (discussed below) and other

communication outside of class provided the opportunity to work through ideas in one particular topic or aspect of the field. The goals outlined at the beginning of the course were as follows: 1) to provide an opportunity to work through scientific controversies by analyzing, comparing and contrasting theories and research, 2) to provide an opportunity to work through the scientific process through writing an annotated bibliography and research proposal, 3) to practice and improve your writing and presentation skills, and 4) to experience and understand a collaborative learning process.

Topic/Reading Schedule
1/14 - *Traditional Cognitive Sciences* –
Newell & Simon, 1976; Searle, 1980

1/21 – *Philosophical Roots* –
Beer, 2011; Gallagher, 2009; Garbarini et al., 2004; Zlatev, 2007
Assignment – Daily Reflections start; Daily Questions start; Discussion Leaders start

1/28 – *Grounded Cognition* –
Anderson, 2003; Barsalou, 2008; Shapiro, 2007; Wilson, 2002
Assignment – Weekly Annotated Bibliographies start

2/4 – *Perception and Action* –
Barsalou, 1999; Chiel & Beer, 1997; Glenberg & Kaschek, 2002; Markman & Brendl, 2005

2/11 – *Morality* –
Helzer & Pizaro, 2011; Schnall, et al., 2008; Zhong, et al., 2006; Zhong, et al., 2010
Assignment – First Draft Paper – Exchange with first partner

2/18 – *Concepts* –
Lowerse & Jeuniaux, 2010; Martin, 2007; Patterson, et al., 2007; Pecher, et al., 2011

2/25 – *Metaphor* –
Camp, 2006; Fauconnier, ; Gibbs, 2006; Lakoff, 1992

3/4 – *Spring Break*

3/11 – *Temporal/Spatial Language* –
Casasanto & Boroditsky, 2008; Boroditsky, 2000; Casasanto, 2008; Kranjec & Chatterjee, 2010
Assignment – Second Draft Paper – Exchange with second partner

3/18 – *Language and Gesture* –
Beilock & Goldin-Meadow & Beilock, 2010; Goldin-Meadow, 2010; Singer & Goldin-Meadow, 2005; Willems & Hagoort, 2007
Assignment – One on One Meetings over Research Papers

3/25 – *Memory* –
Casasanto & Dijkstra, 2010; Glenberg, 1997; Theeuwes, 2005; Postle, 2006

4/1 – *Social Cognition* –
Gallese et al., 2004; Barsalou et al., 2003; Zhong & Leonardelli, 2008; Wolpert, et al., 2003

4/8 – *Emotion* –
Niedenthal, et al., 2007; Goldman & de Vignemont, 2009; Wilkowski, et al., 2009; Havas, 2007

4/15 – *Paper Workshoping*

4/22 – *Weight and Feeling* –
Ackerman et al., 2010; Chartrand & Bargh, 1999; Jostman et al., 2009; Williams & Bargh, 2008
Assignment – Final Paper Due; Research Presentation Due

4/29 – *Research Symposium*

Figure 1. Course schedule, readings and assignments.

SEMINAR COURSE DETAILS

The course met twice weekly for eighty minutes per class period. Students were graded equally on six criteria (Figure 2). The first two weeks, the instructor served as the discussion leader in order to give a broad introduction to embodied cognition and model the general format of the course. Discussion leaders were responsible leading the class in discussion of the readings by preparing presentations, demonstrations and activities as they saw fit. Discussion leaders collaboratively integrated reflections and questions posted on the forum from the previous evening and were mindful of the needs of the class. The

first round of discussion leaders for the students saw the students paired in teams so that they could work with another student before working on their own as many students had not had much practice teaching and learning from discussion (Brookfield and Preskill, 1999). During the student led discussions, the instructor took a reduced role (see Casteel and Bridges, 2007; Phillips and Powers, 1979), only providing clarification of methods or theories that were not well presented in the readings, to facilitate discussion around a particular topic and to provide commentary of personal experience with certain topics or methods.

The instructor provided both quantitative and qualitative feedback on all assignments throughout the course of the semester. Opportunities for collaboration outside the classroom included helping students shape their topic while choosing it, at weekly intervals when submitting their annotated bibliographies and at two additional time-points when students submitted drafts of their research proposal. Additionally, the students were able to provide feedback to each other at those same two time-points as they progressed on their proposals.

Assignments

· **Daily Reflections**
For each day (starting week 2) students shared their thoughts/reactions about the readings. These were not meant to be summaries, and potential questions to get started writing included: what and why you agree or disagree with and what did you find interesting or confusing? These were posted these to the course webpage the night before class so that the professor can (1) read them before class & (2) assemble them all together, print them out and hand them out in class for all to see. Additionally, the discussion leader and rest of class were able to read these before class.

· **Discussion Leader**
Students were expected to be the "discussion leader" for three different days of articles/topics distributed over the semester, beginning Week 2 (after the professor modeled for the class Week 1). The discussion leader should provide structure to the discussion of the issues. They should prepare a powerpoint. handouts, sets of questions for discussion, or something else in order to help structure the discussion. The leader should not do all of the talking that day, but rather facilitate discussion. Students were able to consult with the professor about how to structure the discussion and where to find interesting outside materials.

· **Class Participation**
This is a reading and discussion based course. Students are expected come to class having read the articles and put some thought into them. To facilitate the discussion and encourage reading of the articles students came up with at least 2 questions about each of the readings and post these to the course website the night before class. The discussion leader for the day did not need to post questions to the course website before their presentation.

· **Annotated bibliography (AB)**
In order to aid the preparation of their research paper, students found and summarized related articles on one of the topics (that their research paper was on) covered in the course. Each week they prepared a brief (e.g., 1 paragraph to 1 page) summary, as well as the full reference in APA style. They were asked to prepare a minimum of 11 articles (1 per week) in the bibliography, however, the assigned articles did not count towards the minimum 11 articles.

· **Research Paper**
The major project for this course was a 10-15 page research proposal paper. The final paper included an introduction (literature review and hypotheses) and a methods section. They did not need to conduct an actual research study. They were asked to think through the proposed methodology, the theory and hypotheses, as well as their predictions. There were not expected to provide an exhaustive literature review, however review was necessary for providing context in which to understand the proposed experiment(s), the theory which it is designed to test, and for backing up any underlying assumptions which underlie the hypotheses. The paper was expected to conform to APA style.

In order to facilitate preparation of the project, students were asked to provide updates twice during the semester to different members of the class. This allowed students to receive feedback on their projects and work collaboratively:

About one-quarter of the way through the semester, they turned in a 1-2 page paper that included the research question and briefly described at least 2 academic studies that formed the basis for their research question. to your first writing partner. These should be returned within 1 week and be posted to the course webpage with track changes.

About half-way through the semester, students turned in the first draft of the introduction of their paper (6 pages minimum) to their second writing partner. These should be returned within 1 week and be posted to the class webpage with track changes. In this draft, students should summarize relevant research studies and describe how these research studies support your hypotheses. The papers should include at least 12 academic sources in the reference section. The paper should also include an abstract. Additionally, the professor met one-on-one with everyone at mid-term in order to help with the experimental design.

The final draft of your paper (10-15 pages) was due the week before finals. This paper should be a revised and improved edition of the mid-term paper and include an abstract, an introduction and the method section. After receiving feedback and a grade students wrote a 1 - 2 page response, review, reflection of your thoughts about the paper/experiment/presentation and the professor's comments on the day of the final for up to 6 points back on the paper.

· **Research Presentation**
Psychology conferences typically host symposium sessions, in which researchers construct talks to present their research findings from a recent study or studies. The last week of class, consisted of an academic symposium. During the session, each student presented a powerpoint slideshow describing their research proposal that they have developed over the course of the semester. The presentation should include the following: literature review, hypotheses, method, references. Each presentation should be 10 minutes with 5 minutes for questions. A graph of expected results would be especially helpful! You should post your presentations to the course webpage.

Figure 2. Course assignments. Students were graded equally on six components.

COURSE EVALUATION

The course was evaluated three times over the course of the semester, first at the start, second at midterms and third at the end of the semester (Figure 3). The first

evaluation attempted to identify students' previous experiences with seminars and other classes and then assess their understanding of and experience with collaborative learning. At the midterm and end of the course an informal evaluation assessed the course quality, instructor quality, amount of information learned in relation to other courses, and how well the instructor helped students demonstrate their learning of the material. At the end of the term an additional questionnaire asked students to provide qualitative evaluation of the seminar and collaborative learning.

Evaluation 1
1. How many seminars have you previously taken?
2. What are your favorite/best experiences learning? What have been for the best ways for you to learn in small courses in the past?
3. What are your least favorite/worst experiences learning? What have been for the worst ways for you to learn in small courses in the past?
4. What might make a seminar effective?
5. What aspects of a course influence learning?
6. What makes for an effective teacher?
7. What facilitating method in your courses most enhanced your learning?
8. Are you familiar with collaborative learning? Can you describe what it might mean?

Evaluation 2
1. Compared to what you shared at the beginning of the semester, is this seminar helping to make learning effective?
2. How do you feel the discussions are going in the course? Do you feel like you contribute the amount you wish to?
3. Has your view of collaborative learning from the beginning of the semester changed?
4. Is what you see happening so far collaborative learning?
5. Can you identify a metaphor for 1) my role in the class so far 2) our relationship as teacher and students?
6. What aspects of the course do you enjoy?
7. What aspects do you wish were changed in the future?
8. What am I doing well?
9. What do I need to improve and what do you suggest I can do to change that?
Please use the following scale to rate how this class compares to others in terms of:

-3	-2	-1	0	1	2	3
Much Less			About the same			Much More

10. Time spent working on the class
11. Enjoyment of the class/material?
Please rate the following questions using this scale:

1	2	3	4	5	6	7	8	9	10
Poor									Excellent

12. The overall quality of this course
13. The overall quality of the instructor
14. The adequacy of the amount of information learned in this course compared to other courses you have taken
15. The instructor's skill in encouraging students to apply concepts to demonstrate understanding

Evaluation 3
Combination of *Evaluation 1* and *2* plus:
For the following topics: what were good, useful or helpful aspects. And what aspects need change or improvement?
1. Seminar Teacher
2. Student – active participation, appropriate preparation, discussing theory and explaining concepts
3. Seminar Questions – Stimulate discussion, case based, clinically relevant
4. Facilitating methods
5. Seminar group function – interaction between students, between students and teacher
6. Preparation – student, teacher
7. Schedule – effective use of time

Figure 3. Course Evaluations.

RESULTS

Beginning of Semester Evaluation
At the beginning of the semester only one student had previously enrolled in a seminar course. For the best way for students to learn 6/9 endorsed some sort of applied method for learning, while 7/9 endorsed discussion. Students had varying ideas about the keys to an effective course and seminar including: one where discussion was present (3/9), students were prepared and gave a good effort (3/9), there was good communication between students and instructor (2/9) and there was a good group dynamic (2/9). The qualities of an instructor they found important were one who is a good facilitator and listener (6/9), who provides clarification and interjects their personal expertise and experience (4/9), and who is fun and engaging (2/9).   In terms of collaborative learning, while five students were unfamiliar with it, the themes

mentioned in attempting to describe it included: both the students and instructor learning and teaching (6/9) and a mix of experiences and perspectives forming mutual success (3/9).

Midterm Evaluation
Compared to the beginning of the semester, students thought that the most effective parts of this seminar were discussions (4/9) and thinking in new ways/having open minds (3/9). In terms of the instructor in this course they found the most positive aspects to include good communication (3/9) and the ability to interject advice/opinion/feedback and facilitation (5/9).   In an attempt to have the students apply some of the concepts from the class, they were asked to use a metaphor to describe the role of the instructor in relation to the students of the class. Five students produced metaphors including: 1) an equal learner helping others to find their own paths to knowledge, 2) an uncle "because they could always help them out if they couldn't figure out a concept," 3) an explorer/guide – "this is pretty unfamiliar territory, but you, being more familiar with it than us can guide us toward a better understanding of the questions being asked," 4) knowledgeable facilitator who helps clarify when we can't reach our own conclusions/are confused, and 5) Drivers Education Instructor because "its like a road trip where you are driving the car and can steer it wherever we need to go but we're all in the car together (cars being great places for talking and bonding) and you let us be in the back seat but can intervene and maintain control of the vehicle."

End of Semester Evaluation
The end of the semester evaluation focused on the nature of the collaborative experience in this seminar.   The students continued to touch on themes they raised throughout the semester including:
1) The importance of discussion
"Discussion is a big one because you are more engaged when you are adding your personal touch…This was by far the most collaborative class atmosphere I've ever had, by incorporating class-long discussions and having discussion leaders."
"This course allowed us to pick each others brains for ideas and information. Without being able to bounce things off of each other we would not have had such great discussion. The discussion is super important. This topic [embodied cognition] served well with seminar learning because it was difficult to understand on your own."
2) The connectedness of the students and instructor
"There was a combined effort between students and teacher. It went a lot better than I initially thought it would too. Definitely developed my speaking/presenting skills."
3) The connection of the course material to outside ideas and experiences
"I enjoyed that this class really seemed to have no boundaries. Embodied cognition is so applicable to life! One day we talked about advertising, the next; time travel and education. Discussion could take us anywhere."
"The discussions really put everything into perspective and let us apply all we learned and were thinking about. It

also let us take our own outlook and roll with it."

Students also quantitatively evaluated the course on six questions at midterm and the end of the semester. Two questions asked students to compare the course (on a -3, much less to +3, much more scale) to others they have taken for 1) how much time they spent outside class time working and 2) how much they enjoyed the course. Four questions asked students to evaluate on a 10 point scale (1 = poor, 10 = excellent) aspects of the course including, 1) the quality of the course itself, 2) the quality of the instructor, 3) how much information they learned, and 4) how well the course made them demonstrate their understanding. Scores from midterm and the end of the semester were standardized and t-normed (mean = 100, SD = 15; see Table 1; Figure 4) and then compared using two-tailed paired t-tests. While most questions were not significantly different between the two observations, two questions revealed significant improvement from midterm to the end of the semester including instructor quality (t(7) = 3.0, p = 0.02) and the amount of information learned compared to other courses (t(7) = 2.45, p = 0.04).
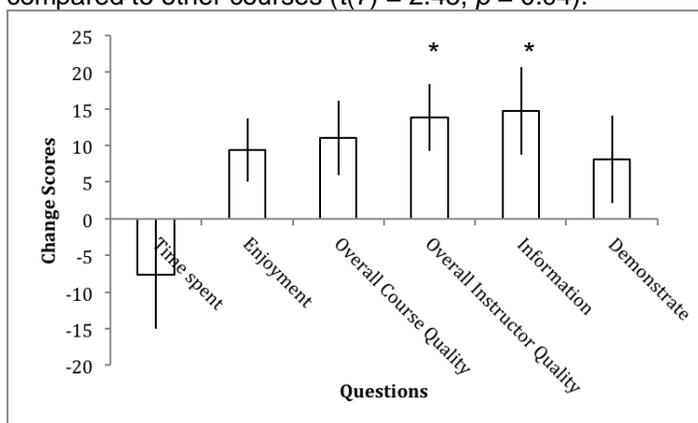

Figure 4. Midterm versus end of semester ratings (mean change) of standardized scores ($\pm$ SE). Two questions were rated significantly higher (almost one SD) at the end of the course from midterm * = significant at *p < 0.05.*

Question	Midterm	End	T Stat	P value
Time Spent	103.8 (15.3) 1.7 (0.9)	96.2 (14.6) 1.3 (0.8)	1.02	0.34
Enjoyment	95.3 (17.7) 1.6 (1.1)	104.7 (10.9) 2.2 (0.7)	2.18	0.07
Course	94.5 (18.6) 8.0 (1.7)	105.5 (8.3) 9.0 (0.8)	2.16	0.07
Instructor	**93.1 (13.7 8.6 (0.7)**	**106.9 (13.7) 9.4 (0.7)**	**3.0**	**0.02**
Information	**92.6 (17.5) 7.2 (2.0)**	**107.4 (7.3) 8.9 (0.8)**	**2.45**	**0.04**
Understanding	95.9 (19.3) 8.5 (2.1)	104.1 (8.5) 9.4 (0.9)	1.37	0.21

Table 1. Midterm versus end of semester ratings (mean 'SD') with standardized scores on first row and raw scores on the second row. Questions correspond to Evaluation 2 questions 10-15. Bolded scores = significantly different from midterm to final at *p < 0.05.*

DISCUSSION

Based on student responses, they learned about and appreciated the collaborative learning method applied in this course. Students felt that they learned more throughout the semester and the instructor became better even though the goal of the instructor was to be a more equal member of the course rather than traditional leader. An interesting, though non-significant trend, was the decrease in time spent on the course (in comparison to time spent on courses in general). While students still rated themselves as spending more time on this course as compared to others, they rated themselves as having spent less time working on the course later in the semester. That might indicate a steep learning curve at the beginning of the semester that decreased as they learned more about the topic. Additionally, it could also relate to the designed reduction in course reading demand to match the increase in time that was meant to be spent on final papers. A final note on this non-significant decrease in time spent on the course is its potential impact on the increase in instructor rating. Perhaps seniors, in their final semester, greatly appreciated a decreasing reading load and that combined with the view of the instructor as a collaborator increased their positive perception of the instructor.

While overall, the students appeared to really enjoy the collaborative learning experience and the benefits of that experience, a comment that was mentioned by a 5/9 of the students at the end of the semester was the wish for a little more input of the instructor's expertise and experience during the discussions. Example comments included: 1) "Sometimes it would have been better if you spoke up a little more during discussion possibly to direct it in specific ways because you know so much and should share the knowledge.", 2) "I really enjoyed the class, but maybe discussion leaders could lead for half the class and you lead/share experiments for half or something. That way students get to hear more about what you've done.", and 3) "Feel free to insert your opinion more though as its more knowledgeable."

While the students appeared to enjoy learning from each other, the difference in how the class functioned (collaborative versus lecture style) may have felt odd for a topic that they felt was difficult. Perhaps with either a topic that students have more experience with or by taking the suggestion of the second comment to include more structured comments and presentation from the instructor during class meetings, future installments of the class could prevent this problem. Interestingly, while the students commented that they wished for more instructor command and input, there was still a significant increase in the rating of the instructor quality over the course of the semester.

These results contribute to a growing field of evidence from embodied cognition that active (situated) learning strategies are perhaps more beneficial than cognitivist views. These benefits in education range from reading, where acting out and imagining a story leads to better comprehension (Glenberg et al., 2004), to science where students who are allowed to manipulate a 3D model have a better understanding of molecular structures (Jones et al., 2006), to mathematics where students learn better when teachers attend to the gestures that they and their students use (Goldin-Meadow et al., 2009). Situated learning theory

sees the role of cognition for action (Wilson, 2002), opposed to being separate and internal. Likewise, a number of researchers in neuroscience have elucidated the role of the body in a number of processes including social/emotional processing and tool use (Adolphs, 2001; Johnson-Frey, 2004; Rizzolatti et al., 2002).

Additional evaluation from neuroscience also provides evidence that active (engaged) learning is beneficial because it promotes deep versus surface learning (Armbruster et al., 2009; Michael, 2006) and that personal relevance of the content to the individual is an important aspect of the affective component of effective learning (Frymier and Shulman, 1995; Sibthorp and Arthur-Banning, 2004). Active learning may be more beneficial because it appeals to multiple sensory modalities and activates a larger set of processing structures so as to create a richer memory representation (Shams and Seitz, 2008). While personal relevance on the other hand may appeal to the affective component of learning, which although generally thought of as separate cognitive processes, actually positively contributes to many other cognitive processes that are important in the learning process including perception, attention, memory and decision-making (Immordino-Yang and Damasio, 2007).

Students in this course appeared to really appreciate the affective components of collaborative learning that were highlighted in the course as emphasized by Immordino-Yang and Damasio (2007). The student's metaphors from the midterm evaluation focused on the "adventurous" feeling of the class where their professor was an "uncle," a "guide," and a "driver's education instructor" working with them and helping them explore new information. Qualitatively, the student's continually emphasized the importance of communication and equal contribution to the learning process between student and teacher. These results corroborate the findings of previous research where students preferred instructors with higher interpersonal skills (Bukist et al., 2002; Kusto et al., 2010) and in particular to seminar courses, preferred instructors who were good at questioning, listening, reinforcing, reacting, summarizing and leading (Spruijt et al., 2012). These results, the importance of emotion and social-emotional factors, should be kept in mind as more and more administrators look to on-line learning options. Administrators should think about how to create community and a sense of connection amongst the (potentially thousands of) students and between the students and professor.

As higher education continues to deal with a time of change it is important to remain open to various evidence-based teaching pedagogies even if they are not a part of the traditional pedagogical standards. Embodied cognition, like other topics in neuroscience, combines multiple disparate fields which make it difficult as an undergraduate student to have much previous experience or expertise in it before starting a course. A seminar course, with their small class size and deep exploration of advanced topics that may be rapidly developing or controversial, lend themselves perfectly to the collaborative learning model. Since their purpose is to evaluate and explore a particular topic rather than master its content, there should be no need for an "expert" sharing knowledge in a unidirectional fashion. Rather, each participant should bring their own experience and understanding and shape the groups evaluation of the topic at hand. While it may at times be frightening to give up control in the classroom, whether by leading open discussion, or asking students to help take charge of their own learning, the students appreciate the chance to discover their own learning. Here we have presented the implementation of a collaborative learning seminar in which the students felt they learned more about the topic when compared to other classes and enjoyed the teaching approach. We have presented evidence both from the students' self-reports and from a neuroscience perspective suggesting why this collaborative (engaged) method of teaching is successful. Hopefully, the evidence from this collaborative seminar experience and others can serve as a model for future instantiations of collaborative learning. The lessons here, that collaborative learning and active, engaged learning are viewed positively by students and helpful to the learning process, can be applied in various ways to other course formats in higher education and neuroscience in particular. As higher education continues to develop and face new pressures, it is important to continue self-assessment and look to educational practices supported by evidence.

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Address correspondence to: Jake Kurczek, Psychology Department, 1220 First Avenue, Coe College, Cedar Rapids, IA 52402   Email: jkurczek@coe.edu