Abstract

As an Associate Instructor (AI) at Indiana University, I assisted in the teaching of the lecture course Biology of the Senses (L104). Since a head instructor controlled the course, content, and time-management, I used my role to promote a learner-centered environment through activities and assessments that encouraged students to critically self-reflect and personalize concepts and study habits. Two activities in particular focused on these goals. The first modeled personalization study techniques, gave students practice personalizing a concept, and called for self-reflection. 86% of students responded to this activity with an intention to make a specific change in their study habits, and 56% intended to personalize their studying. The second activity assessed effective study habits after the 3rd exam. In this survey, 71% of students from the first activity had personalized their studying, 15% more than had initially intended to, and 91% of those personalizing found it helpful. Additionally, 36% reported personalization as their most effective study technique and 43% that passive studying was the least effective. When asked how they would change their studying for the final, only 8% of students did not intend to change. 21% intended to use more active studying techniques and 13% specifically mentioned personalization. Overall, students seemed to benefit and respond to activities encouraging critical self-reflection and personalization techniques.

Introduction

As an Associate Instructor (AI) during the Spring of 2009, I helped teach Biology of the Senses (L104), an introductory, non-majors course in the Department of Biology. The 100 students in the course were almost all non-biology majors trying to fulfill their graduation requirements, and had varying levels of scientific knowledge, interest, and comfort. Most were sophomores and juniors, with some seniors and a few freshmen. I assisted the class by performing learning assessments, interactive activities, grading, holding office hours, and giving two guest lectures. The head instructor gave the rest of the lectures and activities. One goal of the course was to have students learn how the senses (e.g. vision, hearing, smell, touch, etc.) function in humans and some non-human animals. This included how the nervous system works and how sensory receptors in our bodies turn
external signals, like light or sound, into internal signals, which are interpreted by our brain to create a perception of our environment. Another goal was to give the students a more critical, scientific lens with which to examine how they interact with the world.

**Objectives**

Learning objectives in *L104 Biology of the Senses* focused on student understanding of how the senses work using biological concepts. It also focused on fostering critical thinking about biological systems. Because the class had a full-time head instructor, I was not able to control the knowledge-based lecture format, the topics taught, or the amount of time set aside for me to implement active learning or classroom assessments. This challenged me to find ways to improve classroom learning using innovation within the framework set up by the instructor. In other disciplines like Anthropology or Communication & Culture, classrooms seem much more reflective and learner-centered than Biology. This inspired me to focus my efforts this semester on creating a more learner-centered environment. A “learner-centered” environment pays attention to the knowledge, skills, opinions, cultural practices, and beliefs brought into the classroom by the learner (National Research Council, 2000). As a non-major course, I noticed that some students were intimidated by the idea of taking biology, didn’t expect to do well from the beginning, and/or didn’t understand the relevance of some information. Therefore I focused on two learning objectives that I hoped would help students feel more comfortable, confident, and connected to the information.

1. **Critical self-reflection**
2. **Personalization of the information to improve understanding and study habits**

**Implementation**

In the beginning of the course, I focused more on fostering critical self-reflection in the students, head-instructor, and myself. On those days where I was given time, I did this
through classroom assessment techniques such as a ‘memory matrix’ comparing two concepts or the ‘muddiest point,’ where students wrote down what information they felt most and least confident about (Angelo & Cross, 1993). To help students critically self-reflect, I then pointed out that this should give them an idea of what they personally needed to study more and ask questions about. I also encouraged them to use this technique on themselves after lectures to better assess their own learning. I tabulated their responses, created a list of resources to answer the most common questions, and passed the responses on to the instructor so she could adapt her upcoming lectures to clarify their concerns. Some of my activities worked better than others, and I made sure to self-reflect on why to help improve my communication and teaching skills.

Because of my self-reflection, I came to realize halfway through the semester that I needed to better align my teaching practices to my goals of student-centered learning. My opportunity came a week before the 3rd exam when the head instructor asked me to do an activity reviewing two important concepts for color vision. With my learning objectives clearly in mind, I implemented a 2-part activity that could satisfy both the instructor’s knowledge-based objectives and my own student-based ones of critical self-reflection and improving personalization. This activity focused on personalizing the concepts taught in class to better remember it later. I also hoped that personalization would help students not only remember these concepts for the test, but also successfully transfer biological concepts to their daily life. Transfer is a learning principal defined as the ability to extend what has been learned in one context into new contexts (Byrnes, 1996).

**Part 1.** In my “Personalize the Info” activity, I started by summarizing several personalization study techniques that I sometimes use, such as metaphors, acronyms, short stories featuring concepts or terminology as characters, and explaining concepts in your own words either on paper or by saying them out loud. Next I gave a quick micro-lecture on the two vision concepts: color trichromacy and color opponent theory. After explaining each concept, I modeled a personalization technique. For example, I personalized color opponent theory by making it into a short story about a family arguing over Christmas dinner. I then had the students pair up. The first student had to explain color trichromacy theory in their own words, and then they had to explain how they would personalize the
information so they could remember it. The second person had to do the same with the other concept. At the end, they all filled out a worksheet that assessed the effectiveness of the activity in improving their knowledge, comfort, and in teaching them a useful study technique. The results are discussed in the assessment section.

**Part 2.** A week after the 3rd exam, I gave the students another questionnaire to get them to critically reflect on their own study habits before the final exam. First, I wanted to assess if anyone had tried personalization on the last exam and if so, had it helped. I also wanted the students to identify for themselves what their study habits were and to acknowledge what was helpful and what wasn’t. The second part was adapted from a previous course I helped AI, where students had to reflect on their studying before and after every exam. My goal was to improve student study practices, motivation, final grades, and conceptual understanding.

**Assessment (Evidence/Data)**

**PART 1.** After the first “Personalize the Info” activity, students filled out an anonymous survey about their confidence in knowing the two vision concepts and about the usefulness of the personalization of study habits activity. Only 56 students turned in the survey at the end of class. I expect that this is partly because the activity occurred during the Passover holiday and partly because the activity was worth no points and was anonymous. The worksheet asked:

1. What do you feel you could explain to someone else?
2. What don’t you understand?
3. What part of this activity was useful?
4. Rate your confidence in your ability to do this activity and say why.
5. What specific change or action do you intend to make as a result of this activity?

Based on student responses, the questions could have been worded better to evoke more precise answers relating to the activity, especially questions 3 through 5. Nevertheless, after the activity 71% reported confidence in explaining one of the two main concepts versus only 29% that still reported uncertainty. Because of vague wording in #3
about the usefulness of the activity, some people responded with regards to the whole activity, while others focused only on the study techniques section. Thus only 15% did not find the activity useful, and that was because they “already know how to study” (Fig. 1).

The purpose of rating their confidence level in #4 was to have the students be self-reflective about their own knowledge level and to give me more opinions about the activity. Students had an average confidence level of 3.23/5 or 65% for this activity. Responses ranged from the positive, “I am good at personalizing material and telling stories,” “as long as I understand the concepts I can make a story about them,” to the negative, “I’m not good at description,” “Sometimes it is more confusing if you have a lot of stories and acronyms.” Several low scores also came with reflective comments, “I need to review my notes more,” “I’m not used to explaining concepts before studying,” and “I could partially explain both, but not in detail.” In the future, I would try to have students explain concepts more often to each other in class.
Because of how #5 is worded, "What specific change or action do you intend to make as a result of this activity," it could apply either to knowing the concepts themselves or to personalizing the information. 86% of students (n=48/56) responded that they would make a specific change as a result of this activity, with 56% (30/56) intending to personalize the information (Fig. 2). Student responses showed an increase in studying motivation and an intention to use more active and engaging techniques like personalization.

“When studying, I intend to visualize concepts in my head and make them interact in order to remember them better.”

“I will try to create meaning behind the information.”

“I’ll use more stories, I never thought about that before.”

**PART 2: Personalization.** After they got back exam 3, which had the highest test average to date, I gave the class a survey on whether they used personalization to study for the exam and if it had helped. I also asked them to critically reflect on the study habits they had used for the exam, and on what they would change for the next one. Because this is the first time the class has been taught by this particular head instructor, I could not compare the exam results to previous semesters to see if my intervention had helped
improved grades. At this point I was given some discretionary points, so I made the survey worth 2 points. This gave me 94 responses. The lack of anonymity did not seem to affect student honesty, as several students had no problem writing that they didn’t attend my activity, didn’t like it, or didn’t find it useful. The survey asked:

1. What techniques did you use to study for the exam?
2. Were you in class for Karen’s “Personalize the Info” activity? (yes or no)
3. In studying for the 3rd exam, did you try to personalize the info? If yes, did it help?
4. What was your most effective study technique and why?
5. What was your least effective study technique and why?
6. How will you study differently for the final exam?

Starting with the personalization data (#2-3), 48% of students (n=45) in general used personalization to study for the 3rd exam (Fig. 3). Of those, 91% (n=41) found it helpful. Of the 56 students who came to the first activity, 40 people (71%) actually personalized, which was much more than the 29 who had originally reported an intention to do so (Fig. 4). Furthermore, 95% (n=38) of those who personalized reported not being regular users of the technique in the past.
Positive student responses:

“The personalizing the info activity helped me when studying and writing my outline.”

“I used the technique to help differentiate the 2 color theories, and I was able to keep the info for each from being confused.”

“Creating a story is just one more tool to help me remember certain concepts.”

“Yes [I used it], and I did a lot better on the third exam!”

“It helped me to remember information when I made it relevant to me.”

Negative student responses:

“There are too many concepts to personalize everything.”

“It makes it more complicated and takes me a longer time to study”

Study strategies. Because so many students in the class were not even science majors, much less biology majors, I was interested in how they were studying the material and in getting them to critically reflect on if their strategies from a different discipline worked in biology as well. I came up with this idea after talking to a student in the class who was majoring in Fashion Design and was struggling a little with the extremely different testing styles.

In response to how they studied for the last exam, almost all students wrote that they had studied by rereading over their slides and notes. Many also used the provided study guides and tests from previous semesters, and some rewrote their notes. 95 students gave a total of 104 responses (some wrote more than one response).

Students reported that their most effective study technique is reviewing and memorizing the slides (n=15), “because everything is in there.” This was followed closely by taking practice exams (n=14), rewriting the notes in their own words or handwriting (n=12), using the study guide (n=11), and going to the review session (n=7) to, “ask
questions, hear other people’s questions, and hear the information reworded.” The rest of the responses are a mixture of techniques.

However, 36% of students (n=37) found some form of personalization to be their most effective study technique. One student wrote, “I used acronyms and stories to study. The combination of these helped me by personalizing the info and making it relatable. I could quote concepts because I understood how they worked in my story.” Other students responded, “I rewrite terms in my own words and create specific pathways and relationships, which help me see the process and how things are related,” and “I personalized the info and visualized the concepts because it is easier to remember.”

As for the least effective study technique, 41% of students (n=34 out of 84) voted for just reading through the notes and trying to memorize all of the slides. One student lamented, “I cannot find connections when I just read something.” Indeed, 43% of students (n=36) mentioned that using passive study techniques was not helpful, “Just reading over the study guide didn’t help because it wasn’t active study.” They also found that cramming (11%, n=9), rewriting notes verbatim (8%, n=7), and “just memorizing without understanding the material” (5%, n=4) did not help. The difference between those who found rewriting notes to be the most helpful and those who found it the least was in whether they personalized by using their own words or not. However, some students reported that personalizing the information was their least effective technique (6%, n=5), and that “it made it seem like there was just more info to learn. I would rather spend that time actually learning the material.” Another student wrote that it “was too complicated – I want the info straight and simple.” The rest of the students had a variety of individualized responses, such as admitting that not sleeping the night before the test is a bad idea.

Finally I asked, “How will you study differently for the final exam?” My goal was to have students critically reflect on what study techniques do and do not work for them, to motivate them to change for the better, and to give them a sense of control and confidence for the final exam. They were allowed to give more than one answer. Out of 117 responses, 8% (n=9) intend to study the same way they always have and not make any changes. 28% (n=33) intended to study earlier, more, and to spread it out “so I can take my time and try
all of the techniques that work for me," 21% (n=25) intend to use a study guide to “focus my studying,” and 9% (n=10) intend to focus on past and practice exam questions. The rest are split into more specific studying goals. Overall, however, 21% (n=24) specifically intend to use active study techniques and 13% (n=15) intend to use personalization. Some student responses showing this are: “I will make sure I understand why and am not just memorizing,” “I will keep my studying active to stay focused,” “I will conceptualize the information more and build relationships,” and “I will personalize the information more through stories and acronyms.” These results show clear student self-evaluation and a motivation to improve their current habits.

Course evaluations

A week before finals, 89 students filled out the AI evaluation form at the end of my second guest lecture. Their scores were based on my 2 guest lectures, several classroom activities and assessments, and office hours. I received above average scores on being “enthusiastic about teaching” (89%), “treats students with respect” (84%), and being “knowledgeable on course topics” (81%).

Selected student responses from evaluations

1. What do you like most about the AI?

“She is very passionate and seems very excited to teach. She explained the material well and thoroughly, and was encouraging to students.”

“I really like that she is so enthusiastic and knowledgeable. She is a really great teacher.”

“[She is] very knowledgeable and enthusiastic about the course, and willing to find extra information about topics students asked about.”

“She loves the course topic and enjoys teaching.”
2. What do you like least about the AI?

“She seemed excited to talk to the class and share her info. However she talked really fast and sometimes mixed up her words.”

“She takes too long to explain some things.”

“Sometimes, activities weren’t very helpful.”

“We do not need to learn how to study. We’ve made it this far! Activities should instead be used for clarification.”

Analysis and Reflection

In the first half of the course I had some trouble aligning my goals with my activities. Sometimes they were too knowledge-centered, other times too assessment-centered, almost always pressed for time, and often they focused more on what the head-instructor had taught or wanted than on my goal of creating a learner-centered environment during activities. Because I wasn’t clear with my alignment, students were also at times confused about the personal utility of some activities.

After realizing this problem, I made sure to carefully structure my future activities around the objectives of getting students to 1) critically self-reflect about their own position with the knowledge and goals of the course, and to 2) personalize the information taught so it was not longer as intimidating and could be understood and, hopefully, transferred to daily life. As shown in the assessment section, the activities about “personalizing the info” and reviewing personal study habits succeeded in getting students to be more reflective. They also helped the students personalize the information more and increase their active learning. Because this was a non-majors course, I felt that personalization was particularly effective in helping students connect to the material.

In the future, I would do my activity on personal study habits earlier in the semester. Not only would I suggest and model some personalization techniques, I would
also like to solicit techniques from the class. During that activity, I’d would have the class rank both their own and the new techniques for amount of time and effort involved. Then I would challenge students to choose one to two new techniques to try out, and have them report on the outcome after the exam. As only a small percent of students seemed confident about their personal study habits, I think this is an activity that could be utilized in any course. Additionally, the basic survey about study habits could be given before and after each exam to encourage constant self-reflection and allow students to continually improve their personal study habits throughout the semester. I look forward to exploring more about if, just as certain disciplines have signature pedagogies, they might also have signature learning strategies.

Several of the students indicated that they did not find the personalization activity useful at all. I do not think this stems from a problem with the activity itself, as multiple students reported finding it helpful and used personalization for the next test. Rather, I think I needed to better communicate the goal of each activity. Although there will always be someone who does not enjoy an activity, this amount can be whittled down by being transparent about the end goal. When doing activities, I tried to always mention what I hoped students would gain. In the future, though, I will both say and write down the objective. I would also like to include more post-discussion of the activity, which I was unable to do very often this semester because of my lack of control over how much time I was allotted pre- or post-lecture.

I am very happy to know that I helped some students improve their study habits and relationship with biological concepts, though I still have many areas to improve on. It is also good to know that students recognize my enthusiasm for biology and teaching. In the future, I look forward to teaching more courses where I can foster critical self-reflection in students and improve my ability to use and teach active learning and personalization techniques.
References

