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# Improved Student Outcomes in Biological Psychology Courses Through Scaffolded Reading and Writing Assignments.

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## IMPROVED STUDENT OUTCOMES IN BIOLOGICAL PSYCHOLOGY COURSES THROUGH SCAFFOLDED READING AND WRITING ASSIGNMENTS

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### ABSTRACT

The American Psychological Association expects graduating psychology majors to be able to read and summarize complex ideas accurately, and to communicate effectively as writers. However, undergraduates often have little explicit instruction and practice in reading and summarizing academic articles, or in psychology-specific writing practices. Consequently, students' skills as academic readers and writers often fail to meet expectations. In our large public university, writing problems were prevalent in our biological psychology classes. When asked to read and summarize primary sources, students reported that the articles were very difficult to understand, papers commonly included plagiarism, and many students withdrew from the classes. To counteract this, the instructor—first author (JG-F) consulted with an English for Academic Purposes specialist (CD-F) and we created a scaffolded series of homework assignments to help students learn how to read and summarize primary source articles. Students received guided instruction about where to find information in an article and how to take notes using their own words. To help manage the instructor's time, she spent class time going over common errors and modeling ways to paraphrase and avoid plagiarism. A mastery approach to the homework assignments was fostered by grading several assignments on a complete/incomplete basis. Students who received the intervention had higher writing assignment grades, were more likely to persist in the classes, and were less likely to fail than those who did not receive the intervention. Most students felt that the intervention improved their ability to read and to use primary sources in their writing assignments, and thought that these skills would be transferrable to other courses.

### INTRODUCTION

One of the five major goals of the American Psychological Association (APA, 2013) is for psychology majors to be able to communicate well, both orally and in writing. Students typically only take two (or fewer) English composition classes in college (Warner & Koeppl, 2009) and so need other opportunities to develop as writers. The Writing across the Curriculum (WAC) movement emphasizes the need for faculty in all disciplines (including psychology) to take responsibility for improving students' writing skills (for review see Zawacki & Rogers, 2012). However, widespread reports of writing deficits across multiple disciplines have been attributed to a general lack of emphasis on writing in US colleges (Arum & Roksa, 2011). There are several reasons why faculty may be reluctant to focus on writing instruction: they may feel that 1) they do not have sufficient training to teach students how to write (Patton, Krawitz, Libbus, Ryan, & Townsend, 1998); 2) writing instruction takes time away from teaching content (Patton, et al., 1998); 3) students cannot write sufficiently well to tackle writing assignments in their classes and so it is better to avoid them (Arum & Roksa, 2011); and/or 4) they do not have time to provide the feedback that students need in order for their writing to improve.

Indeed, at our large public university it was clear that our students were not getting adequate reading and writing practice in their college classes. Our Departmental assessment findings showed that student writing in psychology classes often fell short of faculty expectations. These problems were prevalent in two intermediate-level biological psychology classes: Brain and Behavior, and Sensation and Perception (taught by JG-F). Although students in these classes were juniors and seniors and most had taken a research methods course in psychology, they struggled to read and effectively summarize empirical research published in scholarly journals. This was compounded by the highly technical nature of the primary source neuroscience articles in these subdisciplines of psychology. Furthermore, the instructor (JG-F) felt overwhelmed by the challenge of giving detailed timely feedback on first drafts of very poorly written papers. Relatively large numbers of students withdrew from these classes early on in the semester, largely because they found the writing assignments unmanageable. Students reported that primary source articles in these fields were hard to understand, and plagiarism was very common. To help to overcome these problems, JG-F consulted with an English for Academic Purposes specialist (CD-F), who helped her to use WAC best practices to design a scaffolded series of homework assignments (summarized in Table 1) to help students learn how to read and summarize primary source neuroscience-based articles.

## BRIEF DESCRIPTION OF THE ASSIGNMENTS

Despite the fact that reading strategies are discipline-specific, there is a general lack of reading instruction in college, especially in the social sciences (Bazerman et al., 2005). Both WAC, and a related movement - Writing in the Disciplines (WID), emphasize that writing and reading skills are strongly interrelated (Bazerman, et al., 2005). Therefore, our intervention consisted of a series of series of homework assignments that stressed the importance of learning how to read academic articles.

Initially, all of the students within a class worked on the same article. The psychology instructor guided students on where to find information in the article and how to take notes using their own words. She also spent class time going over common errors and explaining ways to paraphrase and avoid plagiarism. Students also reviewed each other's work in class. Students were also shown how to use databases to find other primary source articles that were related to the first article. To emphasize process and to foster a mastery approach, some of the homework assignments were relatively low-stakes, i.e., they were graded on a complete/incomplete basis and did not carry as much weight in the final grade as the final products. These low-stake assignments were very quick to grade, and helped students to later write relatively polished final products. The scaffolded assignments were staggered across the semester and so discouraged some of the procrastination that is often associated with writing a single draft of a term paper (Fritzsche, Young, & Hickson, 2003).

To assess the efficacy of the intervention, we compared writing assignment grades and the number of withdrawals for students in classes who received the guided reading intervention to those who did not (control group). Students in the control group also wrote summaries, and received feedback on their writing and participated in class instruction on how to avoid plagiarism. Students in the intervention classes completed a survey at the end of the semester that asked two questions about the helpfulness of the writing homework assignments in the class. Both items were answered using a 5 point Likert scale indicating the extent to which they felt that the note-taking strategies were helpful to them.

## ALIGNMENT TO APA GUIDELINES FOR UNDERGRADUATE EDUCATION

The writing homework assignments described here relate to two of the five APA goals for Undergraduate Education (APA, 2013): the ability to communicate well, and the ability to use scientific inquiry and critical thinking. An underlying principle of WAC is that writing is another way in which to enhance thinking (Bazerman, et al., 2005), so these goals are clearly inter-related.

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### GOAL 4: COMMUNICATION

4.1A. Construct arguments clearly and concisely using evidence-based psychological concepts and theories  
4.1C. Use grammar appropriate to professional standards and conventions (e.g., APA writing style)  
4.1F. Communicate quantitative data in statistics, graphs, and tables (APA, 2013, p.30)

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### GOAL 2: SCIENTIFIC INQUIRY AND CRITICAL THINKING

2.2A. Read and summarize complex ideas accurately, including future directions, from psychological sources and research  
2.2C. Develop a comprehensive strategy for locating and using relevant scholarship (e.g., databases, credible journals) to address psychological questions (APA, 2013, p. 21)

## LEARNING OBJECTIVES

To assess the extent to which students reached the APA goals listed above, the following learning objectives were developed for the two courses.

At the conclusion of this course, students should be able to do the following:

- Describe how research methods can be applied in the study of Brain and Behavior (or Sensation and Perception)
- Use database and library searches to find reliable sources of information to help answer a specific question in the field of Brain and Behavior (or Sensation and Perception)
- Write a detailed research summary using primary sources.

## ASSESSMENT OF LEARNING OBJECTIVES

Student learning was assessed based on three homework assignments. These included writing two primary source empirical journal article summaries (assignments 4 and 7 as summarized in Table 1 and described in detail below) that were assessed using the rubric provided in Table 4. In addition, students found a primary source article that connected to another article and described the relationship between two articles (assignment 5 as summarized in Table 1 and described in detail below), this was assessed using the rubric in Table 5.

## COURSE LEVEL AND RECOMMENDED COURSES

These assignments are particularly relevant for mid and upper-level courses in which students need to read and summarize primary source articles that use neuroscientific methodologies. However, by modifying the note-taking instructions, they can be easily adapted for any class where students are reading primary source materials and using them in writing assignments or discussions.

## DETAILED EXPLANATION OF ASSIGNMENTS

The intervention consisted of seven homework assignments and five in-class workshops as shown in Table 1.

Table 1

Summary of Workshops, Related Homework Assignments and Grading Strategies

**WORKSHOP 1:** What is a primary source empirical article? Discussion of challenges and benefits of using these articles. Reading and note-taking strategies and practice.

**Assignment 1 - Note-taking part 1 (5 points)**

Complete Qs 1-5 in note-taking worksheet (Table 2) and hand in with annotated article.

**Grading:** Grade Complete/Incomplete and identify any common/major mistakes to go over in class.

**WORKSHOP 2:** Discussion of study misconceptions. Patch-writing and checking for plagiarism, paraphrasing practice. Diagramming experimental design.

**Assignment 2- Note-taking part 2 (5 points)**

Make edits to Q 1-5 and complete remaining questions on note-taking worksheet (Table 2). Hand in worksheet (Qs 1-11) and annotated article.

**Grading:** Grade Complete/Incomplete and identify any common/major mistakes to go over in class.

**WORKSHOP 3:** Class discussion of common misconceptions about study and address any writing issues.

**Assignment 3 - Correcting notes using model (10 points)**

Make your own corrections on note-taking worksheet (Table 2) and article annotation using instructor-provided model notes and annotated article (posted on CMS).

**Grading:** Check accuracy of answers. Mark errors with asterisk and provide following notation at top of page - "Check back to the model for marked items". Mark patch-writing and plagiarism with highlighter and provide following notation at top of page - "These sections need to be rewritten in your own words".

**WORKSHOP 4:** Question and answer session on feedback on Assignment 3. Active voice and past tense practice. In-text and secondary citation practice.

**Assignment 4 - Write a summary (25 points)**

Write APA style research summary using framework (Table 3) from corrected notes.

**Grading:** Grade using summary rubric (Table 4).

**WORKSHOP 5:** Database searching.

**Assignment 5 - Database searching (15 points)**

Find a primary source neuroscience article that was published after 2005 and **relates to the article** you have summarized for this class. Note this has to be a connection related to the research question rather than the techniques used, e.g., both used fMRI.

Upload the following to Blackboard (CMS): 1) pdf of the entire article, 2) a word document telling me what this study is about and how it relates to the first article we read together in class, 3) the citation of the article in APA style.

**Grading:** Grade using database article rubric (Table 5).

**Assignment 6 - Note taking on new article (10 points).**

Choose one article from the selection on Blackboard (CMS) that you find interesting.

Complete questions 1-11 on the note-taking worksheet (Table 2) and annotate the article in the same way as you did for the first article.

**GRADING:** Grade Complete/Incomplete - mark items that need correction.

**Assignment 7 – Correct notes and write summary of new article (30 points)**

Make corrections on note-taking worksheet and article annotation using instructor-provided model notes and annotated article (posted on CMS) and then write APA-style summary using framework (Table 3) from corrected notes.

**Grading:** Grade using summary rubric (Table 4).

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## WORKSHOP 1

The primary aim of workshop 1 was to engage students in a discussion about the value of using primary source psychology articles and to increase their motivation for doing well in the reading and writing assignments. First, students talked about what they thought a primary source empirical journal article was and how it differed from other types of writing, such as textbooks or news articles. Students were then asked to look at their copies of a primary source article, which had been posted on the electronic course management system (CMS), and to discuss with a partner why they thought that reading such an article might be difficult. Students were quick to identify that the article was filled with discipline-specific jargon and was clearly written by experts for other experts. This provided the instructor with a chance to affirm that previous classes had struggled a lot with reading these types of papers. When asked why undergraduates might want to be able to read something that was clearly not written with them in mind, most students recognized that primary sources offer the most accurate representation of a study, and so they could be potentially useful. The instructor also asked how many students planned to go on to graduate school; typically 50 to 75% students in our classes aspire to do so. She then explained that she had designed new reading and writing assignments to help students learn how to extract information from primary sources in a meaningful and efficient manner, and that this was a valuable skill that they would need as graduate students. Students then wrote a brief minute paper on why they thought that improving their writing skills and being able to summarize primary sources might be helpful to them both as college students and in their future careers. Ensuring that students appreciate the value of using a particular technique or learning strategy has been shown to increase academic performance, especially in those who are struggling in their classes (Hulleman, Godes, Hendricks, & Harackiewicz, 2010).

The second activity in workshop 1 focused on learning how to read an academic article. Class discussion revealed that many students thought that an article should be read from beginning to end, much like a novel, and so students were surprised to discover that reading the end of the “story” upfront was not “cheating,” but would in fact be beneficial for increasing comprehension. Students were asked to carefully read the title and the abstract several times and to underline the words that helped them to form a general idea of what the study was about. Using the think-pair-share technique (Kaddoura, 2013; Lyman, 1987), students first shared their answers with a neighbor and then with the class as a whole. With the aid of the classroom computer, the instructor underlined the key phrases that students had identified in the text and projected this on a screen for everyone to see. Students were then asked to use their own words to write a brief bullet point that described the general idea of the study. At this stage, many students used quotes from the title and abstract and so we brainstormed other words and phrases that could be used instead. Helping students to avoid the use of jargon was encouraged by asking them to imagine explaining it to their grandmother or a 12-year child. Students then reviewed the note-taking worksheet (see below) that they used for Assignments 1 and 2 (and 6), which gave detailed instructions about how to annotate the article and take notes by answering specific questions. The worksheet includes explicit directions about where to look for the information. The instructor stressed that this exercise would likely take them a long time reminding them that the article was written by experts for experts and so would be challenging to read. Students were given 10 days to complete the first five questions (Assignment 1) and annotate the article, showing where they found the information.

Table 2

### Note-Taking Worksheet

Learning how to read and summarize a primary source research study in physiological psychology

Academic writing is often challenging to read because it is written by experts for experts. Part of the skill of summarizing a primary source is being able to figure out which are the most important pieces of information and what can be left out. Another crucial skill is being able to paraphrase effectively. This first exercise is designed to help you pick out the important parts of the paper and to write about them using your own words.

#### INSTRUCTIONS:

Answer the questions below in note form, as you do so mark the article by underlining the text that you used to answer the question and make a notation accordingly in the margin, e.g., "*General idea*". As you make notes, do not copy phrases from the article - write using your own words. This will help you when you paraphrase the information later. **Please type your answers below and use as much space as you need.**

Please be aware that this exercise will likely take you a long time - I would estimate at least 6 hours. When you first read the article it may not make so much sense to you and so you will need to read it **many** times to improve your understanding. **Be reassured that EVERYONE (including professors) has to do this to be able to understand an academic article well.** This assignment will be graded on a pass/fail basis. If I do not feel that you have put enough effort into the assignment you will fail and this will impact your grade. You should probably try and break up the time spent on the assignment - spend no more than half an hour at a time on it and then take a short break. **MAKE SURE TO CHECK THROUGH YOUR WORK BEFORE HANDING IT IN.**

#### QUESTIONS:

**1. In very general terms, what is the study about?** Read through the abstract several times. Underline the key terms that allow you to figure this out, write **general idea** next to them. Now write your answer here.

**2. What is the specific question that the study is trying to answer, i.e., the goal of the study?** Read through the abstract carefully and skim through the introduction (the part of the paper before the methods but in APA format is not usually marked as Introduction). Focus on the words that say what the study aimed to investigate, underline these words, write **goals** next to them.

**3. In very general terms, how did the researchers carry out the study?** Read the abstract and introduction focus on the words that say what they did. When you read the methods section, focus on the overall idea of the study (not the fine details). Underline and mark the relevant text as **general method**.

**4. What are the major hypotheses (predictions) of the study?** Read the introduction carefully and look for words like hypothesize, predict, and expect. These are often at the end of the Introduction. Underline and mark the article as **hypotheses**.

**a.** List any general hypotheses

**b.** List the brain areas that the researchers predicted would be activated in their study and when these areas would be active. Mark as **brain activity hypotheses** in the article.

**c.** For each of the brain areas listed above see if you can figure out why they predicted this. Read the Introduction and the Discussion looking for these brain areas and see what the authors say when these areas are usually active. Mark the article with the words **brain function**.

**5. Who are the participants in the study?** Read the Participants section carefully in the method and answer the following questions. Make sure you underline all the relevant information in the article.

**a.** How many participated? Note that sometimes not all the data can be used. Make sure you write down both how many people were recruited (mark article with n all) and how many contributed useful data (n used).

**b. Were the participants subdivided into groups?** If so, what characterizes the groups? (e.g., 2 groups: smokers, non-smokers, no groups, etc.). If relevant, underline the group information in the article and mark as group 1, group 2 etc.

**c.** How many in each group?

**d.** How many were male?

**e.** How many were female?

**f.** Age range? Mean age?

**g.** If there are multiple groups provide the information for each group, e.g., 12 smokers (mean age 45 years, 5 men, 7 women; 13 non-smokers (mean age 34 years, 6 men, 7 women). Underline this information in the participant section.

**h.** Is there anything else about the participants we should know to better understand the study? e.g., Ethnicity, race, left or right-handed, were they healthy? Try to summarize this as much as possible.

**6. What did the participants have to do in this particular study?** (Note studies with human subjects typically involve consenting - but this is common to all research studies and so does not need to be reported in your notes or summary). Before you answer the questions below read the Methods section several times, playing close attention to the various steps that the participant had to do, the Procedure section will help you to get an idea of the order in which things happened. Mark the text - as step 1, step 2 step 3, step 4 etc. However, you may also have to read other parts of the Method section to understand more about the specifics of the stimuli etc.

**a. Did participants have to do anything special to prepare for the study?** This might be fasting, studying, etc but don't include any general practice for the task (this is common to most studies).

**b. Did they have to complete any questionnaires?** List them here - with a brief note about what they are designed to assess.

**c. What did the participants have to do in the study proper?** Think about this first in terms of describing the participant's general experience of how they had to interact with the stimuli.

**d. Describe what happens more specifically in a trial for each condition.** What does the participant hear/see/feel/do? Again, write this down in terms of steps. TS1, TS2 etc. and mark accordingly on the article. There is often a diagram (and figure legend) that helps you to understand this in the text. Mark any helpful figures with the words Trial info.

**e.** Stimuli/trials are usually organized into blocks of time to give the participant a chance to take a break in between each block. Underline this information in the article.

**i. How many blocks were there in the study?**

**ii. How many trials/stimuli per block?**

**iii. How were the blocks organized, e.g., did each block have a mix of stimuli or just one kind?**

**iv. If just one kind of stimulus per block - in what order were the blocks presented? e.g., all of one type and then all of the other?**

**f. Psychological research often depends on careful timing of the stimuli.**

**i. How long did each step in the trial last for?**

**ii. How long was the gap between the trials?**

**7. Did the experimenters use a baseline for the physiological activity?** What was the participant doing during the baseline recording? Write the words - baseline in the article.

**8. What was the purpose of the behavioral task in the study?** Note: A behavioral task will result in some data collection - such as reaction time or accuracy. Read the introduction for the rationale and the methods. Mark the text with the words - task purpose.

**9. What are the major independent variables (IVs) and dependent variables (DVs)?** You will have a general idea about these from the methods and will also find these in results section but the authors will probably not refer to them as IVs and DVs. Remember that the IVs are the conditions/groups and the DVs are the things that they measure. DVs depend on the IVs. You don't need to include everything the researchers measured just the ones that are key to the study goal(s). Some may be behavioral - (e.g., accuracy and reaction time) whereas others may be physiological (related to change in brain activity or the size of a particular brain area). List each one here making it clear whether it is a DV or an IV.

**10. What were the main results?** Look in the Results section but also the Discussion section for starting broad with the physiology data. Note there is no need to report the specific stats or statistical tests but you should only summarize the ones that ARE statistically significant. Mark these as B1, B2 etc for behavioral results, P1, P2 etc for the physiological results. Make sure you report on the hypothesized results (especially for the brain areas). You don't need to report every brain area that was activated though. Let the abstract guide you as to which are most important. Use this to answer the following questions.

**a. What are the behavioral findings?**

**b. What do the behavioral findings imply or tell you that is important for the study?**

**c. What were the physiological findings? Start broad and then get more specific.**

**11. What did the authors conclude?** Look carefully in the Discussion Section, it may not explicitly state whether the hypotheses are supported so look back and check what the hypotheses were.

Make sure to say which were supported and which were not. Mark this in the text.

What other major conclusions did the authors make?

How do the results support the goals of the study?

What are the implications of the main findings?

**12. Provide the citation for the article in APA format** (use the back of your textbook for models).

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## WORKSHOP 2

After reading through the assignments (graded on a complete/incomplete basis) the instructor went over common problems in workshop 2. Often students confused the hypotheses of the study with the results of previous studies in the Introduction and plagiarism was very common. Belter and du Pre (2009) have suggested that students plagiarize because they are often unaware of what constitutes acceptable paraphrasing and summarization. Students often thought they were using their own words, but many of them engaged in patch-writing (Howard, 1995), a common practice in naïve writers when reading an academic or difficult to understand text. In patch writing, the student writing is very similar to the original text but synonyms are substituted here and there (Howard, 1995). The instructor demonstrated what patch-writing is by taking a paragraph from the article and changing a word here and there and explaining that this was not acceptable. Students then looked for evidence of patch-writing in their own notes (and then that of a peer). Students then brainstormed different ways of summarizing the idea in the paragraph in their own words.

In workshop 2, the instructor also explained the next homework assignment (Assignment 2), which required first changing any answers that they now knew were unacceptable in addition to answering all of the remaining questions on the note-taking worksheet and annotating the article. Students had to take notes about the details of the experimental design, the results, and the general conclusions of the study. Since the notes were to be used for summary writing, the class discussed what aspects of the study could be left out of the note-taking. Students were understandably unfamiliar with paradigm-specific terms such as *trial* and *block* and so they worked in small groups to draw diagrams to figure out the experimental design from a participants' viewpoint. Students were given about 10 days to complete this assignment, which was graded as complete/incomplete.

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## WORKSHOP 3

Common misconceptions about the study seen in assignment 2 were discussed in workshop 3. During workshop 3, the instructor also explained the next homework assignment (Assignment 3 - see Table 1). In this assignment, students compared their answers and article annotations with models provided by the instructor that were posted on the CMS. This required students to think critically about whether their answer was too lengthy, too short or incorrect because they had misunderstood some element of the article. They also had to check whether or not their article markings indicated the correct location for finding the right answers. The instructor graded assignment 3 based on the accuracy of the corrected answers. By providing students with the model she was able to give feedback quickly by marking unacceptable answers with an asterisk along with a notation at the top of the paper to "*check back with the model for marked items.*" Similarly, she marked plagiarism and patch writing (which was now much reduced) with a colorful highlighter and the notation "*USE YOUR OWN WORDS!!!*"

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## WORKSHOP 4

The instructor answered questions about the feedback on assignment 3 in workshop 4. To gear students up for writing a summary of the article (see Assignment 4 in Table 1), in workshop 4, the instructor also explained the structural framework (see Table 3) for summarization in APA style. Students practiced using active voice and past tense and in-text and secondary citations in class. Students were provided with a link on the CMS to an APA style

guide [https://web2.uconn.edu/writingcenter/pdf/Style\\_Points\\_for\\_Scientific\\_Writing.pdf](https://web2.uconn.edu/writingcenter/pdf/Style_Points_for_Scientific_Writing.pdf) to help reinforce these techniques. The instructor used a rubric (see Table 4) to grade the summaries. One major advantage of having students all work on the same article at the same time was that it made giving detailed feedback much easier for the instructor, who could use class time to provide general feedback. Additionally, students were able to help each other understand elements of the experimental design by discussing in pairs or small groups in the various workshops. In future classes, students will also analyze work from past classes using the summary rubric to help them to identify both successful and problematic writing.

**Table 3: Framework for Summary Writing Using Notes**

First check your feedback on your corrected notes for anything that was marked as incorrect - fix those first. Then use your corrected notes to write a short summary of the paper in full sentences using your **own words**. Do not copy phrases from the paper (or from my notes) – even with quotes - **we do not use quotes in psychology**. **You must paraphrase**. The easiest way to do this is to read your notes (not the article), make sure you understand, then turn your notes over and write without looking at the text. Try to write as though you are explaining the study to someone who does not know anything about it and does not have specialist knowledge. I have attached the rubric that I will use for grading your paper. Here are some suggestions for prompts that might help you write your paper. Even if you do not use these phrases, use the same organizational structure for your paper. **Do not bullet or number the points** - just write in full sentences.

Ganis, Thompson and Kosslyn (2004) were interested in ... (describe the goal of the study).

Participants ... (describe very generally the way that the study was carried out).

The authors hypothesized that... (first describe the main hypotheses and then the more specific brain-area related hypotheses – making sure you explain WHY they thought these brain areas were likely to be activated).

There were X participants... (describe the participants in terms of n, age, gender, and other major relevant characteristics)

Before the study, the participants had to ... (describe any relevant procedure that took place before the study proper, this might include questionnaires, studying materials, fasting, etc.) Note: This does not always apply to every article but it might in the future.

During the study, the participants ... (describe in specific steps what the participant saw, heard, had to do).

The experiment consisted of .... (describe the number of trials, blocks, timing and general organization of the experiment).

The researchers found ... (describe the results – start general and become more specific. Make sure to include both behavioral and physiological findings and link brain areas to their functions )

In summary, the authors' hypotheses were.... (discuss which hypotheses were supported and which were not and the general conclusions of the study).

Provide the citation in APA format.

Proof read your paper by reading it aloud. Make changes – then read it again. Does it make sense to you? If it does not, it will not make sense to me either.

Table 4 Article Summary Rubric

Criteria & qualities	Weak	Adequate	Good	Excellent	Points	Score
Article marked as instructed	Not marked as instructed	Some markings present but some missing	Minor corrections needed	Article well marked	5	
Goal of the study	Not clearly stated OR phrases are copied from the article.	The general idea of the goal is presented but need more details	Goal well described - minor corrections needed	Excellent description of study goals	5	
Hypotheses	Not clearly stated OR phrases are copied from the article.	More detail needed	Hypotheses well described - minor corrections needed	Excellent description of hypotheses	10	
Participants	Not enough detail is given to understand who participated in studies OR phrases are copied from the articles.	Some of the important information about participants is present but need more details	Participants well described - minor corrections needed	Excellent description of participants in terms of age, gender, n, and any other relevant info	10	
Techniques	Not enough detail is given to understand how study was conducted OR phrases are copied from the articles.	Some of the important information about techniques is present but need more details.	Techniques well described - minor corrections needed	Excellent description of techniques written in own words	20	
Demonstrates understanding of findings	The main findings of the studies are not well described or there are many errors in the interpretation or copying from articles	Some of the findings are described but some important information is missing	Findings described clearly - minor omissions	Excellent description of findings written in own words	15	

Demonstrates understanding of conclusions	There are no conclusions/or conclusions are incorrect	Some of the conclusions are described but some important conclusions are missing. No reference to hypotheses.	Conclusions described clearly with reference to whether or not hypotheses were met-minor omissions	Excellent description of conclusions written in own words with reference to hypotheses. Relevance to goal of study is clearly stated.	10	
Clarity of writing and writing technique	In places it is hard to know what the writer is trying to express. Writing is convoluted. Misspelled words, incorrect grammar, and improper punctuation are evident.	Writing is generally clear, but quite a lot of grammar errors and typos. Active voice and past tense not consistently used.	Writing is generally clear, but unnecessary words are occasionally used. Paragraph or sentence structure is too repetitive. Active voice and past tense not consistently used.	Writing is crisp, clear, and succinct. The writer incorporates the active voice and past tense. The use of pronouns, modifiers, parallel construction, and non-sexist language are appropriate.	20	
Citations & References	Citation not included or wrong article cited	Citation included but not APA style	Citation present & minor APA formatting issues	Reference correctly formatted in APA style	5	
				TOTAL	100	

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## WORKSHOP 5

The next homework assignment (see Assignment 5 in Table 1) allowed students a little bit more freedom in finding an article that sparked their individual interests. In preparation for this assignment, workshop 5 covered how to use library databases like PsycInfo and PubMed to find peer-reviewed primary source empirical journal articles, students searched for a relatively recent article (within the past five years) that was conceptually-related to the first one. Students uploaded a pdf version of the article to the CMS, along with its APA style citation and a short statement about how the article related to the first one. This assignment required that students were able to extract the gist of the new article (usually from the title and abstract) and to describe this in their own words. The instructor graded the assignment using a rubric (see database search rubric in Table 5). To encourage students to work independently, extra credit was awarded to students whose article met the criteria and was not chosen by other students in the class. Some students failed to link the studies at the conceptual level and thought that the two studies were related because “both looked at changes in brain activity in response to a set of stimuli”; others had difficulty articulating the connection. After receiving feedback, students were invited to redo the assignment to improve their grade. The instructor then picked a few articles chosen by students that she felt were pitched at the right level and posted them on the CMS. For assignment 6, students chose an article and followed the same general process as they did previously by taking notes using the note-taking worksheet (see Table 2) and annotating the article. These assignments were graded as complete/incomplete, and the instructor posted model notes and annotated copies of each article on the CMS. Making models is time-consuming and so the instructor only selected four or five articles for students to choose among. For the final homework assignment (assignment 7), students both corrected their notes and wrote a summary of their article. To make grading more efficient, the instructor organized assignments by article and graded them in batches using the summary rubric (Table 4).

Table 5. Database Search Rubric

Student name:	Points	Score
<p>Article (5 points)</p> <p>Article attached</p> <p>Peer-reviewed academic journal?</p> <p>Primary source empirical article</p> <p>Published in 2005 or later</p> <p>Includes brain imaging</p> <p>Research question is conceptually related to first article</p>	<p>If <u>any</u> of these are violated then student needs to redo the assignment</p>	
Subtotal	5	
<p>APA style ( 5 points)</p> <p>Authors last names and initials present and in correct order</p> <p>Article title in full.</p> <p>Journal name in full in italics</p> <p>Volume number (italics); page #s</p> <p>Items above in correct order and correct punctuation between items</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	
Subtotal	5	
<p>How are the two studies related? (5 points)</p> <p>Statement explains goal of study 1</p> <p>Statement explains goals of study 2</p> <p>Statement explains how study 2 is different from study 1, e.g., how the study could extend the findings or takes a different direction or approach</p> <p>Statement grammatically correct and written in own words</p>	<p>1</p> <p>1</p> <p>2</p> <p>1</p>	
Subtotal	5	

## ASSESSMENT OF THE EFFICACY OF THE INTERVENTION

To assess the efficacy of the intervention we analyzed writing assignment grades, class grades, and class retention data from 264 students enrolled in intermediate biological psychology courses taught by JG-F at our college between 2008 and 2013. Students were in Brain and Behavior (3 sections) or Perception courses (6 sections). Students in one section of each course ( $n = 80$ ) received the intervention. Significantly, more students withdrew from control classes ( $n = 40$  [21.7%]) than from intervention classes ( $n = 8$  [10%]),  $\chi^2(1, N = 264) = 5.17, p = .02, \Phi = .14$ . For students who remained in the classes until the end of the semester, the writing assignment grade was significantly higher for students in intervention classes ( $M = 81.1\%$ ,  $SD = 11.6\%$ ) compared to control classes ( $M = 70.7\%$ ,  $SD = 28.8\%$ ),  $t(214) = 3.03, p = .003, 95\% \text{ CI } [3.61, 17.10]$ . In addition, significantly more students failed the course in control classes ( $n = 13$  [9%]), than in intervention classes ( $n = 0$ ),  $\chi^2(1, N = 216) = 6.92, p = .009, \Phi = .18$ . Survey data from students in the intervention classes showed that the majority of the students felt that the note-taking activities were either helpful (40.2%) or extremely helpful (47.2%) for writing the summaries. Similarly, the majority of students (56%) felt that they were likely to use the same note-taking and summary writing strategies in other classes. In summary, the intervention was effective in increasing class retention, improving learning, and motivating students to continue to use the practices they learned in future courses; in addition, these benefits were achieved while making grading more manageable for the instructor.

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