

ARTICLE

Cocktail Napkin Presentations: Design of an Activity to Enhance Undergraduate Communication and Critical Evaluation of Neuroscience Primary Literature

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Distilling complex neuroscientific ideas in a succinct and elegant way is an art. The distilled product must have smoothly flowing logic, communicate a substantial body of knowledge, and be easily digestible by the audience. At the same time, the essence of scientific accuracy and experimental design cannot be lost in the distillation process. When undergraduates encounter primary literature for the first time, they are often stifled by its overpowering complexity and astringent technicality, but can quickly learn how exciting and interesting some of their subtle findings can be. Here, the design of a novel learning activity is presented that utilizes a cocktail napkin to synthesize the knowledge and skills required for fluidity in neuroscience primary literature. The activity was implemented within the

context of an upper-level developmental neurobiology course for biology majors. The activity was designed specifically to increase neuroscience literacy and oral communication. The activity appeared to address a needed shift in students' attitudes to reading primary literature, and students additionally remarked how deeply engaged they were with the literature. When paired with mentored instruction, students' values toward neuroscience appeared to change as they learned to produce distillations that were rich in content and delightful to the scientific mind.

Key words: primary literature; neuroscience pedagogy; upper-level undergraduate; developmental neurobiology; science communication; transformational teaching

Creative scientific ideas are often complex and beautiful. However, distilling the essence of complex ideas for an uninitiated audience is a difficult task: it requires expert understanding of the subject matter as well as excellent communication skills. The difficulty of this task is intensified during informal situations—for example, when research ideas need to be explained urgently and succinctly to the press, non-expert colleagues, or political representatives. Spontaneously explaining complex scientific ideas with little to no audiovisual support is therefore an excellent assessment of both scientific knowledge and communication skill. How can we assess this knowledge and skill in our undergraduate neuroscience students?

All of my research mentors—from high school to the present day—have taken the time and effort to explain interesting, complex concepts fully. Their most preferred method of doing so has been memorable: they would take out a pen and paper and sketch out their idea with me. I have found this form of visual and oral presentation to be extremely effective and powerful but I have noticed that I cannot draw with the same facility and mastery as my mentors if I do not have the requisite knowledge or the practice to communicate it fluently to any audience.

Sketching as a way to articulate scientific concepts is also central to photographer Volker Steger's *Sketches of Science* project (Volker, 2012). During the Lindau Nobel Laureate Meetings, Steger arranged a photo shoot with each laureate. Upon their arrival to the studio, they would find a large, blank sheet of paper and markers in addition to the usual photography equipment. Steger would then ask them to "illustrate their great discovery". Many of the photos from this project reveal expressions of surprise and amusement in the laureates, but also imaginative and suc-

cinct sketches. As I viewed the photos, I was surprised at how effectively these quick sketches conveyed the essence of a complex discovery, even if their authors were not given the chance to narrate their discovery to me. While these scientists had years in the public spotlight as Nobel Laureates to clarify and distill their ideas for the interested layperson, they were powerful and effective communicators. I wanted to give a taste of this same power and effectiveness to my undergraduates, and demonstrate that this skill is accessible to all scientists at any stage of their formation (Radford, 2011). This desire was the motivation behind the design of the "cocktail napkin presentation" activity described here.

Below, I present the full design process behind this activity, and how the activity aims to achieve two learning objectives: communicating ideas from the primary literature to novice audiences, and critically evaluating neuroscience primary literature. I present the possibility that the activity achieves two additional learning outcomes, and present how the activity synergistically integrates multiple modes of transformational teaching.

DESIGNING THE LEARNING OBJECTIVES

The design of this exercise was part of a larger course design for a dual-level neuroscience course entitled, "Biology 448/548: *Developmental Neurobiology*", open to all James Madison University (JMU) biology majors. Biology graduate students may enroll, but are expected to achieve additional learning objectives in addition to those shared with undergraduates. The course design for the shared learning objectives took place at jmUDESIGN, a two-week summer institute sponsored by the JMU Center for Faculty Innovation and 4-VA. Course design at this institute is

based on the principle of “backward design” (Wiggins and Tighe, 2008). To summarize the process briefly, a set of learning objectives were defined based on a larger vision for the “enduring understandings” retained by students several years after having completed the course’s learning objectives. Then, a series of activities were designed to attain specific subsets of the learning objectives. Alignment of activities to learning objectives and learning objectives to enduring understandings is a key component of backward design.

Designing Enduring Understandings

At JMU, most undergraduate biology majors and neuroscience concentrators pursue a wide range of professional and academic paths in science- and health-related fields. While a number of my students have gone on to pursue doctoral degrees in neuroscience, knowing that a majority of my students would not pursue a path within academic neuroscience compelled me to broaden my search for a set of “enduring understandings” that would benefit all students. These included thoughtful guidance from a joint committee formed by the Association of American Medical Colleges and the Howard Hughes Medical Institute (AAMC-HHMI, 2009), as well as the consensus brought forward by the AAAS Vision and Change committee (AAAS, 2011). From these documents and from my own professional standpoint, I proposed two enduring understandings that should be beneficial to these students, regardless of their chosen career path: (1) Understand how to be eloquent science communicators, and (2) understand how to rigorously deconstruct, critique, and judge scientific primary literature.

Skilled science communication and critical evaluation of primary literature are essential for biology and neuroscience undergraduates. Public trust in science is currently undermined by poor scientific communication to layperson audiences by scientists (Brownell et al., 2013). Poor communication is thought to stem from little to no formal training of scientists in this skill, and that communicating science to a layperson audience is a highly challenging task. One of Brownell and colleagues’ calls to action was that “upper-level undergraduate science courses should begin to incorporate formalized, layperson-directed communication exercises”. Teaching science communication within an undergraduate neuroscience course could improve the credibility of science communication as an important endeavor (Brownell et al., 2013). Oral communication training was especially encouraged, due to its likelihood of being the primary means to communicate with layperson audiences throughout undergraduates’ future careers (Brownell et al., 2013). Another call to action is to include science communication as a specific learning goal in formal scientific training, so that trainees emerge “well-trained, competent, and rigorous” (Bankston and McDowell, 2018). The inclusion of a science communication goal in this course is therefore a direct response to these calls to action.

Advances in medicine and science are based on primary literature, so giving biology and neuroscience undergraduates the skill to critically evaluate it is paramount.

Learning this skill also confers benefits on student confidence and engagement, which has been reported by several groups using primary literature-based activities (Hoskins et al., 2011; Bodnar et al., 2016; reviewed in Hartman et al. 2017). Broader benefits include retention of undergraduate science students and improved integration into graduate studies (Hartman et al., 2017).

Designing Specific Learning Objectives

The next step in designing this activity was to contextualize the two enduring understandings within the course (*Developmental Neurobiology*) to design specific learning objectives. Students taking this course were mostly junior and senior biology majors, some with an additional declared neuroscience concentration. All students had already prepared an oral presentation to their classmates in other courses, but very few had ever designed a presentation intended for audiences with any other degree of general education and expertise. In addition, all students had regular exposure to primary literature in biology, and although some students even had intensive, consistent exposure to primary literature throughout their undergraduate careers (for example, via multi-semester undergraduate research), most did not. Unsurprisingly, very few students had prior exposure to papers specifically within developmental neurobiology, and none had exposure to a full range of classic and contemporary papers spanning developmental events as early as neurulation and as late as adult synaptic plasticity. To address these gaps in science communication and critical evaluation of primary literature, the first and second learning objectives were aligned to their respective enduring understandings and defined as follows:

Learning Objective 1

Explain experimental developmental neurobiology to audiences of high school-educated novices, college-educated novices, and experts. Because this course aimed to teach skills needed for other types of communication such as scientific conference presentations, Learning Objective 1 was written to include other audiences beyond high school-educated novices.

Learning Objective 2

Take apart, critique, and judge foundational and current papers in developmental neurobiology. Course content was delivered via primary literature and interactive lectures geared at understanding the primary literature, rather than assigning a textbook.

DESIGN ELEMENTS

The “cocktail napkin presentation” was the activity designed to achieve these two learning objectives. Several design elements based on prior literature were included in its final design.

The first design element to include was an active learning approach in the activity. A meta-analysis using a broad and inclusive definition of “active learning” shows that most implementations of active learning activities (either designed to replace or even simply supplement traditional lectures) positively impacted student performance across a

wide variety of STEM disciplines (Freeman et al., 2014). An active learning approach was also appropriate in this activity design, in that the stated learning objectives are both knowledge- and skill-based and therefore require significant time for student-led practice and revision.

The second design element was to include features from previously published activities that address the learning objectives in some way. For example, in the case of Learning Objective 1 (science communication), a variety of activities have been implemented that promote science oral communication skills. For example, undergraduates have prepared short news segments explaining research results to a real layperson audience (Garcia, 2018). One graduate course is devoted to practicing “chalk talks” as well as preparing an “NPR speech”: a “brief, lively and understandable explanation of their research and its importance” to a non-expert audience (Stuart, 2013). Another example is a one-minute “research monologue for the public” (Cirino et al., 2017). Several pedagogies have been developed to improve scientific literacy, which addresses Learning Objective 2 (critical evaluation of primary literature). These include the “C.R.E.A.T.E. method”, “jigsaws”, and “circular responses” to deconstruct the hypotheses and data embedded in the literature (reviewed in Hartman et al., 2017). Another approach similarly deconstructs hypotheses and data from research seminars (Clark et al., 2009). In this activity, students listen to a research seminar and spend several weeks distilling and exploring each aspect of the seminar. As students deconstruct the data and logic and reconstruct it for themselves, they are able to judge which experiments are the most rigorous, and which conclusions are the strongest.

The third design element to include was “learner-generated drawing”. For example, in the case of the C.R.E.A.T.E. method, student-generated drawing and cartooning is a central approach (Hoskins et al., 2007), and is a highly effective method for improving scientific literacy and student perceptions of mastery (e.g., Hoskins et al., 2011; Bodnar et al., 2016). The effectiveness of the C.R.E.A.T.E. method may be partly due to the educational benefits of “learner-generated drawing”, such as improved observation, acquisition of content area knowledge, text comprehension, writing processes, and even student affect (Van Meter and Garner, 2005). Drawings themselves are powerful in that they possess four unique qualities (effortless structure, determinism, perception-action coupling, and pre-interpretation) that could be used to efficiently interact with students’ other sources of knowledge. For example, drawing an image of a growth cone responding to guidance cues during a cocktail napkin presentation (Figure 1C) allows less cognitive load to be placed on simply describing the growth cone’s features (the drawing provides “effortless structure” of the growth cone and gives its exact relation to the guidance cues—“determinism”). Instead, attention can be focused on more important experimental details—for example, how the growth cone might move in response to the guidance cues (“perception-action coupling”). Having a drawing of the experimental result reduces misinterpretations that could otherwise arise from using imprecise language (“pre-interpretation”; Schwartz

and Heiser, 2006). It has also been shown that expert scientists use mental models and simulations based on imagery—rather than purely abstract thinking—in part because of their intuitive nature. (Clement, 2008; Clement, 2009).

The fourth design element to include was a focus on engaging students with higher levels of learning, such as synthesis and evaluation. Students completing activities like C.R.E.A.T.E. cartooning are engaged in various levels of learning. For example, within the framework of Bloom’s taxonomy (knowledge, comprehension, application, analysis, synthesis, and evaluation), students require learning at all levels to complete these activities, but most of the work appears focused on the more integrative levels of synthesis and evaluation (Bloom and Krathwohl, 1956).

The fifth design element to include was scaffolding, which is the stepwise creation of a final product over the course of the semester. Stepwise creation has been an effective tool in writing assignments that involve a similar goal of distilling of scientific information (Cyr, 2017).

The final design element to include was repetition of the activity throughout the course. *Developmental Neurobiology* has four units of content: Early development (e.g., neural induction, fate determination, neuronal migration), Axonal and dendritic growth, Synaptogenesis, and Synaptic Plasticity. The activity could therefore be repeated utilizing different content from each unit. This would provide “multiple opportunities to build on their skills throughout the term”, which is thought to improve science communication skills (Brownell et al., 2013).

The complete design of the activity therefore features each of these design elements: active learning, addressing both learning objectives simultaneously, including learner-generated drawing, engaging at integrative levels of learning, scaffolding, and repetition. Various presentation formats could include these elements, but the “cocktail napkin presentation” appeared the most appropriate to address the ability for students in this course to “explain experimental developmental neurobiology to audiences of high school-educated novices”, as outlined in Learning Objective 1, because students needed to distill information into a simple and elegant format. (Other activities not discussed here address the other levels outlined in the learning objective: college-educated novices and experts.) A wide diversity of “foundational and current papers in developmental neurobiology” (Learning Objective 2) were chosen for each unit (Figure 1).

FINAL ACTIVITY DESIGN

Formally, the prompt for the exercise was as follows:

“Create a 5-minute oral presentation on your paper from the primary literature, at a level where a high school-educated audience would understand the content. Other examples of the intended audience include a relative or attendees of a town council meeting. Your audience might ask you in casual conversation about something interesting you’ve learned, and you won’t have PowerPoint to use when you talk to them. They want to know about what you have discovered

and are fascinated by it, but they will be turned off by too much detail and jargon. Your audience likes consuming popular science media, like watching NOVA on PBS or reading *Popular Science*.”

The criteria for the assessment were carefully selected to give equal weight to both learning objectives. For example, for Learning Objective 1 (science communication), the following four equally weighted criteria were defined:

- (1) presented highly relevant results
- (2) presented a congruous flow of ideas
- (3) *oratory and timing*
- (4) *supportive audiovisual (the cocktail napkin)*

For Learning Objective 2 (critical evaluation of primary literature), the following four equally weighted criteria were defined:

- (1) defined relevant knowns
- (2) defined relevant unknowns/question(s)
- (3) defined approach/methods
- (4) defined relevant results/conclusions

To determine a grade for the activity, achievement in each criterion of the rubric was evaluated according to a rubric (see Supplementary Material 1).

The method of evaluation of these criteria differed in the two iterations of this course. In 2017, each of the 8 criteria was assigned a holistic grade focused on achieving the objectives outlined in the rubric (“exceptional”, “good”, “needs practice/work”, “minimal”, non-existent”). However, evaluating presentations in this way proved extremely time-consuming and fussy. In 2019, one “scientific communication” grade (encompassing criteria 1-4) and one “scientific rigor/logic” grade (encompassing criteria 5-8) were again assigned holistically (“masterful”, “proficient”, “deficient”). This time, evaluation and feedback from the instructor was more impactful, because it only focused on criteria that were particularly weak and could be improved, or criteria that were particularly strong and should be kept. This adaptation to the method of evaluation was also inspired by “specifications grading”. The feature of specifications grading utilized here is that grading is done less on a continuous scale (0-100%) and more on a discrete scale (“masterful”, “proficient”, “deficient”), increasing the stakes for student success. This feature is thought to increase academic rigor and enhance student motivation (Nilson, 2015).

This activity was built incrementally over the course of 3-4 weeks (“scaffolding”), as part of a unit within the *Developmental Neurobiology* course. Students chose their paper preferences after 1st class session, which gave an overview of the unit’s topic. Literature that could be chosen included seminal papers that focused on concepts and techniques covered by the unit overview. Students were assigned one of their top three paper choices by the end of the 2nd class session. Groups of 2-3 students would be assigned the same paper so they would be able to work with each other in evaluating it; at the same time, each student in the group would often wish to focus on one aspect of the paper to minimize content overlap in their

presentations, though this was not required by the activity prompt. Before the 3rd class session, students each wrote a title and abstract for their presentation, geared toward a non-expert audience. Before the 4th class session, they submitted a “rough draft”—a scan or photo of their cocktail napkin as it looked at the end of a practice presentation. By this point in the activity, students were working on this activity outside of class; most in-class time up to this point was devoted to delivering interactive lectures of the unit’s topic and discussion of 1-2 assigned papers related to the topic. These class-wide papers were chosen to include concepts and techniques found in students’ chosen papers. Before the 5th class session, the presentation was prepared for “Practice Day”, a full 75-minute class period devoted to peer presentation and practice in the groups of 2-3 who were assigned the same paper, providing immediate peer feedback. The instructor rotated among the small groups, listening for strengths and weaknesses in individual presentations, and offering candid feedback. The students then prepared for their final presentation, given on the 6th class session (Presentation Day). On Presentation Day, the entire class and instructor listened to each presentation sequentially. Students had only heard the presentations given by their small group on Practice Day, so this day was exciting to students because they want to learn about what other papers their peers had been reading. Each presenter began with a blank cocktail napkin (12.5 cm x 12.5 cm) and drew “on the spot”. The drawing was projected to a screen via a document camera to provide the class with maximum visibility. Following the presentation, the instructor or students asked questions to the presenter, though this time was used as a low-stakes opportunity for further learning and discussion, and was not part of any formal assessment of the activity. Anonymous peer feedback was given after each presentation while the instructor completed his own evaluation of the presentation, using the criteria listed above. Each student presented one presentation per unit for a total of four presentations during the course, which together counted for half of the final course grade.

This scaffolding allowed for instructor feedback and mentorship throughout, and also provided some peer feedback. Another advantage to the scaffolding was the constant exposure to the activity and its goals over 3-4 weeks. This feedback, exposure, and mentorship appeared to increase the quality of final presentations. For example, early in the scaffolding activity, many students would begin with a wordy cocktail napkin (Figure 2A). These students would need to pause to write, which interrupted their flow of ideas and created a stilted presentation. Later, their final presentations would invariably utilize simpler illustrations (Figure 2B). The overall effect was that the audience could focus on the speaker’s narration, who had developed greater knowledge of the topic as well as spontaneity and naturalness in presenting.

To encourage full participation in each part of the scaffolding activities, pass/fail criteria were applied to the on-time and quality completion of scaffolding work. The activities were counted as part of an “in-class performance” component of the final course grade (15%). Activities in

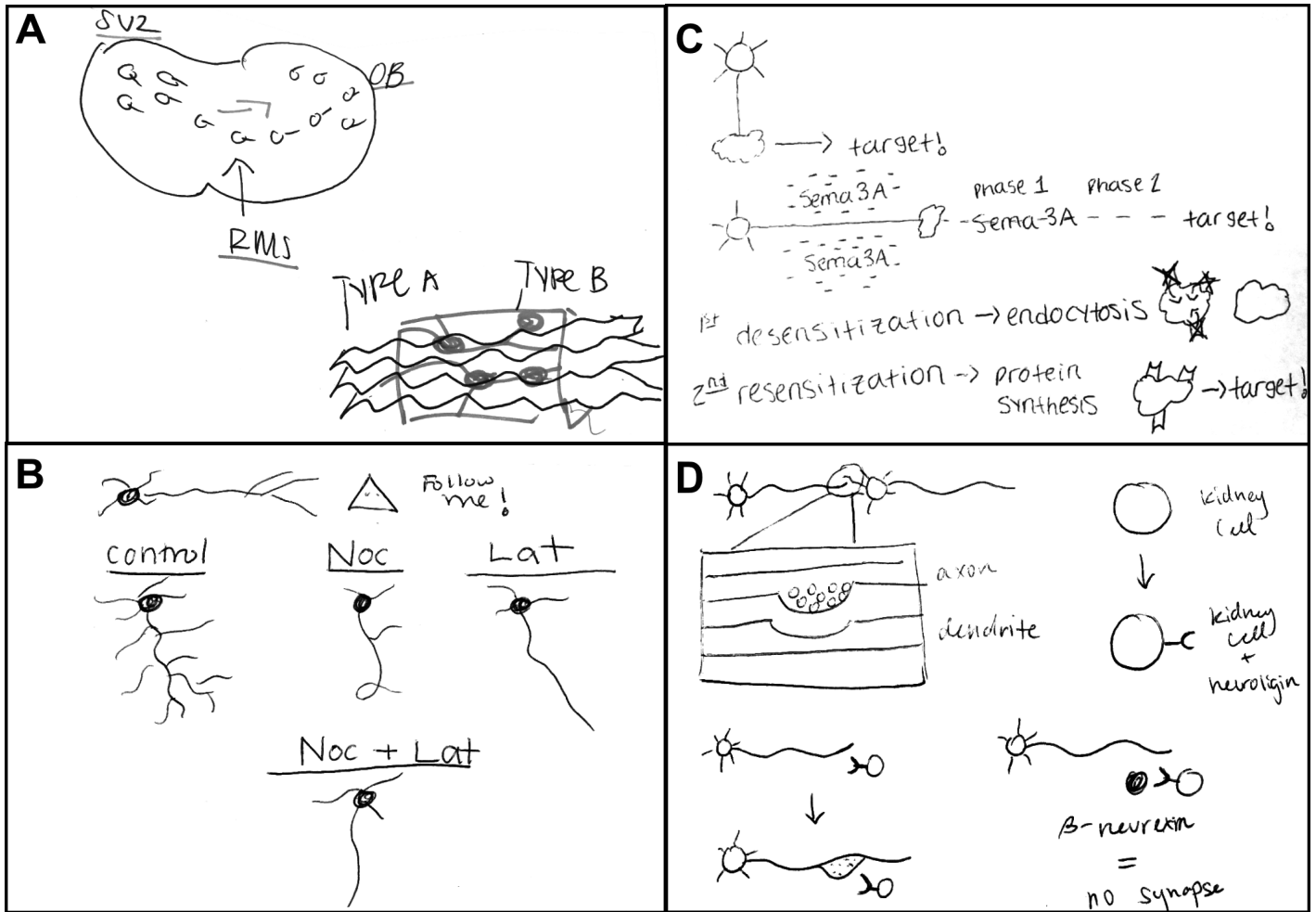


Figure 1. Final cocktail napkin drawings, collected after presentations. (A) Above, newborn neurons from the subventricular zone (SVZ) are shown migrating along the rostral migratory stream (RMS) toward the olfactory bulb (OB). Below, the *in vivo* cytology of the RMS is diagrammed, showing Type A neuroblasts, drawn in black, migrating past flanking Type B glia drawn in gray (Lois et al., 1996). (B) Above, the basic principle of growth cone-mediated guidance is diagrammed. Below, axon branching and outgrowth of cortical neurons *in vitro* are shown after drug treatments inhibiting microtubule polymerization (Noc: nocodazole, Lat: latrunculin A) (Dent and Kalil, 2001). (C) The growth cone of a neuron traveling through guidance cues (such as Sema3A) adapts its response through endocytosis-dependent desensitization and protein synthesis-dependent resensitization (Piper et al., 2005). (D) A diagram showing synaptogenesis (above left) and a diagram showing neurotrophin transfection of non-neuronal cells (above right) set the stage for the experiments in the paper. Below left, a diagram shows how neurotrophin expressed by a non-neuronal cell induces presynaptic differentiation *in vitro*. Another diagram (below right) shows how this process is blocked by application of soluble β -neurexin to the cell culture (Scheiffele et al., 2000).

cluded picking out the paper in time, writing the summary for the abstract book in time, having a rough draft of the presentation ready in time, having a presentation ready for Practice Day, and giving high-quality feedback to peers on Presentation Day

ASSESSMENT DESIGN

This activity was implemented within the context of a completely new lecture and laboratory course containing multiple innovative elements. Initially, therefore, open-ended questions were used to probe the overall impact of this activity on student learning and guide its future assessment. Nonetheless, anonymous student evaluations of the course and the instructor provided an overall quantitative picture of

the course's success. For example, 100% of respondents in 2017 (14 students) and 2019 (12 students) agreed or strongly agreed to all 5 course-related statements in the evaluations: (1) the course was intellectually challenging, (2) course objectives were clearly stated, (3) course content matched course objectives, (4) course assignments enhanced student learning, and (5) evaluations reflected material covered in the course.

Some qualitative observations made during these first iterations of this course could inform the design of future assessments of this activity. For example, while teaching *Developmental Neurobiology* in the fall of 2017 and 2019, I noticed the possibility that students were achieving additional learning outcomes that were not part of the original

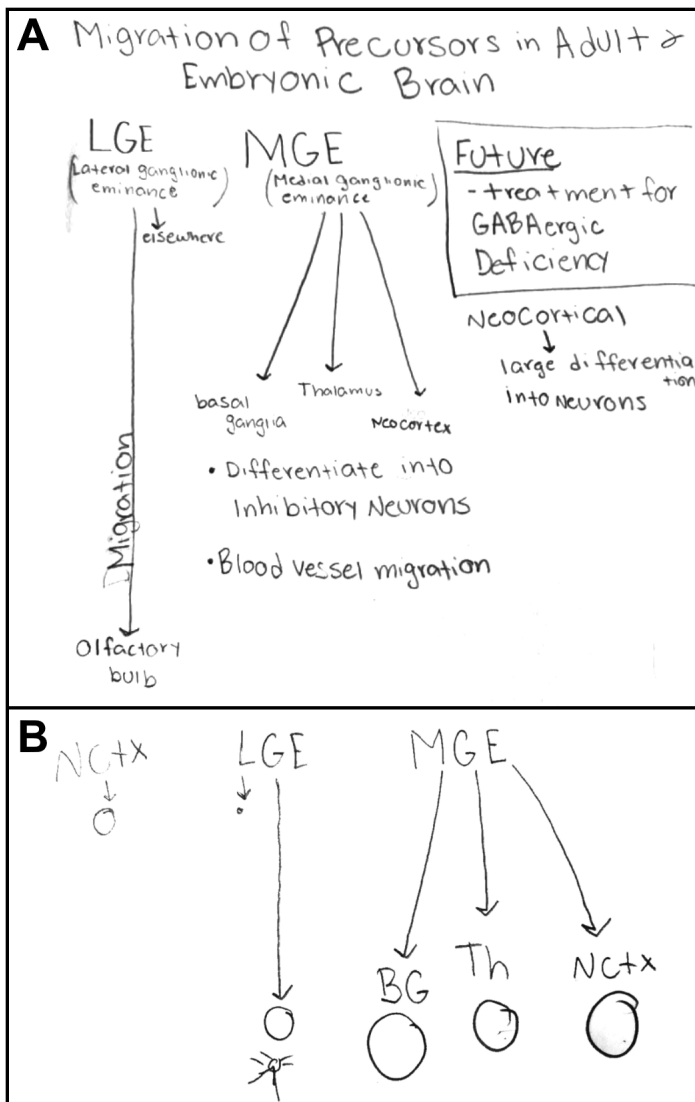


Figure 2. Scaffolding example. (A) Rough draft cocktail napkin drawing to accompany presentation of Wichterle et al. (1999). (B) Final cocktail napkin drawing collected after the final presentation of the same paper by the same student.

design of the activity. Firstly, students appeared to understand the importance of interpreting the figures of their papers over all other sections. Secondly, and perhaps most importantly, students were deeply engaged with the papers because they were motivated to give a high-quality presentation and found the activity valuable.

The results (figures/tables) and methods sections are the most difficult for biology undergraduates to read (Hubbard and Dunbar, 2017). Some undergraduate activities focused on the primary literature have already begun to address this need, for example, by creating a template to interpret data in the results section (Round and Campbell, 2013). Perhaps more troublesome is the fact that undergraduates rate the abstract as the most important section of scientific papers, whereas biology experts (Ph.D. students, postdoctoral fellows, and faculty) consider the results (figures/tables) section as the most important (Hubbard and Dunbar, 2017). Broadly speaking, the attention given to the abstract over the results section by under-

graduates could be a sign that students are behaving as consumers of “textbook science”, where mastery would mean uncritically memorizing large, amassed quantities of facts from a long textbook. Shifting students from being passive textbook science consumers to critical scientists is central to success in this activity. This strategy is similar to the “less is more” approach to neuroscience education, in which science is presented via a discovery-based model based on the primary literature (Hoskins and Stevens, 2008) and is also a broader theme of the Vision and Change consensus (AAAS, 2011). These models, rather than replacing important content delivery, could be used to supplement requisite knowledge with classroom time for deeper discussion, conceptual thinking, and development of scientific skills. The activity presented here could therefore address a career stage-based gap in critical thinking, which could be assessed in future iterations of the course.

At the end of the *Developmental Neurobiology* course in 2017, all students filled out an anonymous, qualitative evaluation survey of the course. Most questions focused on other activities (such as the labs), but one of the open-ended questions asked if activities such as the cocktail napkin presentation were effective at learning scientific literacy, scientific rigor/logic, and scientific communication. All responses were positive but remarkably, most respondents also shared an insight: presenting primary literature caused them to be more deeply engaged with its critical evaluation. For example: “[Cocktail napkin presentations] made us understand the papers well, as we had to really think about how we were going to convey the ideas in the papers...” “In order to give a good presentation, not only do you have to understand the contents of the paper, you have to modify how you give out the information based on the audience.” “...In the end, you wanted to do a good job in front of your classmates, so that added public pressure really made me not want to leave any stone unturned.” “I think that through the presentations I learned how to read scientific papers and understand them better because I had to present on the topic. It also helped me to learn how to communicate science to the audience and find what aspects of papers were the important ones.”

Another surprising aspect of the student responses was that they highlighted how valuable the activity was for them, even though the question did not explicitly ask about this. “I won’t lie: I hated presenting, but I feel like it was very beneficial.” “Not many Bio courses give students the opportunity to practice presenting, and it is an essential tool needed after graduation.” “The presentations were a great way to practice and learn all three of those things [scientific literacy, scientific rigor/logic, and scientific communication] because those are the exact three areas that need to be strong in order to convey the assigned paper adequately to your audience. They were daunting at first, but as we got through the semester I found that they helped a lot in making me feel more comfortable conveying a scientific discovery to a group of people.” “Even though I hate presentations, it was super helpful to practice and learn those things before we have to go out and do them in the real world. I feel like it’s very important to be able to communicate and explain research to those who may not

understand science, because it is relevant to everyone."

Based on these observations and insights, future assessments of this activity could focus on student achievement of more than just the two learning objectives designed here. Assessment could also help determine if this activity pushes students to understand the importance of interpreting the figures of their papers over all other sections, if this activity deeply engages students with primary literature because of high student motivation, and if this activity indeed has high intrinsic value for students.

CONCLUSION

The cocktail napkin presentation activity integrates several teaching strategies to address relevant skills- and knowledge-based gaps needed to equip undergraduate neuroscience and biology majors for the future. Moreover, this activity may also shift students' approaches to reading primary literature by focusing on the results section—as biology experts do—and may also engage with students' learning-related values. Success may therefore involve increased student mastery of developmental neurobiology content as well as enhanced learning-related attitudes.

The synergistic involvement of improved content mastery and learning-related attitudes in this activity is related to the idea of "transformational teaching" (Slavich and Zimbardo, 2012). In this conception of teaching, five apparently disparate types of learning (active, student-centered, collaborative, experiential, and problem-based) are related in that they all increase student mastery and enhance "learning-related attitudes, values, beliefs, and skills" (Slavich and Zimbardo, 2012). The cocktail napkin presentation activity combines features of each of these five types of learning. For example, students are engaged in (1) active learning when having to draw and discuss their paper; (2) student-centered learning when choosing the papers they prefer to present; (3) collaborative learning when conferring with classmates who have chosen the same paper before or during Practice Day; (4) experiential learning when presenting the paper as if their audience were comprised of non-experts; and (5) problem-based learning when designing their presentation to convey scientific information accurately and concisely.

A key aspect of transformational teaching is the relationship between the instructor and the students. During transformational teaching, the instructor assumes the role of an "intellectual coach" who nurtures student mastery and growth (Slavich and Zimbardo, 2012). The design of this activity allowed for classroom time in which I could mentor the entire class, smaller groups, or even individual students as they mastered content and developed personally. This type of mentored instruction was essential in the implementation of this activity and should not be overlooked.

The cocktail napkin presentation activity is designed to focus student engagement on what truly drives neuroscience: experimental discovery of the unknown. Distilling experimental neuroscience and presenting it in a simple format is an activity that should give students the knowledge and skills they need to be confident, literate, and fluent members of our exciting, discovery-based neuroscientific culture.

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APPENDIX: EVALUATION RUBRICS

For the criteria defined for Learning Objective 1 (scientific communication), the rubrics were as follows:

(1) Present highly relevant results: *You were highly selective in the data that you presented from your paper, and if you presented more than one result, the results made sense when presented sequentially. You only chose data that were extremely important for answering your central question, and you clearly and carefully explained all data you presented step by step.*

(2) Present a congruous flow of ideas: *You matched what you were saying with your gestures and cocktail napkin drawings. You were very clear about each idea you were presenting, and your ideas made sense to the audience.*

(3) Oratory and timing: *You presented as close to 5 minutes as possible (± 1 minute), spoke clearly and carefully, projected your voice, and were poised.*

(4) Supportive audiovisual: *You used visuals on your cocktail napkin that added scientific value to your presentation and did not distract from your presentation. You drew a few extremely simple illustrations that made any part of your presentation easier to understand.*

For the criteria defined for Learning Objective 2 (critical evaluation of primary literature), the rubrics were as follows:

(5) Define relevant knowns: *Your audience appreciates that you are studying a topic of great relevance and was taught just enough to understand why you were about to ask your central question (perhaps they even asked it themselves because you did such a good job).*

(6) Define relevant unknowns/question(s): *Your audience understands how important your central scientific question is, understands why you asked that question, and really wants to know the answer (the audience might even feel a sense of urgency about knowing the answer).*

(7) Define approach/methods: *Your audience understands the experimental approach and important details of your methodology, and understands that the approach/methods are truly able to answer the question you asked.*

(8) Define relevant results/conclusions: *Your audience clearly understands the distinction you drew between results (things that your data actually measured) and conclusions (things you inferred from your data), and understands that the conclusions you drew from your data are highly relevant, changed the field, or changed the way we think about a concept.*