New Methods for an Undergraduate Journal Club

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Abstract: Journal clubs have been used to advance students' scientific skills beyond basic knowledge and comprehension, but students often view the traditional format of analyzing reported data and experimental design as laborious and intimidating. As such, the traditional approach can diminish student engagement and enthusiasm for the value of scientific research and literature. In order to overcome this hurdle, we developed a novel journal club format that engages students in discussions of research literature while fostering attitudes of excitement and enthusiasm towards science. The semester begins with a broad discussion of a provocative, mysterious or even controversial central topic. During the course of the semester, students develop a research model about the topic utilizing a wide range of reference materials. Each session consists of developing, evaluating and refining hypotheses, engaging in group discussions, and determining potential directions of investigation. Herein we present (a) the details of this format including an example topic, (b) a discussion of student feedback and (c) observations following the conclusion of the inaugural undergraduate journal club.

Key words: Critical thinking; literature; science education; teaching methods; undergraduate Learning

INTRODUCTION

A review of pedagogical literature over the past decade reveals an abundance of novel classroom and laboratory methods focused on critical thinking (Allen & Tanner, 2003; Breakwell, 2003; Brown, 2010; Chaplin, 2003; Choe & Drennan, 2000; Kolkhorst et al., 2001). The fundamental aspects of critical thinking include the ability to extract key information from literature, debate the evidence, and independently design protocols (Bailin, 2001; Crowe, Dirks, & Wenderoth, 2008). The integration of research literature into classroom activities has been shown as an effective strategy for the development of critical thinking across multiple science disciplines (Breakwell, 2003; Brickman, 2012; Chisman, 1997; Choe & Drennan, 2000; Hoskins et al., 2007; Janick-Buckner, 1997; Krontiris-Litowitz, 2013; Muench, 1999). However, a common concern is that research literature's advanced language may confuse or frustrate novice students and ultimately prevent them from appreciating the applicability beyond traditional textbooks. To address these concerns, science educators often attempt to relate scientific information to real-world situations by utilizing various media sources familiar to a wide-range of students (Brickman, 2012; Brown, 2010; Krontiris-Litowitz, 2013). Some truly novel methods introduce research literature in a particular sequence in order to illustrate the inception and evolution of the scientific process (Hoskins et al., 2007).

Recognizing the potential for research-based literature to help our students improve their critical thinking skills, we decided to develop an undergraduate journal club. However, we wanted to take a unique approach with the objective of creating a relaxed atmosphere that would stimulate scientific curiosity and wonder outside of the academic curriculum. Our objective was to appeal to our student's imagination and curiosity thus intriguing them to explore science beyond the conventional context. Once this was accomplished we could help them develop their critical thinking skills in a way that was not viewed as laborious or intimidating.

METHODS

The following journal club format was implemented at Lincoln Memorial University, a rural four year university in Tennessee, during a sixteen week fall semester. Meetings officially started in October and ended in December holding a total of five sessions. This journal club was extracurricular and no academic credit was offered or rewarded. Participation was open to all enrolled undergraduates from any academic discipline. Email solicitations and fliers providing an overview of the club, scheduled meeting times, and contact information were used to recruit participants. The club met for approximately one hour over the course of three months for a total of five meetings. Prior to the first meeting, a consent to participate form detailing the objective of the study, methods of assessment, and assurance of privacy for collecting and reporting data were given to all students. Students who declined to consent were allowed to attend and participate in the meetings with the understanding that no data would be collected or reported from that student.

Journal Club Format

The overall format for the journal club consists of (a) generating interest through a discussion about a provocative topic, (b) developing questions and

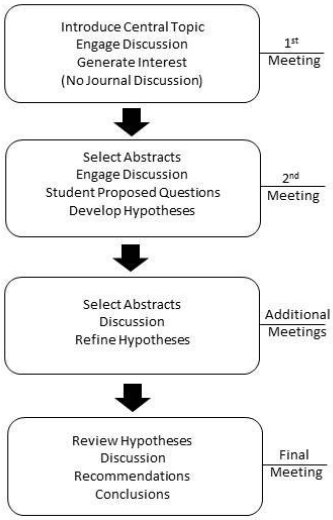

Fig. 1. Review of the journal club format summarizing the activities at each successive meeting.

hypotheses utilizing instructor selected abstracts, (c) further evaluating and refining hypotheses based on student selected abstracts and (d) making a conclusion about the hypotheses and model based on the body of information collected during the semester (Figure 1). In order to illustrate the methodology and format of this approach, the specific topic covered during our inaugural semester is discussed.

The first meeting began with students completing the journal club expectations questionnaire followed by a discussion about unexplained experiences. Students next watched "DMT: The Spirit Molecule"(Schultz, 2010) a documentary on N,N-dimethyltryptamine (DMT) followed with a discussion on the visual experiences reported in the documentary. The study of psychedelic compounds is unique as they often combine established biochemical findings that are challenged by spiritual interpretations from users. Following the documentary, the instructor revealed that the objective of the semester long journal club was to take a scientific approach to investigate claims advanced in the documentary. Specifically, the club was tasked with developing a scientific model by which to investigate the presence of a spiritual or alternate realm of existence accessible by DMT. The group then composed a list of key terms from the documentary and used them to define the journal club topic as well as propose questions that would be used to direct the semester's investigative path. At the meeting's conclusion, the instructor introduced popplet.com, a website developed by Notion Inc.©, which allows users to map and organize information based on conceptual relationships.

Prior to the second meeting, the instructor selected a series of research abstracts related to the terminology list generated during the previous meeting and posted these on Popplet.com illustrating their possible relationships to the central topic. The group then discussed these abstracts at the second meeting, developing a series of working hypotheses. Based on the presented abstracts, the group selected one article to analyze in depth at the beginning of the next (third) meeting. In addition, each student was instructed to continue finding abstracts that would contribute to the ongoing discussion and potentially narrow the investigative focus.

At the beginning of the third meeting, students discussed the article in its entirety selected from the previous meeting. The discussion included analysis of the author(s) hypotheses, methods design and results. The investigation continued as students presented additional abstracts and defended how their findings contributed to the discussion and the developing series of hypotheses. Following the student presentations, the group discussed how the new information impacted the current hypotheses. The group decided which resources failed to contribute to, or misdirected, the investigative path. The group utilized the accepted resources to assess, update and add (if necessary) hypotheses to the working list. This format was repeated for the fourth meeting.

The final meeting consisted reviewing the

Table 1. Questionnaire results from the student expectation survey.

"I expect Journal Club to be a forum for topics outside the normal science topics discussed. I would like to see topics that can be studied in animals instead of focusing solely on humans. I would like to further develop my skills at reading and comprehending primary research and review articles quickly and accurately. "
"Have a wonderful time about learning new scientific concepts. Mainly help prepare and improve for other research in the near future. Discussion of research I believe is one of the best ways to become more knowledgeable. This club should expand the ideas of researching and the best approach. "
"My expectations for a journal club are that the participants should be ready to discuss the articles in an open manner. Openness is a must. Most likely, any topic should be fair game. Skills that should developed are researching skills, relational skills, and also improvements in critical thinking."
"Relaxed atmosphere; interesting topic; refined researching skills. Should have variety of students involved with wide-range topics and have 1 to 2 meetings every month on a specified day(s) to let students schedule appropriately. "
"I expect journal club to provide skills in researching topics and discussing articles to their importance. When reading an article, I want to be able to distinguish between information that is important to the articles topic and filler information that doesn't pose any importance. I don't want to get caught up in scientific jargon or concepts that misdirect my attention….no mainstream articles that lose attention easily."
"I expect that we will examine scholarly journal articles as well as individual accounts. I would like to look at clinical research"

Table 2. Results of activities conducted during the first meeting of the undergraduate journal club.

Central Topic: Is there an alternative spiritual realm of existence?
Sub-topic: Do psychedelics, particularly DMT, allow access to this realm?
Key Terms
Ego, ego death, hallucinations, pineal gland, sensory processing, serotonin, tryptophan, visual cortex
Student Generated Questions
Are they referring to an afterlife?
Are drugs causing hallucinations or accessing "special" senses?
What exactly is ego death?
What is the neurobiology of ego?
Does inhibition of ego allow us to see an alternate or "true reality?"
Is ego development an evolutionary survival mechanism?
Is ego a form of visual filtering?
Does DMT inhibit visual filtering?

collective list of gathered resources, questions and hypotheses to determine if a general consensus could be reached. This discussion was facilitated by using the conceptual map generated during the semester on Popplet.com. The meeting concluded with the distribution and completion of an evaluation form prompting the students to discuss their experiences with the new journal club format.

RESULTS

The initial enrollment for the journal club was 6 students of junior and senior status primarily representing basic and health science majors. All 6 students consented to the collection of information and participation in the study. The responses to the initial expectation survey revealed that students expected to talk about research in a manner that was (a) concise and efficient, (b) open and relaxed and (c) beyond the realm of what was typically encountered in their courses (Table 1). Following the revelation of the central topic a list of terms was generated followed by a series of questions from the students based on any of the listed terms. A majority of the generated questions focused on ego and ego death from which hypotheses would be generated (Table 2). As a result of the terminology list, three abstracts were selected that the group discussed. Based on a summary of all three abstracts, students generated a series of hypotheses and selected one article to analyze in its entirety (Table 3). Subsequent meetings resulted in student-selected abstracts, a complete article and resources that were used to evaluate, delete, modify, and add additional hypotheses. During the final meeting, the group determined that they were unable to arrive at a satisfactory research model because the resources deviated from the initial findings and were ultimately inconclusive and contradictory. The results of the exit questionnaire were overwhelmingly positive and expressed a general appreciation for the unique topic, group discussions and relaxed environment (Table 4).

DISCUSSION

Our objective was to develop research skills and foster attitudes of excitement and enthusiasm for science. The response from student participants was overwhelmingly positive with an appreciation for the uniqueness of the subject matter, group discussions, and relaxed environment. Since our intention was to frame all discussions in a scientific narrative, we had some trepidation about the efficacy of working with an unconventional topic. Initially we were unsure of how the students would respond and once the topic of spiritual or alternate existence was revealed the initial reaction could best be described as confusion and bewilderment. However, once the group started

Table 3. Sample of the activities conducted during the second meeting of the undergraduate journal club.

Central Topic: Is there an alternative spiritual realm of existence?
Sub-topic: Do psychedelics, particularly DMT, allow access to this realm?
SELECTED ABSTRACTS
ANQUIANO-RODRIQUEZ ET AL., 2007
REUS AND KIEFER, 1989.
*MCDANNALD AND SCHOENBAUM, 2009.
Student Generated Hypotheses
DMT induced visual experiences result from inhibition of ego.
There is decreased serotonin receptor expression in visual cortex during development, allowing development of ego.
DMT increases and stimulates serotonin receptors in the visual cortex.
Egocentric navigation may serve as a model for ego development.

*Indicates article selected for complete review

Table 4. Selected questionnaire results from the exit survey.

"My expectations for journal club were met because I found out more about a very interesting topic. I realize the objective of the club this semester was to develop a scientific model to test for the existence of a spiritual realm and we did not achieve this; however, I feel that we eliminated some potential paths of research because they led nowhere. We made progress by eliminating options."
"The journal club enlisted interesting topics that taught how to look up articles on a topic that might not have significant number of published works. The club also helped teach through experience how to dissect an article into helpful bits of information. Journal club supplied an entertaining way to practice science. "
"My expectations for journal club were exceeded. I have found the principles taught and utilized in journal club very helpful when reading abstracts for classes' research papers. Before, I would try to muddle through the whole paper. [The instructor] has demonstrated a better, more efficient way to cull through a lot of abstracts in a short amount of time so that less time is wasted on reading material that I'm not going to end up using."
"This club is new, and we have had more and more students attend throughout the school semester. I am pleased that it's progressing. I like going through abstracts instead of reading entire articles. If we read the entire article, we wouldn't have gotten far in the club at all investigating the role of DM T. I did not think the popplet site was helpful to us. But, I thought it was cool that we reached a point in the club that was a dead end for DMT. It shows us how real research is and how to adapt and change gears."
"They were quite successful. The only thing that I wish we had more of is time or in some cases just an idea on what exactly we want to find. I love the research aspect and wish I knew better was of gathering information. I think that having others finding topics on the subject and them everyone discussing the importance of the information towards the study was a great learning experience."

utilizing scientific resources (e.g., research abstracts) as a lens by which to view the topic, the atmosphere relaxed and dialogue quickly ensued. Ultimately the students were receptive to this approach as evidenced by their positive evaluations of the experience.

The deliberate focus on abstracts was an important feature of this journal club format. This approach allowed students to rapidly locate and identify information relevant to the topic while permitting a wider variety of topics to be discussed when compared to the traditional journal club format. Responses on the exit survey indicated that students liked this tactic and perceived it as a valuable way to collect information as well as an efficient use of their time. We did stress to students the limitations of relying on abstracts. Thus, over the course of four meetings, excluding the final fifth meeting, students reviewed two complete journal articles to allow more in depth analysis of experimental design and results.

Developing a specific research model from the gathered resources proved to be a difficult task given the limited meeting time. Moreover, some students expressed frustration when attempting to incorporate subsequent findings into the developing model. At times, some students declared that they believed the investigative process had reached a dead end. As an instructor, there was great temptation to assist with the research. For example, subjects of illusory perceptions may have provided a more direct approach. However, it was critical to allow students to guide their own investigation. Surprisingly, the failure to reach a consensus at the semester's end was viewed by the students as a positive experience, coming to the realization that this can (and does) happen in "real world" research. The use of popplet.com, an interactive conceptual mapping program, was implemented as a means for students to visualize how all selected material and information links with the main topic. Despite this objective, students found the site difficult to navigate and were hesitant to engage the website. Future sessions should include a detailed tutorial on using such interactive web sites.

We conclude that this unique journal club approach can produce an appealing and exciting atmosphere that may help students develop their critical thinking skills. The unique format allows students, instead of the instructor, to direct the path of investigation regardless of where that path may lead. The format presented is not restricted to the sciences and can easily be modified for any discipline. Ultimately this approach can be used with novice or advanced students to engage their interests through the use of research-based resources.

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