Historical ethical dilemmas are a valuable tool in bioethics courses. However, garnering student interest in reading and discussing the assigned cases in the classroom can be challenging. In an effort to actively engage undergraduate and graduate students in an Ethical Issues in Biotechnology course, an activity was developed to encourage reflection on a classical ethical dilemma between a patient, St. Martin, and his employer/caretaker, Beaumont. Two different texts were used to analyze the ethical ramifications of this relationship: a chapter in a popular press book and a short perspective in a medical journal. Participants read the book chapter for homework and discussed it in class. This easy read highlights the fundamental ethical issues in the relationship between two men. Students were then provided with a second text focusing on the scientific accomplishments achieved through Beaumont’s experimentation on St. Martin. A structured worksheet prompted participants to reflect on their feelings after reading each text and create a concept map depicting the dilemma. Student-generated concept maps and written reflections indicate participants were able to list the ethical issues, analyze the situation, and evaluate the information provided. This activity not only encouraged higher-level thinking and reflection, it also mirrored the course’s structured approach of using concept mapping and reflection to dissect ethical dilemmas.

INTRODUCTION

Higher-level thinking skills and reflection can be applied to finding workable solutions to ethical dilemmas (1). Specific classroom activities can contribute to higher-level thinking. For example, structured reflective writing provides learners with the opportunity to organize their thoughts and improve critical thinking performance (3). Students can then, in conjunction with reflection, employ concept mapping, a powerful tool that promotes meaningful learning by allowing students to visually organize the interconnections among concepts (2). Nevertheless, while proven pedagogical tools offer the framework for activities that promote higher-level thinking skills, student motivation to read the assigned texts and participate in class discussions remains a crucial factor for the success of these activities.

Engaging students in bioethical discussions and enabling them to reflect on their opinions and those of their peers is fundamental for the creation of a dynamic learning environment. Further, by analyzing current and historical ethical dilemmas, participants in bioethics courses are exposed to different perspectives, which contribute to the development of their own “moral compasses,” helping students to refine strategies for moral decision making. The Ethical Issues in Biotechnology course at North Carolina State University enrolls 16 to 20 juniors, seniors, and graduate students in a semester-long class that includes guest lectures on bioethics, in-class group activities, and student-led presentations on the ethical implications of current biotechnologies. One of the goals of this course is to focus on the development of individual bioethical decision-making strategies. The challenge of engaging this diverse audience in productive discussions of the factors influencing ethical decision making prompted the incorporation of several new activities. Concept maps and flowcharts were used to visually depict the steps and factors involved in the issues discussed (e.g., flowcharts of ethical decision-making strategies and “summary concept maps” at the end of presentations). Additionally, the course included numerous relevant opportunities for written reflection and in-class and online discussions.

One particularly engaging activity described here consisted of reading two different texts about a classical ethical dilemma: the case of Beaumont, who, in the 1800s, systematically experimented on St. Martin, his wounded patient/employee, to gain insights into the inner workings of the human stomach. The selected texts have strikingly different tones and appeal to a variety of majors and educational levels. The goal of this activity was to prompt participants to analyze the situation and reflect on the issues presented. The learning outcomes assessed were the students’ ability to list the main ethical issues and to create a concept map to visually summarize the incident. A worksheet was

Carlos C. Goller
Biotechnology Program, North Carolina State University, Raleigh, NC 27695

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used to guide students through their analysis of the ethical considerations of this situation using a series of reflective writing prompts (adapted from Ref. 6) that culminate with the creation of concept maps. This approach can be adapted to other topics, texts, and courses while still using simple approaches for fostering in-depth analysis and discussion of the information provided.

**PROCEDURE**

This activity was conducted after a series of guest lectures on morality, ethical principles, responsible conduct in research, concept mapping, and intellectual property. An entire 90-minute class period was devoted to the activity to ensure sufficient time for reading the second text, completing the worksheet, analyzing concept maps, and discussing feelings and opinions as a class.

Two different texts describing the Beaumont and St. Martin incident were used (Appendix 7a): a chapter in a popular press book (Chapter 5: “Hard to Stomach,” in Gulp by Mary Roach [4]) and a short historical perspective in a medical journal (Beaumont and St. Martin, by Stefan Schatzki [5]). Both readings were posted to the course website (Moodle) for student access.

Participants first read the assigned chapter for homework and discussed it during the class period for ten minutes (see Fig. 1). Students were then provided the second text, focusing on the scientific accomplishments achieved through Beaumont’s experimentation on St. Martin, and given ten minutes to read it. At this point, a worksheet (Appendix 1) was distributed, and students were asked to reflect on their feelings after reading each text and create a concept map depicting the ethical dilemma. After providing participants with sufficient time (30 minutes) to anonymously complete the task, the worksheets were collected (see Appendix 2 for student examples). Next, students discussed whether their feelings had changed after reading the second text and examined the challenges of creating a concept map to illustrate this complex situation. Finally, an instructor-created concept map (Appendix 3) was evaluated as a class and discussed to wrap up the activity. Students actively participated in the discussion and offered numerous suggestions to amend the example concept map. Some expressed interest in reading other chapters of the book or additional research on Beaumont and St. Martin.

**INSTITUTIONAL REVIEW BOARD APPROVAL**

The North Carolina State University Institutional Review Board approved the reflective writing and concept mapping activities as well as the postsurvey used in the spring 2014 BIT 501 Ethical Issues in Biotechnology course. The survey was anonymous, and the IRB received exempt status. NCSU IRB # 3757: Impact of diagramming software

![FIGURE 1. Flowchart of Beaumont and St. Martin activity.](image-url)
and reflective writing activities on attitudes and opinions in a bioethics course.

CONCLUSION

This scaffolded activity encouraged reflection and discussion of a thought-provoking ethical dilemma. Student responses and concept maps suggested that participants were able to list and analyze the ethical issues (Appendix 2). Anonymous end-of-course self-evaluations indicated that 63% (of 19 responses) found concept maps to be helpful in understanding ethical dilemmas, and all respondents (out of 17 responses) reported achieving the course learning outcomes (Appendix 6). This is supported by their ability to interpret ethical issues in their final reflections and create flowcharts or concept maps depicting their approach to solving moral dilemmas (Appendix 4). This novel activity can be readily adapted to other topics or to include individual or team-based creation of concept maps using software such as Lucidchart or Coggle.it (Appendix 7b). Building on this framework, the enthusiasm generated from captivating reading assignments can be harnessed to create an engaging learning experience and productive discussion.

SUPPLEMENTAL MATERIALS

Appendix 1: Student worksheet for discussion of the Beaumont and St. Martin case
Appendix 2: Student examples of completed worksheets for Beaumont and St. Martin activity
Appendix 3: Instructor-created concept map for Beaumont and St. Martin activity
Appendix 4: End-of-course reflection assignment (a), instructor feedback to class (b), and example of flowchart presented in lecture (c)
Appendix 5: Class participation rubric
Appendix 6: End-of-course survey summary
Appendix 7: Notes about the texts and activity (a) and software used for concept mapping (b)

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