

Introducing Weekly Themes to Engage Students in a Microbiology Class†

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INTRODUCTION

After having taught upper-division microbiology for multiple years, I decided it was time to refresh the course. Rather than intermittently adding a few innovative assignments and activities, I wanted something more organized and consistent that would address student learning outcomes and provide variety throughout the course. This led to the development of “theme weeks,” where assignments and activities address a specific theme introduced at the beginning of the week. Themes, by definition, provide a background or setting in which to learn the course topics. Assignments and activities for each theme are assessed as class participation points. The goals of theme weeks are (i) to increase student interest, (ii) to help students connect to course topics, and (iii) to help students achieve student learning outcomes.

PROCEDURE

Choosing the themes

Themes should promote student learning, align well with the course subject, and address student learning outcomes. Themes I use in my microbiology class are Art, Relevance to Life, Analogies, Group Work, Asking Questions, and In the News, all of which incorporate effective teaching strategies (1–7). Additional suggestions for themes are listed in Appendix 1. Note that some themes are metacognitive strategies or study techniques (e.g., Group Work, Analogies), while others could be defined as applications (e.g., In the News) or means of creative expression (e.g., Art). Regardless of specific category, for simplicity's sake I refer to them all as “themes” and do not distinguish between them when introducing themes to students.

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Assigning and introducing the themes

Table 1 shows the order of themes in my microbiology class and their aligned topics. Themes are broad enough that they can overlap with virtually any content, although some naturally fit better with certain topics. For example, Art pairs well with bacterial cell structure and function, and Relevance to Life connects well with microbial growth and control. In the News is more suitable for later in the semester when students have a broader knowledge of microbiology and can explore a diversity of topics.

Although I originally intended to assign a different theme each week, due to exams, student presentations, holidays, and the nature of some assignments, I typically introduce a new theme every 2 weeks, as shown in Table 1. Depending on the format of your course and how often it meets, the frequency of themes can be adjusted as needed (e.g., weekly, biweekly).

On the first day of class, I inform students that the course will involve biweekly themes (with corresponding assignments and activities) to increase their interest and motivation for learning microbiology. When a new theme is introduced, I define the theme on a single PowerPoint slide and include images to generate student interest (e.g., agar art for Art Week, a cell analogy for Analogies Week).

Designing assignments and activities for each theme

Table 1 lists the assessments I use for each theme and the student learning outcomes that each theme addresses. The approximate amount of class time for each assignment and activity is provided in Table 2. For Art, I include a take-home assignment (Appendix 2) and an in-class activity (Appendix 3). With student permission, I share their artwork (Appendix 2, part 3) with the class. The in-class activity for Art Week involves the performing arts, with students performing a simulation of one of three cellular transport systems in bacteria (Appendix 3).

For the Relevance to Life theme, when lecturing, I highlight connections between the content and common activities like eating and cleaning (e.g., why enzymes from alkaliphiles are found in laundry detergents, how high-solute concentrations preserve foods, why packaged coffee

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TABLE 1
Theme schedule and alignment to course content, student learning outcomes, and assessments.

Themes ^a	Weeks ^b	Topics	Learning Outcomes ^c	Assessments
Art	2-3	Bacterial Cell Structure and Function; Nutrient Transport	Distinguish bacteria shapes and cell structures. Compare and contrast bacterial cell wall structures. Demonstrate a mechanism of nutrient transport in bacteria.	Take-home assignment (Appendix 2) and activity (Appendix 3)
Relevance to Life	5-6	Microbial Growth and Control	Identify methods of controlling microbial growth in daily life and in industries (e.g., food, medicine). Distinguish between antiseptics and disinfectants.	Take-home assignment (Appendix 4)
Analogies	7-8	Biofilms; Antibiotic Resistance; Plasmids; Protein Secretion	Connect microbiological concepts (e.g., biofilms, antibiotic resistance) to prior (non-scientific) knowledge.	Take-home assignment (Appendix 5)
Group Work	9-10	Gene Transfer; Quorum Sensing	Compare and contrast gene transfer mechanisms in bacteria. Explain how phage conversion benefits host cells. Compare and contrast quorum sensing mechanisms in gram-positive and gram-negative bacteria.	In-class group activity (Appendix 6)
Asking Questions	11-12	Viruses; Microbial Symbiosis	Construct questions to address gaps in knowledge.	Take-home assignment (Appendix 7)
In the News	13-14	Pathogenesis; Microbial Diseases	Connect microbiology topics to current news.	Take-home assignment (Appendix 8)

a. Themes in bold address (Biology) program or institutional learning outcomes related to critical thinking, information literacy, written communication, academic honesty, and/or disciplinary knowledge (e.g., evolution, interaction, structure/function).

b. Based on a 16-week semester.

c. Examples of course student learning outcomes for each theme.

creamers do not require refrigeration). The take-home assignment for Relevance to Life is shown in Appendix 4.

I provide a few analogies throughout the lectures during Analogies Week(s), although the main focus is for students to generate analogies to help in their learning (i.e., self-generated analogies). Students are given two take-home assignments in which they are asked to provide analogies for various topics (Appendix 5). I request that students start their analogies with “This is (just) like...” or “This reminds me of...” to keep the format consistent. Volunteers are asked to share their analogies in class.

The in-class activity for Group Work involves students working in groups to answer content-related questions (Appendix 6). The questions include recall and analytical questions (many coming directly from the textbook) and address the learning outcomes for Group Work shown in Table 1. The take-home assignment for Asking Questions

asks students to review lecture slides and submit a question related to the content (Appendix 7). Note that the focus of this theme is on asking questions, not answering them.

During the In the News week, I begin each class with a summary of a microbiology-related news story. Students are given a take-home assignment (Appendix 8) in which they are asked to write a paragraph summarizing the key points of a current news article or video clip related to any microbiology topic. A few students are selected to share a summary of their news story in class.

Assignments and activities for each theme are treated as formative assessments. Qualitative feedback is provided (either in class or written on the assignment). Assignments are graded as Credit/No Credit based on completion by the due date. At the end of the semester, the percentage of “credits” is determined and incorporated into the course grade as participation points.

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TABLE 2
Estimated amount of class time devoted to theme week assessments.

Themes	Assessment	Class Time ^a
Art	Take-home assignment (Appendix 2) Activity (Appendix 3)	5-10 minutes to share artwork ^b 20-25 minutes Total: 25-35 minutes
Relevance to Life	Take-home assignment (Appendix 4)	None Total: 0 minutes
Analogies	Take-home assignment (Appendix 5)	5-10 minutes (per part) to share analogies ^b Total: 10-20 minutes
Group Work	In-class group activity (Appendix 6)	30 minutes per class meeting ^c Total: 90-180 minutes ^d
Asking Questions	Take-home assignment (Appendix 7)	15-20 minutes to discuss questions Total: 15-20 minutes
In the News	Take-home assignment (Appendix 8)	5-10 minutes to share news stories ^{b,e} Total: 5-10 minutes

a. Based on a class size of 15-25 students. Total refers to the total amount of class time dedicated to assessments during the duration of the theme.

b. Time spent sharing work depends on number of students willing (or selected) to share.

c. Based on a course that meets for an hour three days a week.

d. Maximum assumes the activity continues for all six class meetings within a two-week period.

e. Does not include news story summaries provided by instructor at the start of each class meeting.

Safety issues: None. This is not a lab activity and requires no chemicals, equipment, or living organisms.

CONCLUSION

Theme weeks are an inventive way to refresh a course. They bring an element of surprise to the class and help students connect to the subject. Themes engage students by providing a variety of learning approaches throughout the duration of the course. Assignments are designed to provide students with choices, increasing their motivation for learning by giving them freedom to pursue their interests. Themes support student achievement of learning outcomes, as seen in Table 1. Theme weeks are easily integrated into a course, without taking away too much class time (Table 2). Activities and assignments are not difficult or lengthy to design or assess and are included as course participation points to encourage student involvement and completion. Returning to the goals of theme weeks, I have observed increased student interest and connection to course topics inspired by theme week assignments. Examples include creative and accurate endospore cartoons (Art), a student who wrote passionately about antibiotics saving her life (Relevance to Life), and a comparison of biofilm formation to a scene in a Disney movie (Analogies). Most students complete

theme week assignments, suggesting they find them useful for their learning and worthy of their time. Although I have not quantitatively assessed the impact of theme weeks on student learning, I consistently receive enthusiastic participation and positive feedback from students when implementing this teaching method.

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SUPPLEMENTAL MATERIALS

- Appendix 1: Suggested list of themes
- Appendix 2: Student take-home assignment for Art theme week
- Appendix 3: Instructor directions for in-class activity for Art theme week
- Appendix 4: Student take-home assignment for Relevance to Life theme week
- Appendix 5: Student take-home assignment for Analogies theme week
- Appendix 6: Instructor directions for in-class activity for Group Work theme week

Appendix 7: Instructor directions for take-home assignment for Asking Questions theme week

Appendix 8: Student take-home assignment for In the News theme week

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