Using concept map assignments to promote course content integration

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WSU Teaching Toolkit
Challenges

Students’ scores in comprehensive questions in immunology were lower than the exam average.
“The instructors could be more engaging with the students. They could make the lectures more of a discussion of the concepts rather than presenting them all.” Veterinary Immunology, 2016.

“Because this course is so information-heavy, I think there should be more tests with fewer concepts on it. I found myself memorizing information more than learning and applying what I know. More in-depth tests on fewer subjects would be more beneficial, I think.” Veterinary Immunology, 2017.
How do you work on a puzzle?
How do you work on a puzzle?
Tips for better learning

1. **Gather information**

2. **Organize** information into meaningful groups
   - Start putting pieces together in different sections based on colors, patterns, etc.

3. **Connect and apply** - make connections and associations between these groups
   - Apply the material you learn
   - The more connections the better!

4. **Analyze concept as a whole, identify and fill in gaps**

5. **Peer teaching, discussion**

6. **Recall and practice** - use it or lose it
   - The more you use information, the better you retain it
   - Transfer information from working memory to long-term memory
- Divided Immunology course into 3 parts with 2 modules each
- Assigned specific learning outcomes to each module

<table>
<thead>
<tr>
<th>Module</th>
<th>Lectures</th>
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<tbody>
<tr>
<td>I</td>
<td>Lectures 1-6</td>
</tr>
<tr>
<td>II</td>
<td>Lectures 7-15</td>
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<tr>
<td>III</td>
<td>Lectures 16-17</td>
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<td>IV</td>
<td>Lectures 18-22</td>
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<td>V</td>
<td>Lectures 23-24</td>
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<td>VI</td>
<td>Lectures 25-35</td>
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<table>
<thead>
<tr>
<th>Module Learning Outcomes</th>
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<td>I</td>
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<td>V</td>
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<td>VI</td>
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Immunology Course Design

Course Learning Objectives

- Apply your knowledge of immunological concepts to explain the basis of vaccines, hypersensitivities, transplantation, cancer, autoimmunity and immunodeficiencies
- Apply your knowledge of immunological concepts to explain the principles of immunodiagnostics
- Apply your knowledge of immunological concepts to explain the basis of defense against infection: mucosal immunity, and immunity to bacteria, fungi, parasites and viruses
- Given a specific pathogen, construct a concept map that includes the components of the immune system and how they related to each other in response to an infection.
- Explain how the components of the immune system work together and how they are regulated
- Describe the function of the components of the adaptive immune system
- Describe how T and B cells develop at a cellular and molecular level, how they recognize and respond to antigen
- Describe the components of the innate immune system and their functions
- Construct a concept map that includes the components of the innate immune system and how they relate to each other in response to an infection.

Assignments and Assessments

- Concept Map + Comprehensive Exam Questions
- Case discussions
- Quiz 3 + Exam
- In-class questions + Exam
- Concept Map + Comprehensive Exam Questions
- In-class questions
- Quiz 2 + Exam 2
- Quiz 1 + Exam 1
M7534 - Veterinary Immunology
Group Assignment 1
Due 01/29/20

Please assign your group members before you submit this assignment. Here are instructions on how to do that: https://community.canvaslms.com/docs/DOC-10516-421264913

The Objectives of this assignment are to encourage students to:
- Review class material
- Demonstrate a general understanding of the function of the innate immune system
- Integrate the material learned in the first four lectures of Immunology
- Apply what was learned in Immunology to a real-life case.

Scenario:
Mrs. Davis comes into your small animal clinic with her dog Bella. Bella is a spayed 9-year-old female Australian Shepherd mix who loves hiking. Two days ago, on a beautiful morning while hiking with Mrs. Davis, Bella accidentally ran through a barbed wire fence while chasing a squirrel (one of her favorite live "toys"). Upon examination, Bella has several cuts in her shoulder area. Mrs. Davis reports that the night before Bella’s accident, she did not eat her dinner, she was quiet, sleepy, and her nose felt dry and warm.

Instructions:
A. Construct a concept map describing how Bella's innate immune system is responding to the injury. Make sure to:
- List the body's defense barriers that are breached.
- Illustrate how this injury is recognized by Bella's innate immune system.
- List the components of the innate immune system we discussed in class and demonstrate their functions (exclude the anaphylactic acid products, complement system and natural killer cells, as we will study these in more detail later in the course). 
- Illustrate in your diagram how the cells, molecules and mechanisms interact with each other and in what order they respond to the injury.
- List the cardinal signs of inflammation and briefly explain how they are generated.
- Explain the causes of Bella’s sickness behavior.
- Submit a photo of your concept map in Canvas. Only one group member is required to upload this photo. Make sure to include the names of all group members with your assignment.

B. Explain the events described in your concept map using complete sentences in half page or less.
- Submit a word file containing your explanation in Canvas. Only one group member is required to upload this file. Make sure to include the names of all group members.
Group Assignment 1 - Concept Map

Veterinary Immunology
Group Assignment 1
Due: 06/30/22

Please assign each group member before you submit this assignment. Here are instructions on how to do that: https://www.youtube.com/watch?v=DOOGjUI7iNQ

The Objective of this assignment are to encourage students to:

- Review class material
- Demonstrate a general understanding of the functions of the immune system
- Integrate the material learned in the text into the case study
- Apply what was learned in immunology to a real-life case.

Scenario:
Mrs. Davis came into your small animal clinic with her dog, Bella. Bella is a spayed 9-year-old female Australian Shepherd mix who lives in Napap. Two days ago, on a beautiful morning while hiking with Mrs. Davis, Bella accidentally ran through a herbed wire fence while chasing a squirrel from her favorite tree. Upon examination, Bella has several cuts in her shoulder area. Mrs. Davis reports that the night of Bella’s accident, she did not cut her dinner, she was quiet, sleepy and her nose felt hot and dry.

Instructions:
- A. Compose a concept map describing how Bella’s immune response system is responding to her injury. Make sure to:
  - List the body’s different barriers that are breached.
  - Illustrate how the injury is recognized by Bella’s immune response system.
  - Illustrate how the immune system is activated by the injury.
  - Illustrate how the immune system is activated by the injury.
  - Illustrate the cellular signs of inflammation and explain how they are generated.
  - Include a photo of your concept map in Canvas. Only one group member is required to upload this photo. Make sure to include the names of all group members with your assignment.

- B. Explain the case described in your concept map using complete sentences in full paragraph form.
  - Submit a word file containing your explanation in Canvas. Only one group member is required to submit this file. Make sure to include the names of all group members.

Due 37
For
Available from
Until
Apr 30 at 11:59 pm

Concept Map 1 Rubric

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Rating</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>List the body’s different barriers that are breached.</td>
<td>Yes</td>
<td>0.3 pts</td>
</tr>
<tr>
<td>Illustrate how the injury is recognized by Bella’s immune response system.</td>
<td>Yes</td>
<td>0.2 pts</td>
</tr>
<tr>
<td>Illustrate how the immune system is activated by the injury.</td>
<td>Yes</td>
<td>0.2 pts</td>
</tr>
<tr>
<td>Include a photo of your concept map in Canvas. Only one group member is required to upload this photo.</td>
<td>Yes</td>
<td>0.2 pts</td>
</tr>
<tr>
<td>Explain the case described in your concept map using complete sentences in full paragraph form.</td>
<td>Yes</td>
<td>0.2 pts</td>
</tr>
<tr>
<td>Total Points: 2</td>
<td></td>
<td></td>
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</table>

- 2 pts
Examples of Submission
Examples of Submission
Examples of Submission
VM7354 - Veterinary Immunology
Group Assignment 2
Due 03/27/20

Please assign your group members before you submit this assignment. Here are instructions on how to do that: https://community.canvaslms.com/docs/DOC-10516-221294813

The Objectives of this assignment are to encourage students to:
- Review class material.
- Demonstrate a general understanding of the function of the adaptive immune system.
- Integrate the material learned in the second part of the Immunology course.
- Apply what was learned in Immunology to a real-life scenario.

Scenario:
Remember Bella, the Australian Shepherd mix who accidentally ran through a barbed wire fence? Well, Bella’s wound got infected with Staphylococcus aureus which is an extracellular aerobic bacterium. If you don’t remember the case, go back to “Concept Map Assignment 1” in the “Concept Map Assignment” folder in the VM7354 Canvas page.

Instructions:
A. Construct a concept map describing how Bella’s adaptive immune system is responding to this infection. Start your concept map from the point antigen presenting cells phagocytose the bacteria to present those to T cells.

Make sure to:
- Illustrate in chronological order the components of the adaptive immune system (cells, molecules and mechanisms) we discussed in class involved in fighting this infection.
- Include the components of the innate immune system that are involved in the adaptive immune response.
- List the function of each of those components. Please do NOT explain what each mechanism does in detail. Simply name the mechanisms, for example, it is enough to write “isotype switching” in one of the steps of B cell activation.
- Demonstrate how these components interact with each other and in what order they respond to the infection.
- More specifically, include:
  - How antigen presenting cells present peptides to and activate T cells
  - The mechanisms used by the complement system that help fight this infection.
  - The mechanisms that lead to T and B cell activation and antibody production during this primary immune response.
  - The effector mechanisms used by the immune system to fight this type of infection.
  - List the mechanisms B cells use to generate a more effective immune response the second time Bella gets exposed to Staphylococcus aureus.

Submit a photo of your concept map in Canvas. Only one group member is required to upload this photo. Make sure to include the names of all group members in your assignment.

B. Explain the events described in your concept map using complete sentences in half page or less. Submit a word file containing your explanation in Canvas. Only one group member is required to upload this file. Make sure to include the names of all group members.
### Steps in developing concept map assignments

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td>Identify the need</td>
<td>Determine in which (if any) parts of a course there is need for assignments that require integration of large amounts of information</td>
</tr>
<tr>
<td>Step 2</td>
<td>Determine the timing</td>
<td>Determine when to give this assignment</td>
</tr>
<tr>
<td>Step 3</td>
<td>Create the scenario</td>
<td>Identify a real-life scenario where class material can be applied to</td>
</tr>
<tr>
<td>Step 4</td>
<td>Set learning outcomes and expectations</td>
<td>Clearly articulate the objectives of the assignment and provide examples</td>
</tr>
<tr>
<td>Step 5</td>
<td>Give instructions</td>
<td>Provide clear instructions of what should or should not be included in the responses</td>
</tr>
<tr>
<td>Step 6</td>
<td>Use a rubric</td>
<td>Develop a rubric that is directly related to the instructions and the learning outcomes</td>
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<tr>
<td>Step 7</td>
<td>Provide feedback</td>
<td>Provide specific feedback on what was missing, what was incorrect and organization of information</td>
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<tr>
<td>Step 8</td>
<td>Revise and resubmit</td>
<td>Provide students who committed severe errors to revise and resubmit their work</td>
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Adapted from Rutigliano, 2021
[https://www.nactateachers.org/index.php/teaching-tips-notes](https://www.nactateachers.org/index.php/teaching-tips-notes)
Five days ago, my friend's dog, Finn, got out and had an altercation with her neighbor's dog. She has developed a nasty bite abscess in her neck area with foul-smelling pus coming out of it. As we know, pus is rich in neutrophils. The area is reddened, swollen, warm, and painful. You recognize these signs of acute inflammation and know that the innate immune response is at work in an attempt to resolve what is most certainly a bacterial infection.

Describe the mechanisms that lead to the signs of acute inflammation and the formation of pus in 10 complete sentences or less.
Student scores

Scores of comprehensive exam questions before and after redesign of the Veterinary Immunology course (VM7534).
Results

Students considered concept maps the most helpful active learning technique used in this class.

How helpful were the techniques below to your understanding of course material?

<table>
<thead>
<tr>
<th>Percentage of students</th>
<th>Very helpful</th>
<th>Somewhat helpful</th>
<th>Neutral</th>
<th>Not helpful</th>
<th>Not helpful at all</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept maps</td>
<td>60%</td>
<td>40%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>In-class clinical examples</td>
<td>50%</td>
<td>30%</td>
<td>20%</td>
<td>10%</td>
<td>10%</td>
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<tr>
<td>Case studies</td>
<td>50%</td>
<td>40%</td>
<td>10%</td>
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Student perception of knowledge of immunology before and after taking Veterinary Immunology (VM7534) in 2021 and 2020 in response to the following prompts: A) Before taking this course, I could articulate how the components of innate and adaptive immunity cooperate in response to infection, and B) After taking this course, I can articulate how the components of innate and adaptive immunity cooperate in response to infection.
Questions?