Use of Team Modeling Projects to Teach Immunology

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Authors

Gail Snitkoff
Albany College of Pharmacy
Albany, New York
USA
Email: snitkofg@panther.acp.edu

Abstract

In this activity, students invent a method to teach a concept in immunology without using a lecture format. This collaborative project, involving 4 to 6 students per team, fosters teamwork, critical thinking, tailoring a learning exercise to an audience and self-assessment.

Activity

Invitation for User Feedback. If you have used the activity and would like to provide feedback, please send an e-mail to MicrobeLibrary@asmusa.org. Feedback can include ideas which complement the activity and new approaches for implementing the activity. Your comments will be added to the activity under a separate section labeled "Feedback." Comments may be edited.

Editor's Note (2008): This Curriculum Resource was published prior to establishment of current criteria of submission, and as such, does not contain all criteria required of current publications. However, the Editorial Committee felt that the activity itself remained worthwhile and relevant, and encourages potential users to contact the authors for clarification as needed. If you do update this activity for use with your students, and are interested in updating the resource for distribution in the library, please contact ASM at MicrobeLibrary@asmusa.org.

INTRODUCTION

This activity allows students to select abstract topics within a larger field of study and then design a mechanism for teaching the topic in a nonlecture format. Specifically, this activity allows for development of models which can be manipulated and projects which create nonlinear learning situations. This activity has been used in an immunology class, but topics represented in student projects have included cell development, DNA rearrangement, transcription and translation, protein-protein interactions, and pathogenic processes. Therefore, its usefulness is limited only by the instructor's and students' imaginations.

PROCEDURE

Materials.

Models - instructor copies of textbooks, current periodicals, library holdings, modeling materials
Posters - instructor copies of textbooks, current periodicals, library holdings, posterboard, paper, mounting materials
Computer simulations - instructor copies of textbooks, current periodicals, library holdings, computers with appropriate software for multimedia presentations
Computer Web page - computer with Internet access, instructor copies of textbooks, current periodicals, library holdings

Instructor Version.
This project takes place over approximately 10 weeks of a 15-week term. To encourage students to work on the project throughout the term, there are established benchmark dates by which certain objectives must be achieved. These include forming groups (1 week), choosing a topic (1 to 2 weeks, concurrent with selecting groups), deciding how to proceed (2 to 3 weeks), producing a finished piece of work (4 to 6 weeks), and discussing the work (1 day). The deadlines for completion of group selection and choosing a topic are incorporated into the course syllabus. In addition, 4 to 5 weeks into the project, required meetings are scheduled with each group to make sure they are on track. The final presentations of the projects take place on a single day which is scheduled in the syllabus. If deadlines are not met, up to 10 points may be deducted from the final grade for **each** deadline missed, totaling a maximum of 30 points off the final project grade.

Following is the paragraph from the syllabus about the projects:
"Project
Projects will be assigned the week of September 27 and are due on November 22. The project will be done in groups and will count as an hour exam for grading purposes. The options for the project include developing a model or teaching tool for a topic in immunology or presenting a case study. The teaching tool can be anything from a computer simulation, animation or Web page, to board games, or anything else creative. Case studies must connect physical and laboratory findings to the basic immunologic mechanisms underlying the disease. Failure to meet project deadlines will result in the loss of up to 10 points from the final grade for EACH deadline missed (therefore, up to 30 points total)."

The project can be introduced by explaining that many of the topics covered in the course are descriptions of microscopic or submicroscopic events which take place in and between cells and that understanding many of these interactions is not intuitive. The class can also discuss learning styles, emphasizing the fact that a great number of students are visual, kinesthetic, or multimodal learners; thus, use of the spoken and written word does not provide an optimal learning experience. Therefore, students are encouraged to rethink the course as visual images or models, rather than words to be memorized.

Since this is intended to be a collaborative group project, students are required to form their own teams containing 4 to 6 members. Many students prefer to work as individuals, so group formation is often difficult for them. The process can be facilitated by requiring that all groups be formed by a specific day (students not in groups lose credit). Students can also be assigned to specific groups by the instructor. Once groups are formed, students receive a grading rubric, so they know what criteria will be used in evaluating the project.

Following the formation of groups, students are required to choose a topic. Students may choose a topic from numerous sources, including the course syllabus, a list of immunologically mediated diseases, tests using immunologic reagents, or a topic of their own. All topics are to be registered with the instructor.
List of immunologically mediated diseases

Students research their topics, with help from the instructor to find resources when necessary, and identify a method for teaching the topic. The instructor should avoid providing assistance in selecting a presentation method, so there is no impetus for students to model what the instructor "wants" instead of what they have learned. This exercise requires students to find creative solutions for their learning (and teaching). Teaching material can be presented in the form of models, posters, computer simulations, or an Internet Web page. Students must verify that all information presented is correct and supply a bibliography for their work. Beyond that, the information presented is specific to the type of project.

> *Models.* Models can be constructed from whatever the students feel is most appropriate for the task. Possible materials include, but are not limited to, styrofoam, papier-mâché, wood, pipe cleaners, pipe insulation, clay, or polymer clay (e.g., Fimo). The best models are often interactive rather than static.
>
> *Posters.* Posters should be visually interesting and provide information which incorporates images and the written word.
>
> *Computer simulations.* Simulations should be visual and not based solely on the written word. A student using the simulation should be able to access information in a nonlinear manner.
>
> *Computer Web pages.* Web pages should be visually interesting (not based solely on the written word) and contain links to additional sites or pages as appropriate. Additional links, quizzes, and other information are regarded positively.

After all projects are completed, an informal presentation session is held. This can be set up similar to a poster session, but with all projects available for inspection. At all times, each project must be staffed by at least one member of the group who can provide further explanation or discussion. Access to computer-generated projects is provided via computers set up at the presentation. Both students and faculty can avail themselves of the opportunity to discover new information and new ways of viewing immunological concepts.

In addition to the instructor evaluating the level of understanding and execution of the project, this exercise provides a good opportunity for students to assess their own work. When students hand in their project, they also hand in an assessment form. This form allows them to grade their project using the same rubric as the instructor. The rubric is general enough to allow for variation in project design and specific enough to afford ease in grading. Students can also be given the opportunity to reflect on the learning experience that this exercise provided through use of a survey form which can be handed in with the project.
Immunology Project Assessment Form
Rubric for Grading Immunology Project

Safety Issues. Not applicable.

ASSESSMENT and OUTCOMES

Problems and Caveats.
Students often have problems within their groups. Dysfunctional groups are becoming less common, but significant amounts of time can be spent dealing with them. In an effort to ease the transition to working in a group format, it may be helpful to spend one class period addressing how groups work.

The problem of missed deadlines is handled by having a portion of the final grade tied to successfully meeting each deadline. For any given deadline, students can lose up to 10% of their grade. The absolute value is left to the instructor's discretion and is based on length of time past deadline and any extenuating circumstances.

SUPPLEMENTARY MATERIALS

Sample Applications
Projects have included classical pathway of complement, isotype switching, Th cell activation (a circuit board that lights up when the correct connections are made), "Thymusland" board game, development of thymocytes, "Colorforms" T-cell receptor-antigen binding board, and a large model of Th cell binding to an antigen-presenting cell.
Photos of student projects

Curriculum Resources

List of Immunologically Mediated Diseases

Tumor Immunology

Multiple Myeloma
Acute Lymphoblastic Leukemia
Chronic Lymphocytic Leukemia

Immunodeficiency

Selective IgA deficiency
X-linked agammaglobulinemia
DiGeorge syndrome
Wiskott-Aldrich syndrome
Acquired immunodeficiency syndrome
Chronic granulomatous disease
Type 1 hereditary angioedema

Hypersensitivity

Anaphylactic shock
Allergic Rhinitis
Allergic Asthma
Atopic eczema
Insulin-dependent diabetes mellitus
Hemolytic disease of the newborn
Autoimmune hemolytic anemia
Myasthenia gravis
Drug induced serum sickness
Contact dermatitis
Leprosy
Pulmonary tuberculosis
Crohn’s disease

Transplantation

Bone marrow transplant
Graft rejection

Autoimmunity

Systemic lupus erythematosus
Rheumatoid arthritis
Hashimoto’s thyroiditis
Addison’s disease
Ankylosing spondylitis
Felty’s syndrome

Vaccinations

Curriculum Resources

Immunology Project Assessment Form

Group Members:

What attracted your team to this project? What factors did the team consider when choosing a project?

Once the team chose a project, what sources did the team use for information?

Once the team chose a project, how did the team decide on the presentation of the project (model, computer simulation, poster, etc.)?

Once the team chose a presentation, how did the team decide how to execute the presentation?

How did the team decide what to include/exclude in the project? What was excluded? Why?

Does your project demonstrate the group's mastery of any specific immunological topic(s)? If so, how?

What did the team learn from the project?

What did **you** learn from the project?

Answer the following statement on a scale of 1 to 5 as shown below.
"This project helped me to understand immunological concepts beyond the scope of this project."

1	2	3	4	5
Disagree Strongly	Disagree Generally	No Opinion	Agree Generally	Agree Strongly

How?

Using the "Rubric for Grading Immunology Project" which was handed out earlier in the term, what grade would you give your project?

Justify this evaluation.

Curriculum Resources

Rubric for Grading Immunology Project

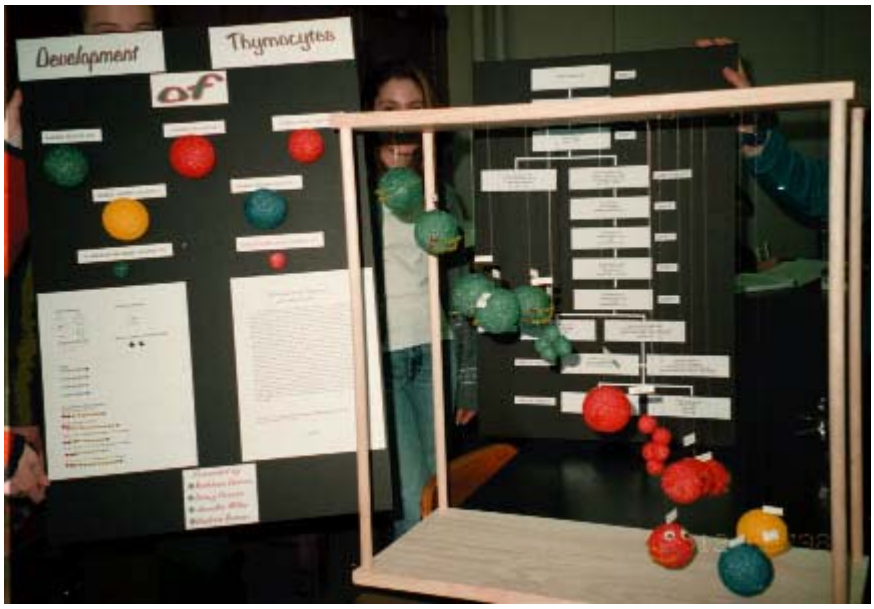
Score	A - Superior	B – Very Good Work	C – Acceptable Work	F – Rush/Sloppy Work
General	-Followed directions. -Surface level distractions (erasures, misspellings/typos, grammatical, mechanical problems) are few if any. -Information is accurate and well organized. -Presenters can clearly explain the information and its relevance; all of the information presented is relevant and accurate.	-Followed directions. -Surface level distractions (erasures, misspellings/typos, grammatical, mechanical problems) occasionally interfere with the presentation. -Information is mostly accurate. -Presenters can clearly explain the information and its relevance, but some of the information presented is not relevant and/or accurate.	-Did not follow directions completely. -Surface level distractions (erasures, misspellings/typos, grammatical, mechanical problems) are many and interfere with the presentation. -Information has many inaccuracies. -Presenters have difficulty explaining the information and its relevance.	-Did not follow directions completely, in fact, missed many directions. -Surface level distractions (erasures, misspellings/typos, grammatical, mechanical problems) suggest that the presenters do not understand the information. -Information has many inaccuracies. -Presenters have difficulty explaining the information and its relevance.
Model	-The model is well designed and skillfully executed. -The model conveys the important concepts in an easily understandable manner. -The model has a key which is clear and which correlates easily with the model. -The key conveys all necessary information not available on the model.	-The model is well designed and reasonably well executed. -The model conveys the concepts. -The model has a key which correlates with the model sometimes. -The key conveys some necessary information not available on the model.	-The model is reasonably designed and its execution is average. -The model conveys some of the concepts and they are not always accurate. -The model has a key which may or may not correlate with the model. -The key conveys some information not available on the model.	-The model is poorly designed and its execution is sloppy. -The model conveys few of the important concepts and they are not always understandable. -The model has a key, but it does not correlate with the model. -The key does not convey information unavailable on the model.
Computer	-The computer program is well designed and skillfully executed. -The computer program uses animation or links to convey the desired information in a manner other than the written word. -The computer program uses links which allow the 'student' to explore the information in a non-linear manner.	-The computer program is well designed and reasonably well executed. -The computer program uses some animation or links to convey the desired information in a manner other than the written word. -The computer program presents information in a linear manner.	-The computer program is reasonably designed and its execution is average. -The computer program uses few examples of animation or links to convey the desired information in a manner other than the written word. -The information is presented in a poorly organized manner.	-The computer program is poorly designed and its execution is poor. -The computer program provides information primarily as the written word. -The information is presented in a poorly organized manner.
Case Study	-The information is thorough and relevant. -The clinical information is clearly correlated with the basic science and pathology behind the disease state. -The poster presentation is clear, visually interesting	-The information is thorough and mostly relevant. -The clinical information is correlated with the basic science and pathology. -The poster presentation is clear, somewhat interesting visually and conveys	-The information is not thorough and may lack important information or include inappropriate information. -The clinical information is not correlated with the basic science and pathology.	-The information is not thorough and lacks important information and includes inappropriate information. -The clinical information is not correlated with the basic science and pathology.

	and conveys appropriate information. -The paper correlates well with the information in the poster.	mostly appropriate information. -The paper correlates with the information in the poster.	-The poster presentation is clear and conveys information. -The paper does not always correlate with the information in the poster.	-The poster presentation is sloppy. -The paper does not correlate with the information in the poster.

Curriculum Resources

Appendix IV. Photos of Student Projects

Th cell binding to an antigen presenting cell, large model



Development of Thymocytes

"Thymusland" board game

Isotype switching

Th cell activation (a circuit board that lights up when the correct connections are made)

"Colorforms" T-cell receptor antigen binding board

Classical pathway of complement