

What's Your Diagnosis? A Rapid Inquiry–Based Game To Differentiate and Review Medically Important Microbes†

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INTRODUCTION

The ability to conduct the process of scientific inquiry, that is, formulating and testing hypotheses and evaluating the data to refine understanding, is considered one of the core competencies across scientific disciplines (1–3). There is ample evidence in the literature showing that games and active learning can simulate real-world problems and engage students, promoting critical thinking and application (4–8). To assist allied health students in learning the process of scientific inquiry we developed a game, “What’s Your Diagnosis?,” that applies their knowledge of medically important microbes to identify a microbe from a group of diverse and related organisms.

Infectious microbes often share numerous characteristics and can be difficult for students to distinguish. Using a “20 Questions” mechanic, “What’s Your Diagnosis?” requires students to construct a line of inquiry that exploits their knowledge of microbial properties, such as structure, preferred environment, mode of transmission, symptoms and signs, risk factors, treatments, and prevention of diseases. During gameplay, teams of four to eight students collaborate to form a hypothesis based on their course-derived knowledge of infectious diseases and then question the opposing team by asking them Yes/No questions. The students’ questions should help them eliminate possible microbes, allowing them to refine their hypothesis based on the information they have gathered from the opposing team. They then decide the avenue of questioning that will help them identify the microbe in the other team’s possession through a process similar to the deductive and inductive reasoning processes used in medical diagnosis (9, 10). “What’s your Diagnosis?” can be set up quickly and easily by the

instructor, and while the presented version was developed for comprehensive review by introductory-level students, it can be tailored to particular course units or skill levels.

PROCEDURE

Materials

The game board we created, including all microbe images, and the accompanying microbe guide are provided in the supplemental materials (Fig. 1; Appendices 2 and 3).

The game materials include: per class—one set of microbe picture cards in an opaque bag; per team of four to eight students—one laminated erasable game board with the microbe pictures in an array, one set of dry erase markers, one recording sheet, and one optional microbe guide that contains descriptions of each microbe included in the game (Appendices 1 to 3). If a microbe guide is not used, students can rely upon their notes or other sources of information. The microbes on the cards and game boards need to be identical. We selected a diverse set of microbes covered in our course syllabus that students generally have difficulty distinguishing from one another.

Game play

Students should be grouped in teams of four to eight, to allow for collaboration. For explanatory purposes, we will describe two teams, “A” and “B.” Each team is given a game board and a recording sheet. The object of the game is for each team to be the first to determine the identity of the opposing team’s microorganism by asking a series of Yes/No questions. To prevent blind guessing, students get only two opportunities to make a definitive guess.

One team member records the questions asked and the answers received. Each team draws a card from the opaque bag containing the microbes. During the first round of play students are given three minutes to research and discuss the microbe drawn, using their notes or the optional microbe guide. The team also must then decide which Yes/No questions they will ask the opposing team to begin identifying their microbe.

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†Supplemental materials available at <http://asmscience.org/jmbe>

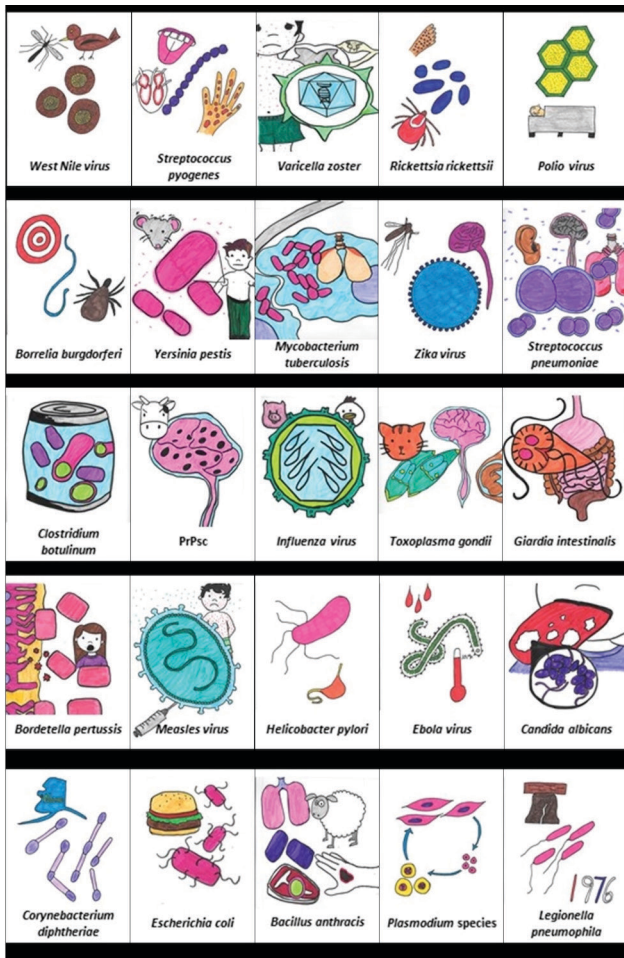


FIGURE 1. Sample game board for, “What’s Your Diagnosis?”

When the 3-minute period of research is complete, Team A will ask one question to team B, record the answer, and based on that answer, eliminate possible microbes by crossing them out on the Team A game board. Team B will then do the same, eliminating microbes from the Team B game board. The round is then complete, and the cycle repeats with shorter subsequent rounds of 2 minutes each.

Questions are determined solely by the student teams. Common questions include, “Is your microbe a bacterium?” or “Is it transmitted through drinking water?” The opposing team members are given one minute to develop an answer to the question posed. If they are having difficulty, students are allowed to ask the instructor for an answer a maximum of two times per game. Rounds of play continue until one team correctly identifies the microorganism originally drawn by the opposing team.

Through repeated play, students develop strategies that move from the general to the specific properties of microbes, allowing them to make an identification. They learn how to refine their hypotheses based only on the information given by the opposing team, rather than wildly guessing or making unsupported assumptions. They

also review nuances that allow different microbes to be distinguished. For example, *Streptococcus pneumoniae* and *Legionella pneumophila* both cause pneumonia. However, the structural properties of the organism and risk factors for the disease are different for each. Teams must identify and exploit these differences to reach their conclusion.

Safety issues

None.

CONCLUSION

The “What’s Your Diagnosis?” game described in this work has been used for several semesters in introductory allied health and general microbiology courses at Kingsborough Community College. Although the effectiveness of the game has not been formally assessed, anecdotally we have observed a high degree of student engagement while playing the game, and students have stated that playing “What’s Your Diagnosis?” helped them bring together the course concepts in a meaningful way. The mechanics of this game employ reasoning processes similar to those medical professionals use when making a differential diagnosis (10). Differential diagnosis requires consideration of signs and symptoms and diagnostic test results to distinguish among etiologies. These etiological agents often produce similar syndromes, or have shared characteristics that students find difficult to discern. As students play the game, they create lines of inquiry that analyze and exploit subtle differences in microbial behavior, structure, or environmental niche, leading to an identification. The game board and card graphics provide the students with detailed information, helping them make connections to improve their inquiries and apply their knowledge. The game may be modified easily to include additional microbes or focus on a specific body system. “What’s Your Diagnosis?” provides a social and collaborative learning intervention in the form of a fast-paced game that inspires critical thinking and problem solving in a fun and engaging manner.

SUPPLEMENTAL MATERIALS

- Appendix 1: Quick rules, tips, and recording sheet
- Appendix 2: Sample game board
- Appendix 3: Sample microbe guide

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