Fun and Games: Creating Enjoyable and Memorable Learning Experiences in a Comfortable Setting

Dylan Freas, Chemistry, G2

Objectives: This document will help you learn about:

- Recognizing the potential advantages / disadvantages of classroom games for both students and instructors
- Effectively incorporating a game into a classroom
- Assessing games and critiquing poorly planned / executed games

An introduction to using games in a classroom or recitation/tutorial session

Active learning is a process in which students engage in activities, such as reading, writing, discussion, or problem solving and promotes analysis, synthesis, and evaluation of class content. *A game can be thought of as a specific type of active learning activity, namely one that is* ***goal-oriented, collaborative, and focused on problem solving.***

Advantages of games

For students
-Engage deeply with course material
-Develop communication/collaboration skills
-Fun
-Activity in which failure is OK

For instructors
-Can result in greater class attendance and participation
-Immediate feedback on students' understanding of material

Disadvantages of games

For students
-Can cause anxiety / discomfort if game requires speaking in front of class
-Game may be too easy for some students and too difficult for others
-May not actually be helpful in learning if not planned/facilitated appropriately
-Games can feel patronizing/condescending

For instructors
-Requires time to plan
-Game may require large portion of class time

Can games actually enhance learning?

There are many scientific studies which suggest that games enhance learning in the classroom. Below are a few examples:

- Evaluating the effectiveness of game-based learning on improvement of student learning outcomes within a sophomore level chemical product design class. (Bodner, C. A. et al. *Int. J. Eng. Ed.*, **2016**, *32*, 448).
- Active learning increases student performance in science, engineering, and mathematics. (Freeman, S. et al. *PNAS* **2013**, *111*, 8410).
- Cooperative learning in organic chemistry increases student assessment of learning gains in key transferable skills. (Canelas, D. A. et al. *Chem. Educ. Res. Pract.* **2017**, *18*, 441).
- Learning through debate during problem-based learning: an active learning strategy. (Mumtaz, S. et al. *Adv. Physiol. Educ.* **2017**, *41*, 390).

Effectively incorporating a game in the classroom

1. **Establishing a comfortable and welcoming learning environment as soon as possible.**

- Establishing a welcoming learning environment in the classroom is crucial for students to feel comfortable enough to engage with their classmates, participate in activities and games, and admit when they do not understand a concept.

- Certain classroom settings can lead to anxiety and discomfort in students, especially when the game or activity is designed in a way that makes their confusion / misunderstanding of the material known to their classmates.
    - For example, see "Student anxiety in introductory biology classrooms: perceptions about active learning and persistence in the major" (England, B. J. et al. *PLoS ONE* **2017**, *12*)

- As an instructor or TA, there are many ways you can create a comfortable learning environment on the first day of class. Some strategies to accomplish this are below:
    - Humor: An occasional joke can ease tension or bring life to a classroom. Even if your joke is not funny, it shows your students that you are making an effort to establish an enjoyable space to learn.
    - Connect with the students: Relating the class to your own personal experiences can bridge the gap between you and your students and make them feel comfortable expressing their thoughts in class.
    - Be transparent: Making your objectives for the class, along with your plan of how to achieve those objectives, clear to your students will foster a sense of honesty and disclosure.

Connecting with your students to establish a comfortable environment

On my first day as an organic chemistry recitation TA, I told my students "I know you may all be a little anxious because organic chemistry is rumored to be one of the most difficult classes in college. I remember feeling nervous too. However, I ended up loving it and I'm looking forward to sharing that enthusiasm with you this quarter."

2. **The process of choosing, planning, and facilitating a game**

- Know your audience: Who will actually be playing the game? Factors to consider about the audience are **size, age, differences in demographics,** and **experience.** The ideal game will depend on the audience.
    - *For example:* "My audience is my recitation section: about 20 students, all of them are college freshmen, with differing levels experience with chemistry in high school. I probably should not have a competition-based

game, especially because Caltech freshmen may be sensitive to having their misunderstanding / confusion known to their classmates."

- Identify the learning goal: Because games are educational experiences, you must ensure that you have a well-defined learning goal in mind.
    - *For example:* "My goals for this game are for students to *compare* different methods of characterizing organic molecules and to *apply* these methods to the characterization of biologically-active molecules.

Useful verbs for stating learning goals:

- **Knowledge**: define, repeat, record, list, recall, name, relate, underline
- **Comprehension**: translate, restate, discuss, describe, recognize, explain, express, identify, locate, report, review, tell
- **Application:** interpret, apply, employ, use, demonstrate, dramatize, practice, illustrate, operate, schedule, shop, sketch
- **Analysis:** distinguish, analyze, differentiate, calculate, experiment, test, compare, contrast, criticize, diagram, inspect, debate, inventory, question, relate, solve, examine, categorize
- **Synthesis:** compose, plan, propose, design, formulate, arrange, assemble, collect, construct, create, set up, organize, manage, prepare
- **Evaluation:** judge, appraise, evaluate, rate, compare, value, revise, score, select, choose, assess, estimate, measure

- Choose a game that is suitable for the audience and learning goal: Sometimes it may be difficult to envision a game that perfectly suits your audience and achieves the learning goal. However, don't be afraid to be creative and think outside of the box when thinking of a game!

Qualities of a good game

-Encourages students to think deeply about material

-Fun and goal-oriented

-Collaborative

-Based on problem solving

-Allows for creativity

Qualities of a bad game

-Focuses on competition and not on learning

-Boring

-Not actually educational

-Too easy or too difficult

Examples of games that can be employed in a classroom

Game	Description	Good for…	Pros	Cons
Trivia	Have students form small groups and have a Powerpoint with a series of questions. Can separate the questions into different categories (short answer, fill in the blank, draw a picture, etc.)	Reviewing a large amount of material prior to an exam	-Can accommodate a very large group -Team building -Easy to measure student understanding of material	-May be too difficult for some students and too easy for others -Does not foster creativity
Clickers	Students use hand-held clickers (or their laptops or phones) to answer questions on a screen projected to the class	Gauging the class's understanding of material during lecture	-Can accommodate a very large group -Easy to measure student understanding of material	-May be too difficult for some students and too easy for others -Does not foster creativity -Can be very boring if poorly executed
Jeopardy	Have students form teams and have a Powerpoint with a Jeopardy-style series of questions	Reviewing a large amount of material prior to an exam	-Can appeal to a large range of students with different levels of understanding ($100 questions are easy, $500 questions are difficult) -Easy to measure student understanding of material	-May appear competitive and/or intimidating -Does not foster creativity -Can be very boring if poorly executed
"The Big Picture"	Beginning with focused topics covered in class, students link these topics to "big picture" topics (society / economy). This can be done by drawing pictures for each item that links the topics	-Ice breaker at the beginning of a class -Fun activity in celebration of the end of a class	-Can be executed in a lecture or lab course -Inspires creativity and group effort / discussions -Not competitive	-May be difficult to apply this game to topics that are not relevant to everyday life
Debate	Have a series of intentionally false statements / claims. Have students debate with the instructor (or form small groups and debate within group)	Reviewing either specific topics or broad topics before an exam or at the end of the quarter	-Allows students to verbalize knowledge -Encourages critical thinking and deep engagement of material -Suitable for students with wide range of understanding	-May be difficult to execute in a large class -Students may feel that they are being put on the spot

For other examples of games and active learning activities: http://www.calstatela.edu/dept/chem/chem2/Active/main.htm

- Facilitate the game in class: Encourage participation from everyone and do not let one student dominate discussion. Fostering a fun and enthusiastic atmosphere can help achieve this. Read the atmosphere (you can ask yourself questions like "Is the game too easy, too hard, too boring, not engaging enough?) and respond appropriately. Also, make sure adequate time has been allotted to the game – never rush it!

CASE STUDIES: Critiquing poorly planned/executed classroom games

Game 1: In a freshman general biology course, Professor A wants to measure her students' ability to recall certain aspects of a cellular pathway. She plans a game in which she splits the class into men vs. women. She then has one student from each team come to the front of the class and asks them each a question. Whoever answers correctly first wins a point for their team.

What is good about this game? Professor A identified a clear learning goal and asked questions relevant to the topic.

What could be improved? Professor A did not carefully consider her audience. College freshmen may be sensitive to being called out in front of their peers. In addition, splitting the class as men vs. women can give rise to conflict. There may be significantly more of one group in the class, and this division may give rise to discomfort for LGBTQ+ and gender non-conforming students.

Game 2: In an organic chemistry course, Professor B devises a game about synthesizing organic molecules. Using Powerpoint, he shares a series chemical syntheses with the class and asks them to rate each synthesis as "good" or "bad."

What is good about this game? Professor B is allowing his students to express an opinion, which may require critical thinking. In addition, this game will likely not make anyone feel uncomfortable.

What could be improved? Professor B did not identify an explicit learning goal. What exactly is he hoping his students will learn from this experience? If Professor B had identified a more effective learning goal, he would be able to choose a game that is more educational. For example, if the learning goal were for students to be able to *design* a chemical synthesis, the game could encourage students to engage more deeply with the material and think creatively.

Game 3: In an advanced physics course, Professor C wants to measure her students' ability to analyze experiments in the published literature. She has her students form small groups and discuss the experimental section of a series of papers. During this time, Professor C puts on headphones and works on her laptop until the class begins to get quiet. Upon regrouping the class and discussing the papers, Professor C calls on the only student who raises their hand.

What is good about this game? Professor C has identified a clear learning goal. Also, the game gives students to develop analytical skills in and verbalize their understanding in a small group setting.

What could be improved? Professor C did not facilitate the game effectively. Instead of engaging with the students during the game, she focused on her own work, and only returned to the game when it had already been over for some time. Upon discussing the papers with the whole class. Professor C let one student dominate the discussion. Instead, Professor C could have reached out to the rest of the class and give them more time to articulate and voice their thoughts.