

# Game Factory

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A simulation exploring the connection  
between games and probability

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# Goodwin's Game Factory

Welcome to ***Game Factory!***

Your students are about to embark on an exciting mathematical journey! In this stimulating simulation, students not only sharpen their mathematical reasoning skills, but also learn how to connect math with real-life experiences.

The Goodwin Game Factory has been taken over by the conniving Cheatum Swindle, and your students are hired to save the factory's reputation. Students make their way through the factory in pairs, checking to see if the games are fair for all players and making suggestions on how to change the rules. Students then use their knowledge of probability to create and present their own "fair" games.

*Game Factory* is formulated for grades 3-7, with separate lesson plans for grades 3-5 and 5-7 to make it easy to adapt the unit for your classroom needs. With an abundance of assessment opportunities and optional take-home activities to strengthen the learning process, this fun and practical unit is one that students will enjoy and remember.



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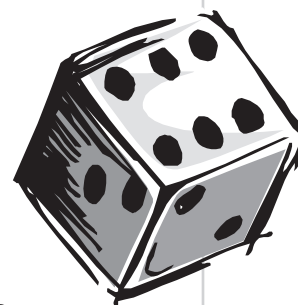
## Purpose and Overview

### What is *Game Factory*?

*Game Factory* is a classroom simulation designed for two separate grade levels: Level 1 (grades 3-5) and Level 2 (grades 5-7). The unit stimulates math skills, encouraging students to use their knowledge of basic addition, subtraction, multiplication, division, and fractions to determine probabilities.

In this simulation, students are assigned to save the reputation of Goodwin's Game Factory. After the death of founder Gary Goodwin, the game factory is inherited by his partner, Cheatum Swindle. But Cheatum secretly hates games, and is only out to make as much money as he can in the shortest amount of time possible. Goodwin's son, Gregory, has figured out that Cheatum doesn't take the time to test the fairness of the games, and Gregory is afraid that the company could go under when the public finds out the chances of winning some of the games are weighted. Student pairs are asked to help Gregory check the games for fairness and modify them when necessary to ensure an equal chance for all players.

Student investigators explore probable outcomes using spinners, dice, coins, cards, and other hands-on objects that generate an element of chance. The selection of the games explored each day is based on chance according to a factory map. There are many different paths the students may follow through the factory. After working through a game using a particular manipulative, game investigators move on to their next factory design room based on the probability they learned about in the game they are currently investigating. The unit culminates with groups testing their learning as they develop their own "fair" game to share with the rest of the class.



### What do students learn?

The nationwide movement for high standards has not only determined what students should learn, but also has mandated that students demonstrate what they know. We use national standards to identify and communicate learning objectives for each Interact unit. The math content and skills taught in *Game Factory* are targets of most state frameworks for probability. The simulation provides the opportunity for performance assessment when students demonstrate their understanding of probability by designing a "fair" game in which all contestants have an equal chance of winning. The record keeping and cooperation required in this unit also address standards collectively described as Applied Learning. In the back of the Teacher Guide, you will find the national standards as determined by McREL, Mid-continent Research for Education Learning; the National Standards for School Mathematics; and the California Applied Learning

Standards that apply to this title. These standards detail what students will learn as well as how they will demonstrate their new knowledge.

In this unit, students gain and experience the following:

### **Knowledge**

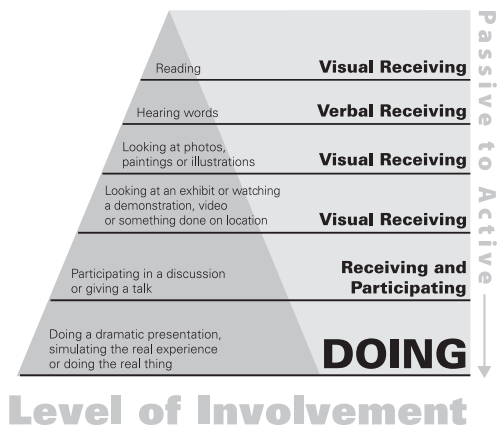
- Develop understanding of probability as it applies to games
- Connect math to real-world applications
- Choose problem-solving strategies
- Understand relationships in graphs

### **Skills**

- Predict outcomes of games
- Solve mathematical problems
- Collect data
- Communicate mathematically
- Tally and graph outcomes
- Organize mathematical information
- Develop number sense

### **Attitudes**

- Develop positive attitude toward math
- Develop sense of working cooperatively with another person toward the common goal of saving the game factory and creating a “fair” game
- Develop appreciation for mathematical connections across curriculum areas
- Accept the consequences of decision making in real-life contexts



Adapted from Edgar Dale's "Cone of Experience"

### **Experiential Learning**

Students learn best through experience. Research shows that student retention and understanding increase as students become more involved and engaged in the learning process, regardless of whether they are high achievers, reluctant learners, or second language learners. This unit puts students in a true-to-life situation and asks them to use their own knowledge and critical thinking skills to make decisions and

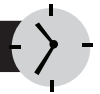
solve problems. By working cooperatively in pairs, students assist each other in the learning process.

### How are students organized?

Students are paired in game investigator groups of two. If there is a group of three, students can rotate roles. Make sure students are paired with someone with whom they can work well, since the pairs will be working together during the entire simulation toward the common goal of saving the factory; they will **not** be competing against one another.

### How much time is required?

Two weeks or 10 class days



*Game Factory* is designed to last two weeks, or 10 class days.

### How is learning assessed?

Assessment opportunities are embedded throughout the simulation. Students write about their games in daily journals and explain decisions. Questions are provided to guide learning discussions and journal entries. Two rubrics are included: one for assessing writing and the student-created games, and one for assessing the final presentation. In addition, a checklist of guidelines for teacher observation of student learning is provided.

**Discussion questions:** Using these to debrief the activity gives insight about the thinking processes of students and shares strategies and reasoning skills with others in the class.

**Observation checklist:** As students are working on the activity each day, select pairs to observe for the characteristics listed on the "Teacher Observation Checklist." As you observe each student, interview the student as to the probability of the particular activity the student is doing. Does the student think the game is fair? Ask why or why not based on what he/she knows about probability.

Keep in mind that you will not be able to observe every student every day. You should have an opportunity to observe every student every three to four days, so all students will be observed a minimum of three times during the simulation. The level of understanding for students you do not observe doing a specific task can be assessed through their journal entries.

### **What do Rubric Scores Mean?**

- 4 Exceeds Expectations**—This rating describes work that exceeds the standard. The descriptor includes words such as “consistently,” “complete,” “with detail,” “actively,” and “willingly.” Students who earn a “4” demonstrate leadership and knowledge during participation in the unit activities. Their performance and/or product are significantly better than what was required or expected.
- 3 Meets Expectations**—This rating describes work that meets the standard with quality. The descriptors lack some of the positive adjectives of a “4,” but this student has mastered the content or skill and can demonstrate his or her understanding in an application setting.
- 2 Nearly There**—This rating describes work that almost meets the standard. Sometimes inconsistent effort or a misconception of the content will result in a “2” rating. This student needs to try a little harder, or needs to revise his or her work in order to meet the standard described.
- 1 Incomplete**—This rating describes work that has not yet met the standard in content and/or skill. This student will require more instruction and another opportunity to demonstrate a knowledge or skill, or will require alternative instruction and assessment.

### **Why use *Game Factory*?**

*Game Factory* offers teachers and students a motivating setting for the study of probability. The tasks are designed to stimulate problem solving and reasoning and require communication skills as students explore to decide if a game is fair. Based on probability models, students learn how to apply their math skills to new situations. Here are some ways this unit will support student learning:

#### ***Differentiation***

This unit, like all Interact simulations, offers differentiated instruction through a broad range of activities and assessment options. Students learn and experience knowledge, skills, and positive attitudes as they interact with important mathematical curriculum.



***Here are some ways to differentiate this unit:***

- Teachers may select from the different levels provided in the unit for each activity.
- The final product – a game – can be designed by one student, by pairs, or as a whole class project.
- Discussion questions may be used for oral or written communication, as can the journal entries.
- Having students work in pairs supports slower learners and encourages faster learners.

***Motivation***

Probability activities are entertaining for students and foster a hands-on approach to teaching the concept of probability. The basis for this study of probability is to see if a game is “fair” for both players. Predictions lay the groundwork for considering outcomes. Games connect teachers, students, and families, and connect math to positive real-life environments. Children will be excited to share their games with their families.

***Flexibility***

- Games of different levels of difficulty are offered and may be interchanged as needed.
- The simulation can be lengthened or shortened to a period of time that fits for classroom scheduling.
- The games can be introduced in any order.

***Ease of use***

- Once the simulation procedures are established, teachers will be able to focus on assessment and monitoring individual students.
- Solution models and discussion questions are provided to assist teachers in debriefing students after the activities.
- Teacher tips discuss simple techniques for managing the use of manipulatives students need for practicing and developing games.
- The Teacher Observation Checklist and the Journal Entry rubric help manage assessment.