

Teacher Preparation for Activity

GLORIOUS GERMINATION – Do Microbes Help or Hinder Germination?



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Teacher Preparations

Game titled "Glorious Germination" helps students to explore how microbes that live within seeds may help seeds to germinate. This is important because seeds today are facing many challenges both in agriculture and in our natural habitats. The beneficial aspects of microbes have largely been unexplored, and they are an untapped resource that has the potential to solve important problems in our world. This learning activity was funded by a USDA NIFA Agriculture and Food Research Initiative - Research and Extension Experiences for Undergraduates Grant (REEU; 2021-69018-34639 to Julie Beckstead and research collaborators) and the Gonzaga Science Research Program (2022-grant from Gonzaga University to JB).

Keywords: Ecology, species interactions, plants, germination, and microbial organisms (such as bacteria, fungi, and pathogens)

What is it? This card game consists of small groups playing three separate games with six rounds within one game. This fun game provides students with the opportunity to discover a world they have never considered before—that of microbes within seeds that help the seed to germinate, and potentially solve important problems related agriculture and our natural areas.

Total Time for Activity: A minimum of 50 minutes is needed.

Time to Play Game: 40 minutes to play 3 games of 6 rounds; once game has been played for the first time, subsequent games take around 10 minutes to play.

Time for Wrap-up and Questions: Teachers can pick and choose which wrap up questions to provide to students. From our experience, a 50-minute class will have time for 1 or 2 short questions. Whereas a 75-minute class will have time for additional questions. Questions can be assigned as a homework assignment to students or as a follow-up activity the next class.

Number of Players per Game: 2-5 players or larger groups with 6-7 players

Type of Game: Card and dice game

Handouts: Student worksheet – one for each student or can provide one for each group.

Card Game Options: There are two sizes of card decks. The small deck is designed for groups of 3-4 but works okay for groups of 5. The large card deck works best for groups of 6-7 players. The cards come in double sided and single sided; single sided is cheaper but not quite as fun. Additionally, the cards can be printed in color, but the game works just fine if you print black and white, especially a grey scale. You can also print on different color of card stock to keep the decks separate. Ziploc bags help with this organization as well.

Game Kits to Assemble (1 per group):

- Deck of cards (cardstock; decide size of deck, color of print, color of cardstock, and single sided or double)
- 1 die per group (Purchase Amazon for \$7.00 for 50 dice; <https://a.co/d/71BwmNa>)
- 1-2 game instructions per group (Optional: printed as booklets)
- Sandwich Ziploc bags (one for each game kit above: cards, die, instructions)

Introducing Concepts to Students: A PowerPoint slideshow is ready for you to present to students along with a YouTube video of how to play the game. Introduction takes 10 minutes.

Wrapping-up Concepts: Students can answer post-game questions to summarize the material. The teacher can discuss some of the questions with the class. Additionally, there is a PowerPoint slideshow that shows information about the program that created this game and provides information about the research projects that inspired the game. A discussion of career opportunities related to this game can follow. See Time for wrap-up above.

Download Documents: www.gonzaga.edu/SeedsforTeachers

1. Game deck
2. Game Instructions
3. Student Worksheet
4. Extra scoresheets
5. PowerPoint slides with Intro and Wrap-up
6. This Teacher Preparation Sheet

Game Card Printing Tips: Thick cardstock recommending. If printing on color cardstock, then we found light colors in pink, grey, blue, yellow, peach, and cream worked well. If printing double sided, then make sure that everything lines up and print on 8.5 x 11 with landscape right/left binding. Laminating cards will make them last longer but is optional.

Game Instructions Printing Tips: To print as booklets, open pdf in Adobe Acrobat. Under Page Sizing Y Handling – select Booklet on right of screen. Default setting usually work well: subset – both sizes; Sheet from – is the number of resulting sheets; Binding – left works for booklets. Under Orientation, select Portrait and check auto-rotate pages within each sheet. Then select Print.

Printing costs as of 2023: Costs of \$2.00 for small deck printed in color on white cardstock by a printing service. Costs of \$3.00 for large deck printed in color on white cardstock by a printing service.

Link to Seed For The Future REEU Program:
www.gonzaga.edu/SeedsForTheFuture



YouTube Video – How to Play (5 minutes):



<https://www.youtube.com/watch?v=gUXCDYw8F4E>

Photo Credits for Game Cards: Pictures for each card were photographed by people not involved with the creation of this card game. The photographers were not affiliated with the creation of this game. Each picture was cropped to fit the card size. Photos were public domain or with an Attribution 2.0 Generic License, allowing for copy, cropping, and redistribution of material with reference to the source website. All website links are provided below.

Western Yarrow: <https://www.geograph.org.uk/photo/4663830>

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Blue Flax Flower: <https://www.flickr.com/photos/swallowtailgardenseeds/34432508282>

Wild Mint: https://www.flickr.com/photos/plant_diversity/7938046454/

Glacier Lily: <https://www.flickr.com/photos/fsnorthernregion/14511510064>

Wildrye: <https://www.flickr.com/photos/127605180@N04/16160624471>

June Grass: https://www.flickr.com/photos/plant_diversity/29051865037

Squirreltail: <https://www.flickr.com/photos/usfwsmtnpairie/27600543896>

Idaho Fescue: https://www.flickr.com/photos/plant_diversity/48184780222

Arctic Bluegrass: <https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PMPOA4Z080>

Bald-Hip Rose: <https://www.flickr.com/photos/northcascadesnationalpark/7816372628>

Western Peony: <https://www.flickr.com/photos/127605180@N04/16850427152>

Ocean Spray: <https://picryl.com/media/bush-ocean-spray-or-rock-spirea-holodiscus-microphyllus-var-glabrescens-78588b>

Golden Currant: <https://pixabay.com/photos/currant-fruits-white-currants-550>

Huckleberry:

<http://biology.burke.washington.edu/herbarium/imagecollection/photo.php?Photo=wtu060043&Taxon=Vaccinium%20membranaceum&SourcePage=taxon>

Garry Oak: https://commons.wikimedia.org/wiki/File:Garry_Oak_Meadow_%2850060196206%29.jpg

River Birch: <https://www.flickr.com/photos/tonyfrates/6496196269>

Quaking Aspen: <https://www.flickr.com/photos/zionnps/5205494244/in/photostream/>

Fireberry Hawthorn: <https://fieldguide.mt.gov/speciesDetail.aspx?elcode=PDROS0H840>

Mountain Alder:

https://commons.wikimedia.org/wiki/File:Alnus_alnobetula_subsp_alnobetula_2_RF.jpg

Bull Pine: https://www.flickr.com/photos/plant_diversity/50040811833

Western Juniper: <https://pixahive.com/photo/western-juniper-on-hilltop/>

Canoe Cedar: <https://www.flickr.com/photos/jmaughn/16522080922>

Western Yew: <https://pixabay.com/photos/yew-berry-red-nature-evergreen-4581580/>

Engelmann Spruce: https://commons.wikimedia.org/wiki/File:2013-07-14_11_02_29_Engelmann_Spruce_trees_near_tree_line_along_the_Wheeler_Peak_Summit_Trail.jpg

Game Acknowledgements for Glorious Germination

Game Designers: Dylan Eisenbrandt and Julie Beckstead

Game Development Assistance: Erik Hallstrand, Alexandrite Greenhouse, Mackenzie Rowley, Margarita Washington, and Abbey Shuster

Video Assistance: Abbey Shuster, Libby Shuster, and Sara Wifall

Photos for Game Materials but not Photos on Game Cards: Zack Berlat, Anna Muhich, and Julie Beckstead

Location of Research Program: Program is called *Seeds For The Future*. Students participated in the program at Gonzaga University (Spokane WA) and University of Idaho (Moscow ID). The development of this game occurred at Gonzaga University.

Funding: USDA NIFA Agriculture and Food Research Initiative - Research and Extension Experiences for Undergraduates (REEU; 2021-69018-34639 to George Mary Ridout, Julie Beckstead and George Newcombe) and the Gonzaga Science Research Program (2022-grant from Gonzaga University to JB).

Game Testers: Several classes of biology students and non-science major students taking a biology class contributed to the development of this game and their feedback is appreciated!