Network Science: Activity Guide Introduction

NETWORK SCIENCE ACTIVITY GUIDE

Introduction

Welcome to the *Worlds of Connections* network science activity guides. We are happy to share our fun, engaging, and hands-on activities and hope you enjoy them. College students, teachers, middle school youth in afterschool programs, learning researchers, artists/designers, psychologists, and sociologists helped create these guides over several years. We suggest that you use them to build community in clubs, classrooms, and camps; develop systems thinking and network science knowledge; plus promote curiosity and opportunities to discover.

Each guide has all the information you need to lead a 20–50-minute activity with groups from 5 to 35+ people. You will find learning goals, materials lists, guiding questions, brief overviews of the key science concepts, and links to more in-depth explanations if you want to learn more. While leading the activities, you can choose to emphasize fun, play, community-building, career exploration and/or learning.

What are systems?

Benson and Jost (2019:7) define a system as "a group of interacting, interrelated, and interdependent components that form a complex and unified whole." Systems are relevant to all areas of science and society—they are everywhere. The *Worlds of Connections* network science activities build on many of the useful resources from the Waters Center on Systems Thinking, including the idea from Benson and Jost (2019:7) that "most systems thinkers focus their attention on living systems, especially human social systems. However, many systems thinkers are also interested in how human social systems affect the larger ecological systems in our planet."

What is network science? Why does it matter?

Systems become complex quickly, and network science emerged in part to measure, model, and understand interrelated parts of systems. Network science is a recent and still evolving approach to answering questions in many fields that study systems (e.g., social science, economics, biology, mathematics, and computer science; Kaufman 2018). Network science is the study of connections that are often complex and hard to see. It combines graph theory from mathematics and software tools from computer science with applications in multiple disciplines. Network science has also emerged as a particularly powerful tool for health-related research on topics such as disease spread, neuroscience, and addiction.

To help those new to systems and network science, we provide a **one-page quick reference guide to the core concepts**. We hope that readers can readily imagine how studying relationships is useful for all fields of science. Teachers may be curious how network science fits with Next Generation Science Standards*; we see it as relevant to the crosscutting concept on systems and system models.

*Next Generation Science Standards is a registered trademark of WestEd. Neither WestEd nor the lead states and partners that developed the Next Generation Science Standards were involved in the production of this product, and do not endorse it.

Why activity guides?

Science is usually social and active. Many scientists find their work engrossing, collaborative, and exciting. We provide low-cost-to-implement informal activities so that youth can experience similar active and social dimensions of science and discovery. The guides also use insights from the National Academies of Science "How People Learn" report and seek to maximize the criteria for best practices with science activities created by the PEAR Institute Dimensions of Success.

References

Benson, T., and T. Jost. (2019). Introduction to systems thinking for early childhood. Waters Center for Systems Thinking CEELO Leadership Academy, Washington D.C., July 3—Aug 1, 2019. http://ceelo.org/wp-content/uploads/2019/08/CEELO_2019Cohort5Workbook.pdf

Kaufman. P. (2018). Small worlds, degrees of separation, and social network analysis. Everyday Sociology Blog. https://www.everydaysociologyblog.com/2018/05/small-worlds-degrees-of-separation-and-social-network-analysis.html

National Research Council. (2000). *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. Washington, DC: National Academies Press.

NGSS Lead States. (2013). APPENDIX G: Crosscutting concepts in the Next Generation Science Standards. In *Next Generation Science Standards: For States, By States.* Washington, DC: National Academies Press.

PEAR: Partnerships in Education and Resilience. Dimensions of Success. Partnerships in Education and Resilience (PEAR), https://www.pearinc.org/dimensions-of-success. Accessed 24 October 2023.

Funding

The development of this activity was supported in part by the *Worlds of Connections* Science Education Partnership Award [R25GM129836 (2018–2023)] at the University of Nebraska–Lincoln, funded by the National Institute of General Medical Sciences of the National Institutes of Health. This content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health or the University of Nebraska.

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD SUPPORTED BY THE NATIONAL INSTITUTES OF HEALTH

WORLDS OF CONNECTIONS

UNIVERSITY OF Nebraska Lincoln