

Exploring the Topology of the Common Core with Media

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Problem

Students Have Conceptual Gaps in Math Understanding

The Math Snacks project was developed based on extensive research on topics in the mathematics curriculum that presented learning challenges for students and teachers. The research team studied 24,000 student standardized tests, 600 teacher standardized mathematics knowledge for teaching tests and observed over 500 hours of mathematics classes in order to compile a set of mathematics conceptual learning goals for sixth and seventh grade students.

Based on these areas of greatest learning needs, the Math Snacks team has developed animations, games and support materials that provide students and teachers with an alternative way to engage in conceptual mathematics. Using media allowed us to provide meaningful real life representations and entertaining concept images that have helped students learn conceptual mathematics.

Math Snacks Website (www.mathsnacks.org)



Animations

These animations address ratios, number lines, fractions, and more.



Atlantean Dodgeball



Bad Date



Number Rights



Overruled!



Scale Ella

Games

This game addresses fractions, decimals, and negative numbers on the number line.



Pearl Diver is available for play on iPhone, iPad, and as a Flash applet on computer.

MATH SNACKS

www.mathsnacks.org
Addressing Gaps in Conceptual Mathematics
Understanding with Innovative Media



Ratey the Math Cat

The latest Math Snack at NMSU, helps students understand ratios and proportions to represent quantitative relationships.

Development

Engaging Games and Animations

Developers at NMSU's Learning Games Lab are working with researchers and mathematicians to create innovative, engaging media that address the established gaps in mathematical understanding. Building on animations and designing conceptual games, the team is creating new tools for learning enhanced by the Web and mobile devices. The iterative instructional design process integrates research, best practices in educational game development, and extensive user testing with students and teachers in labs and classrooms.

- Targets math learners grades 6-8 for classroom and informal use



- All Math Snacks are aligned with the Common Core State Standards in Mathematics
- Recent pilot testing shows positive gains for students in learning math concepts
- Mathsnacks.org provides access to free Math Snacks Products and Support Materials

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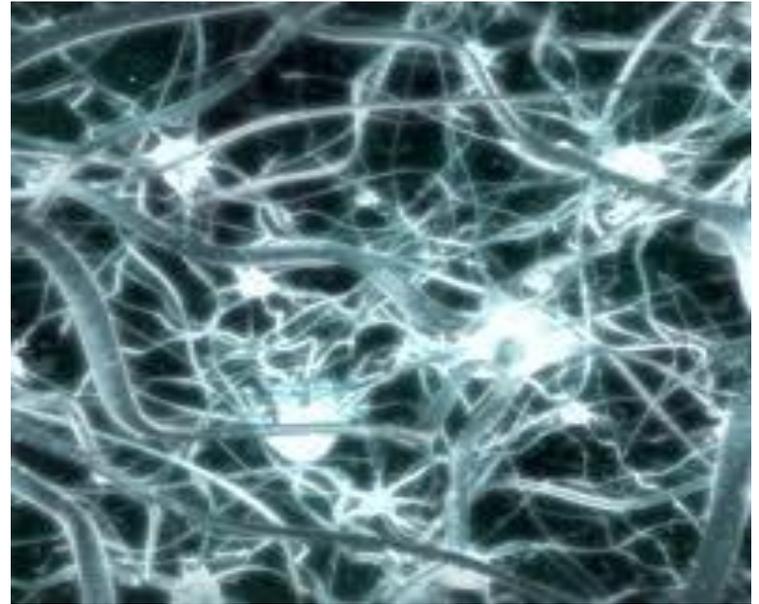
www.LearningGamesLab.org



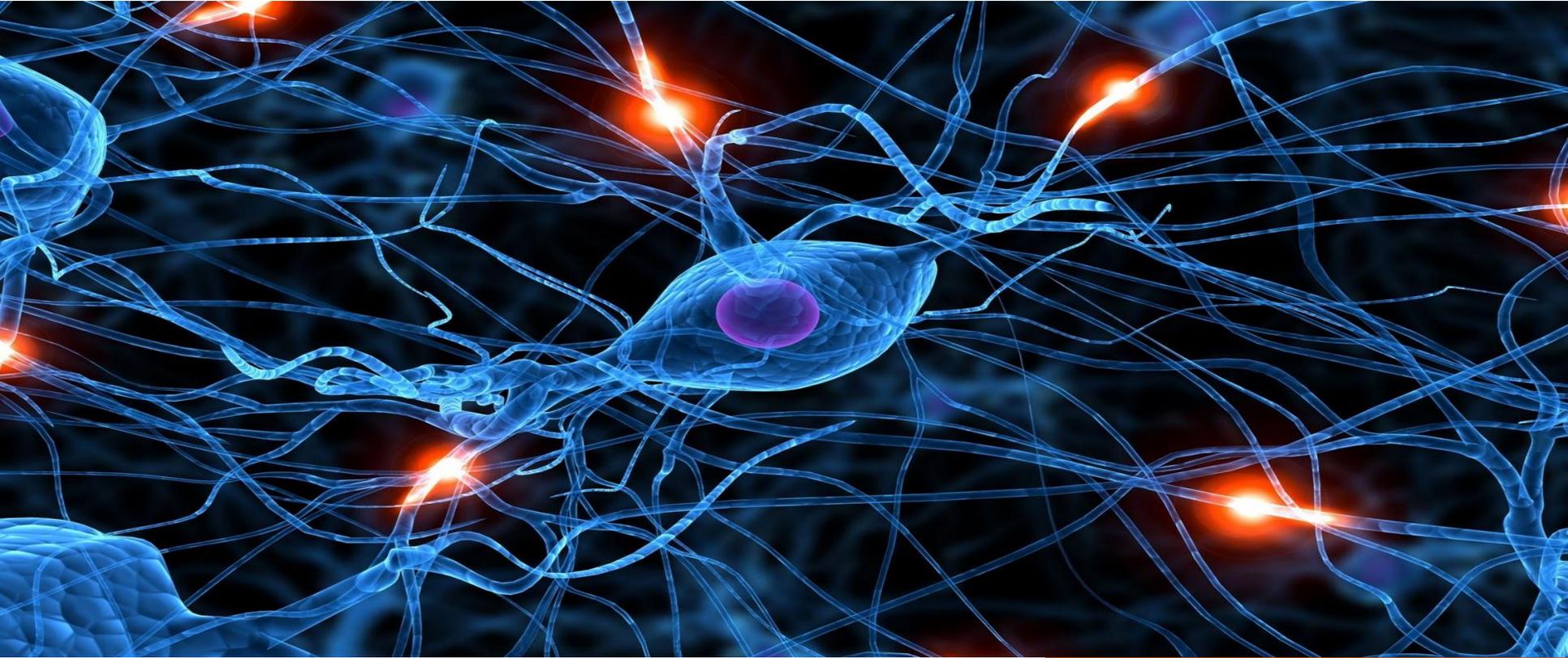
Math Snacks and Learning

Facilitating Brain Connections for Learning and Retention

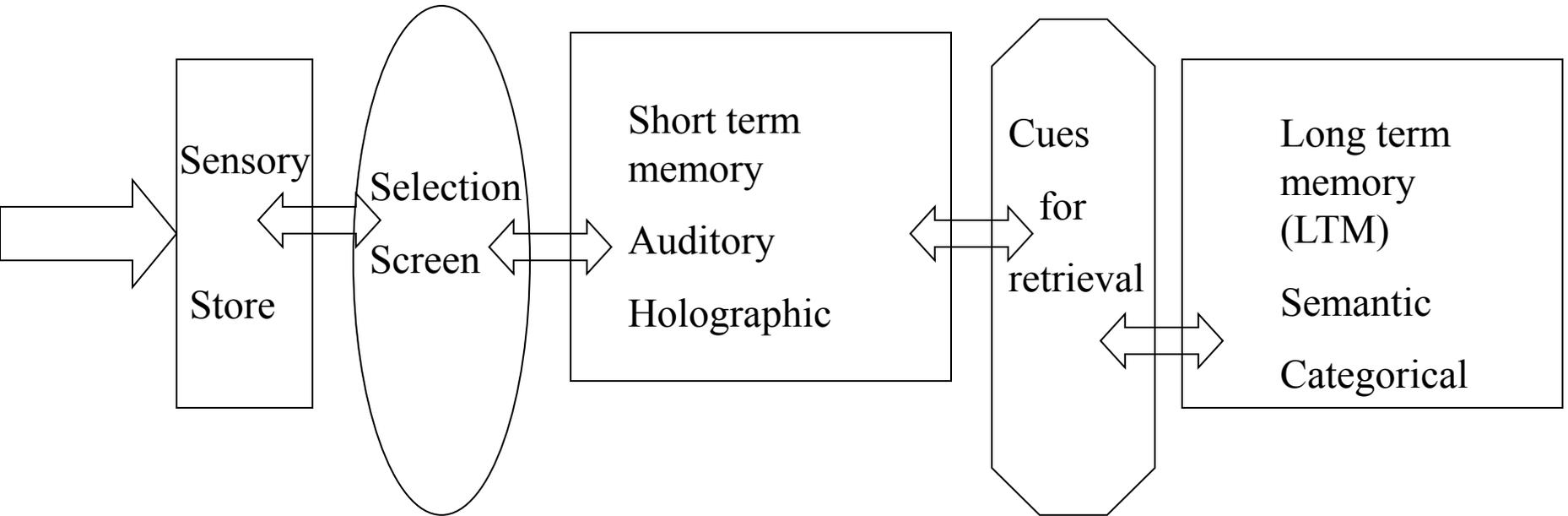
Babies are born with tons of undifferentiated neurons. As they interact with the environment, clusters of neurons are created.



What Piaget theorized we can now see on a physical level



Cognitive Learning Theory



1. Sense
2. See
3. Name
4. Understand.....
5. Elaborate, Manipulate, analyze, evaluate, compare, contrast

Gagne's Instructional Theory

Instructional Events

1. Gain Attention
2. Share goals/expectations
3. Stimulate recall
4. Present all modalities
5. Provide meaningful frameworks
6. Monitor/Adjust
7. Apply
8. Closure

Internal Events

1. Attend
2. Expectancy
3. Recall
4. Perception
5. Encoding/decoding
6. Oh, I see. Ah ha.
7. Schema building
8. Retention

Wiburg's Modifications to Theory

Instructional Events

1. Gain Attention
2. Share goals/expectations
3. Stimulate recall
4. Present all modalities
5. Provide meaningful frameworks
6. Monitor/Adjust
7. Apply
8. Closure

Affective/Cognitive

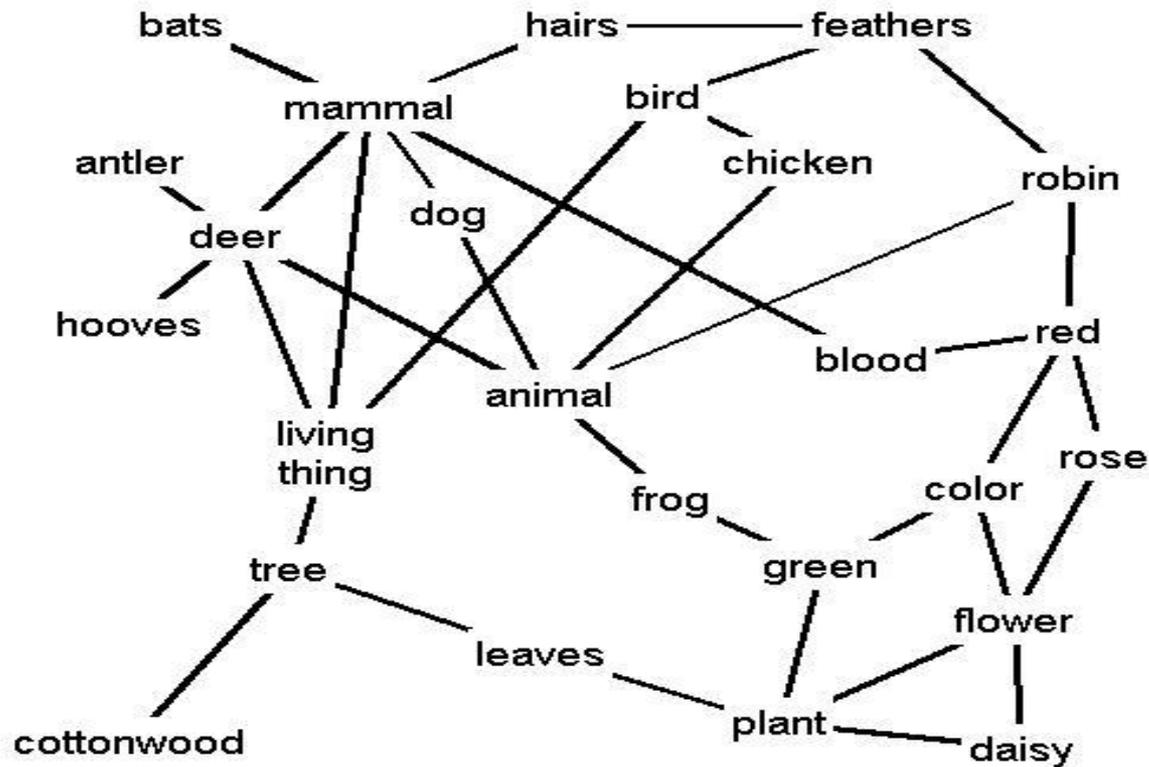
- Able to attend
- Emotionally ready
- Practice
- Open channels
- Schemas/concept maps
- Feeling of
- Confidence
- Competent

Internal Events

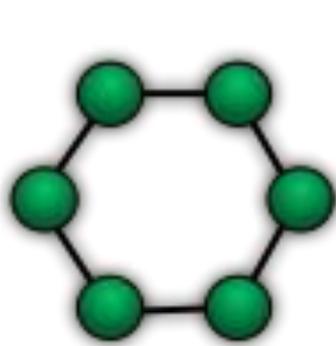
- Attend
- Expectancy
- Recall
- Perception
- Encoding
- Oh, I see.
- Schema building
- Retention

Original theory ignored readiness to learn, emotional learning, individual experience, and cultural relevance

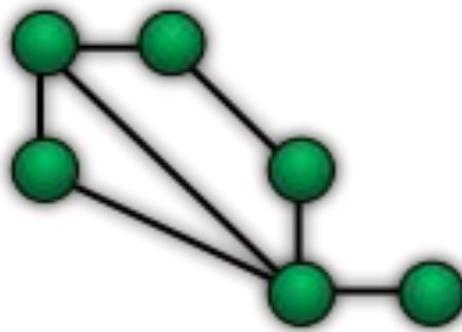
An Undirected Pathfinder Network



Network Topologies



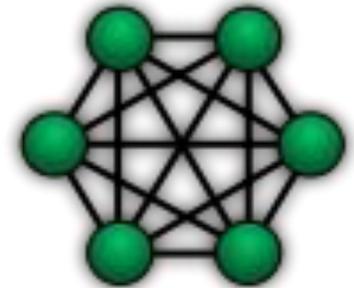
Ring



Mesh



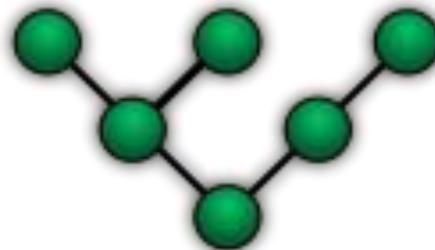
Star



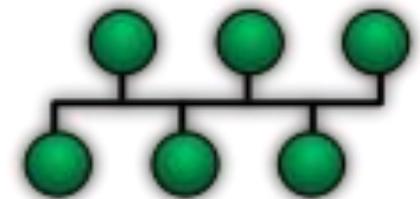
Fully Connected



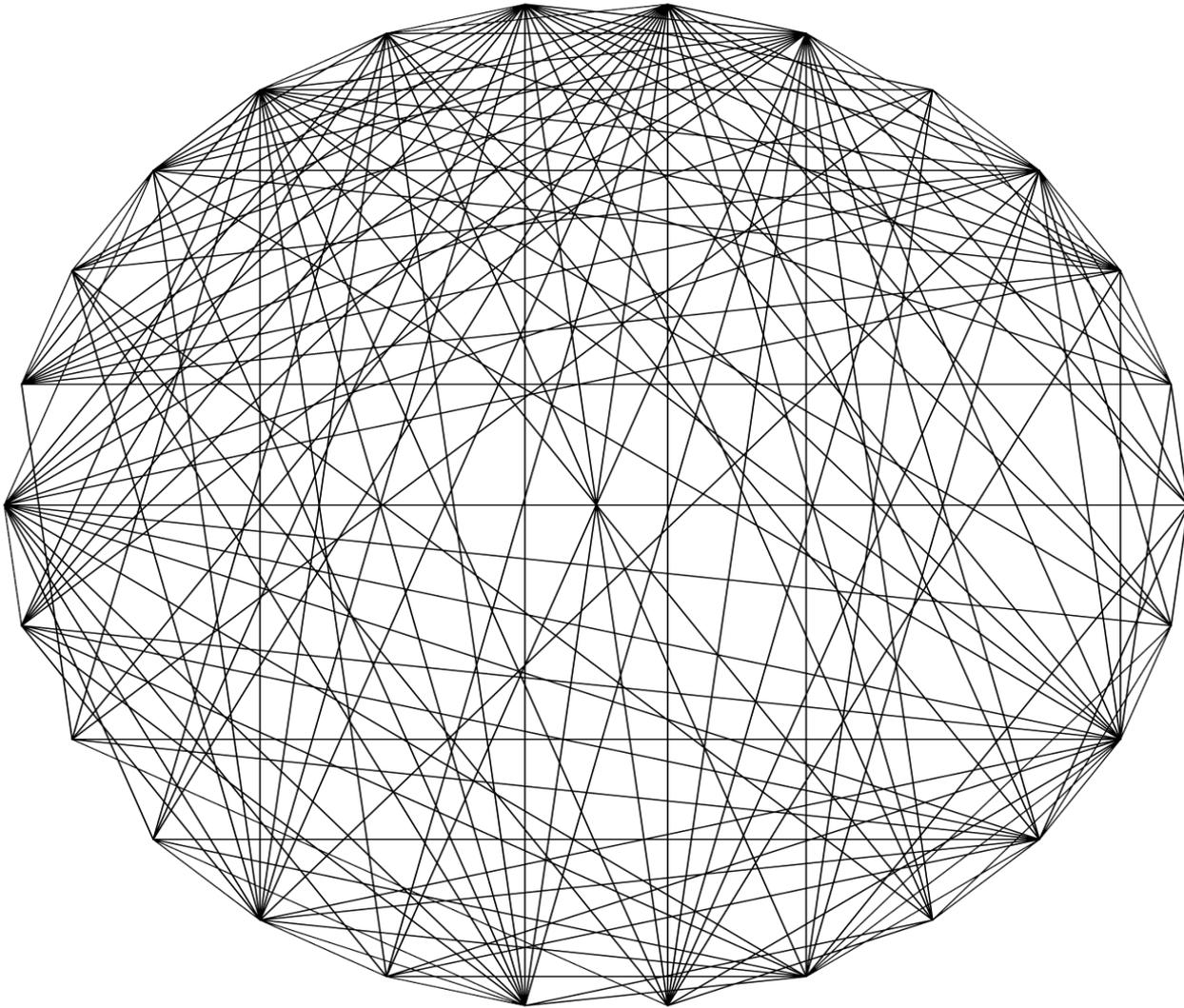
Line

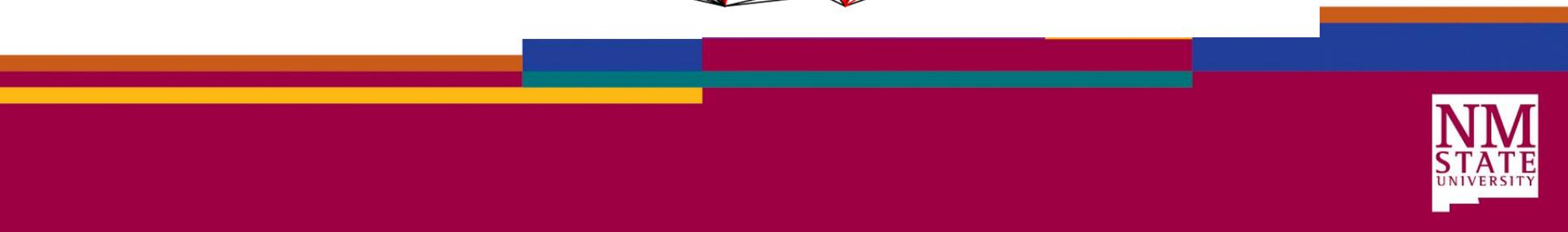
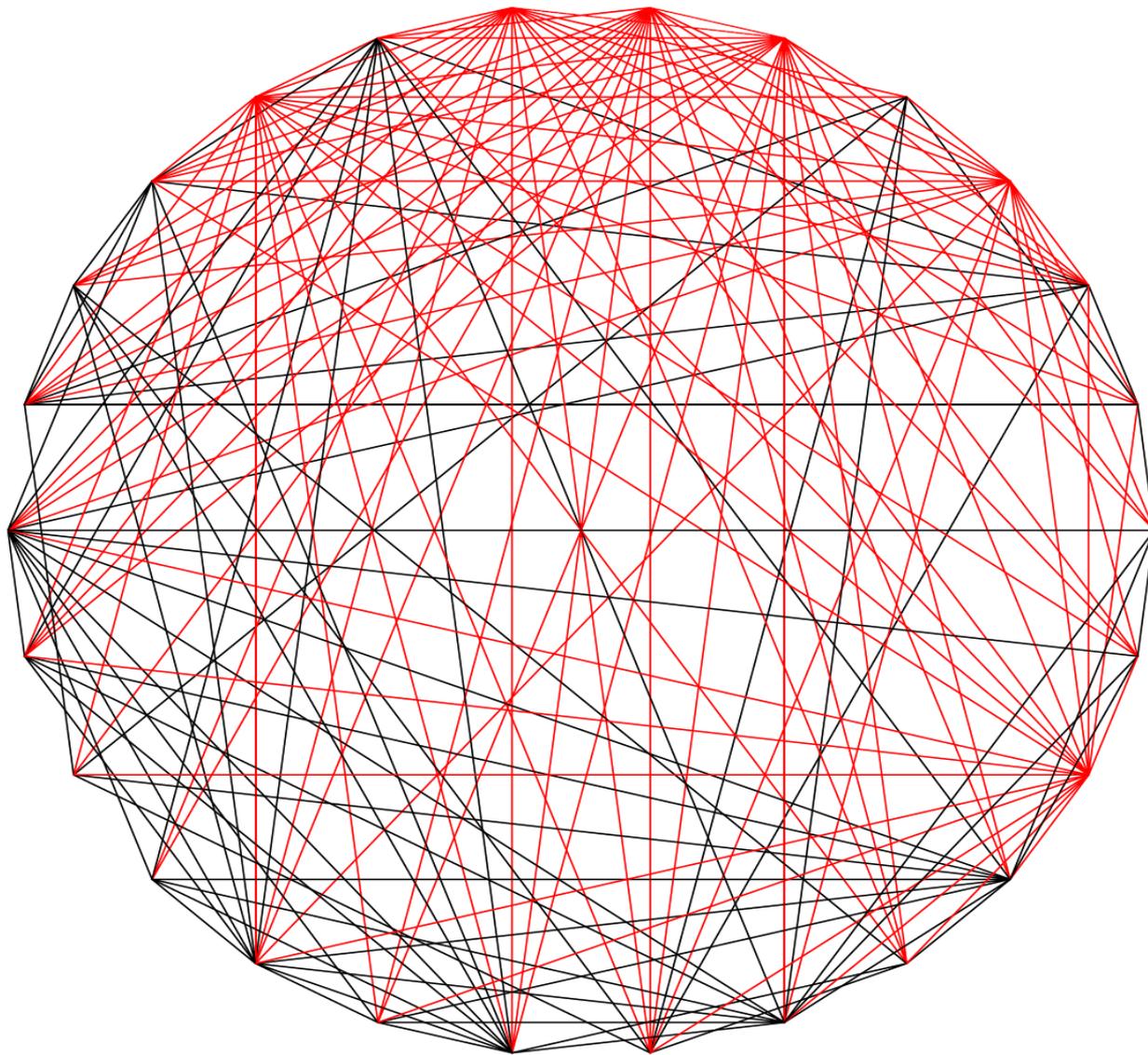


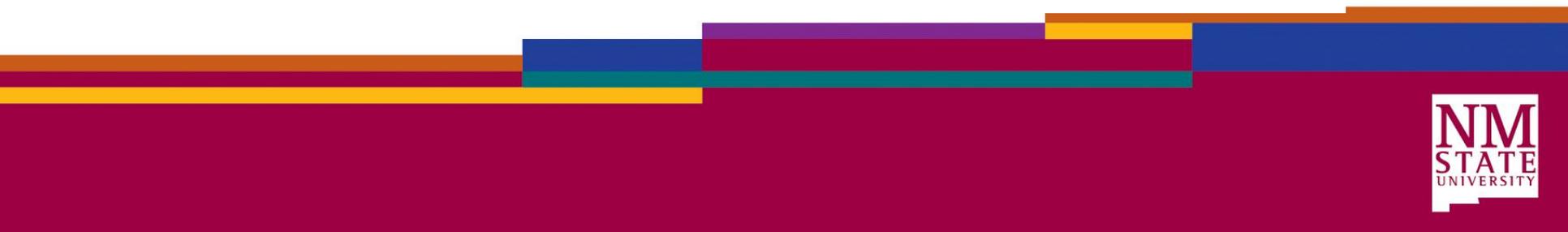
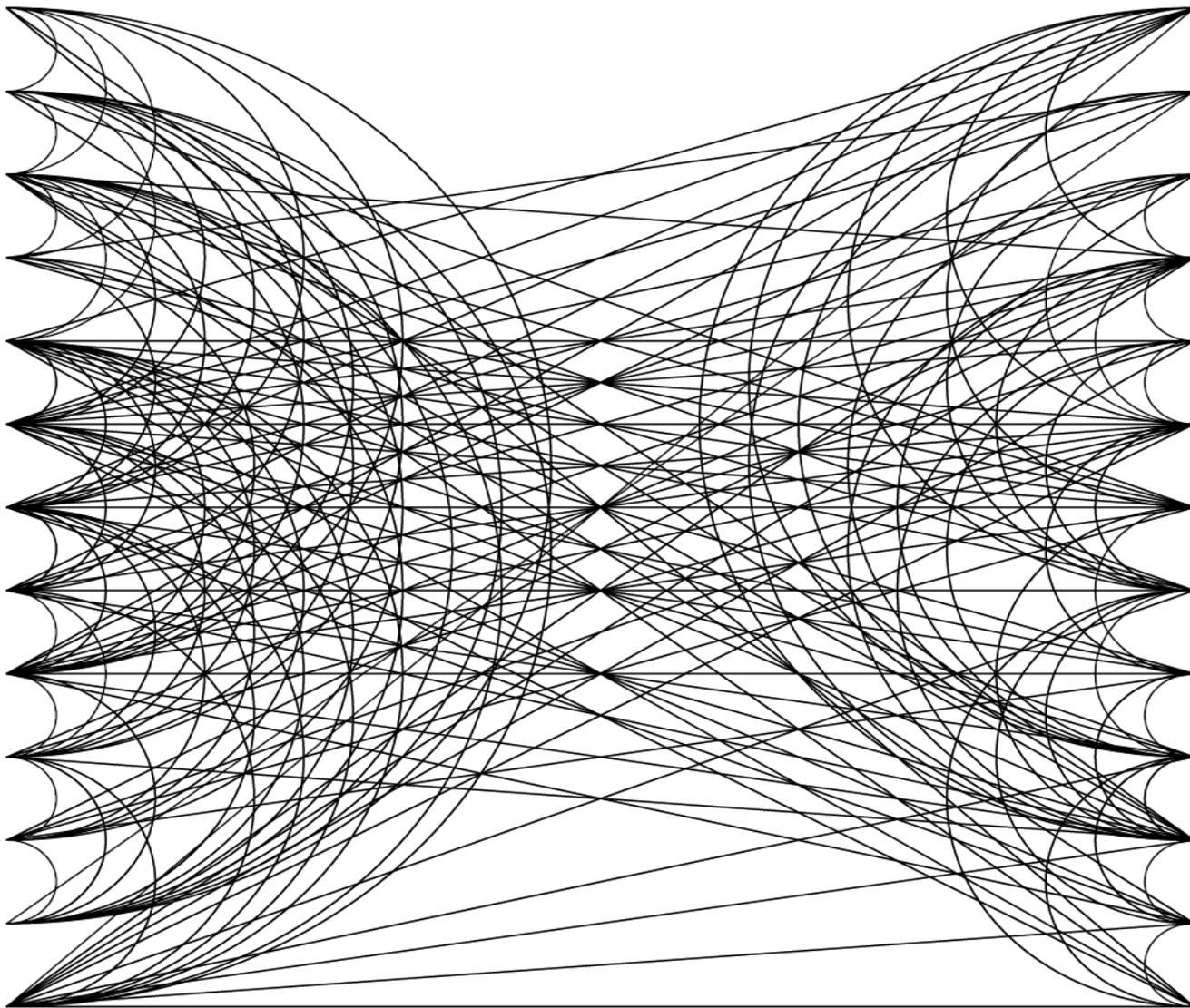
Tree



Bus







Ratio and Proportion

- 13 Topics from 6.RP and 7.RP
- 13 Topics from 6.NS, 7.NS, 6.EE, 7.EE, 7.G, and 7.SP

What does the structure of the graph tell us?

- Overall connectivity
- Some vertices have more edges than others
- No two vertices are more than two steps apart
- Can look for complete subgraphs

Six Highly Connected Vertices

- (#3) 6.RP.3 Use ratio and rate reasoning to solve real-world and mathematical problems.
- (#5) 6.RP.3.b Solve unit rate problems.
- (#6) 6.RP.3.c Percent of a quantity as a rate per 100.
- (#7) 6.RP.4.d Use ratio reasoning to convert measurement units.
- (#9) 7.RP.2.a Decide whether two quantities are in a proportional relationship
- (#24) 7.G.1 Solve problems involving scale drawings of geometric figures.

Some Connections with #5, Unit Rates

- (#7) 6.RP.4.d Use ratio reasoning to convert measurement units. *12 inches per foot, 1.609344 km per mile*
- (#11) 7.RP.2.c Represent proportional relationships by equations. *How much will x gallons of gas cost at \$3.89 per gallon?*
- (#14) 6.NS.1 Interpret and compute quotients of fractions. *4 $\frac{1}{2}$ miles in $\frac{2}{3}$ hours, how many miles per hour?*
- (#26) 7.SP.6 Approximate the probability of a chance event by collecting data. *33 thousand traffic fatalities in one year out of 300 million people, what is the probability of one person being killed in a given year?*

Some Issues

- Vertices aren't always well-defined. Some standards have more than one part. Should cluster headings be their own vertices?
- Edges are even less well-defined. Is there a reliable and objective way to decide where the edges (connections) are?
- The process of looking for and identifying the connections may be more important than the final graph. For example, it could be part of a PD activity for teachers.

Ratey the Math Cat

- <http://www.mathsnacks.com/ratey.html>

Questions

- How does this presentation connect with your work?
- What kinds of connections would you like your students to make?