

# Science Outcomes Achieved by Students Participating in Spaghetti Bridge Building

The activity of spaghetti bridge building is very rich in opportunities to achieve the skills for each grade level. This is a sample of some of the outcomes that can be reached in this activity.

## Kindergarten – Skills (Cluster 0)

*K-0-4B:* Construct an object to solve a problem or meet a need.

*GLO: C3*

*K-0-4C:* Identify, with guidance, improvements to an object with respect to pre-determined criteria.

*GLO: C3*

## Grade 1 – Skills (Cluster 0)

*1-0-4A:* Follow simple directions while undertaking explorations.

*GLO: C2*

## Grade 2 – Skills (Cluster 0)

*2-0-3D:* Identify tools and materials to be used, and explain their choices.

*GLO: C2, C3, C4*

*2-0-5B:* Use, with guidance, tools to observe, measure, and construct.

Examples: ruler, meter stick, pan balance, magnifying glass, bathroom scale, thermometer.

*GLO: C2, C3, C5*

## Grade 3 – Materials and Structures (Cluster 2)

*3-2-01:* Use appropriate vocabulary related to their investigations of materials and structures.

Include: strength, balance, stability, structure, frame structure, natural structure, human-built structure, force.

*GLO: C6, D3*

*3-2-02:* Conduct experiments to compare the strength of common materials.

Examples: wooden toothpicks, plastic straws, paper, cardboard, polystyrene foam...

*GLO: A1, A2, C2, D3*

*3-2-03:* Explore to determine ways to strengthen a material used for building.

Include: changing shape, bulk, and number of layers.

*GLO: B1, C2, D3*

*3-0-1B:* Make predictions based on observed patterns, collected data, or data provided from other sources.

*GLO: A1, C2*

*3-0-3A:* Brainstorm, with the class, one or more methods of finding the answer to a given question and reach consensus on which method to implement.

*GLO: C2, C7*

*3-0-3B:* Identify, with the class, variables that have an impact on an investigation.

*GLO: A1, A2, C2, C7*

*3-0-3C:* Create, with the class, a plan to answer a given question.

*GLO: C2, C7*

*3-0-4A:* Carry out a plan, and describe the steps followed.

*GLO: C2*

3-0-5A: Make observations that are relevant to a specific question.

*GLO: A1, A2, C2*

3-0-6C: Place materials and objects in a sequence or in groups using two or more attributes, and describe the system used.

*GLO: C2, C3, C5*

3-0-7A: Draw a simple conclusion based on their observations.

*GLO: A1, A2, C2*

## **Grade 4 – Skills (Cluster 0)**

4-0-3D: Brainstorm possible solutions to a practical problem, and identify and justify which solution to implement.

*GLO: C3*

4-0-3E: Create a written plan to solve a problem or meet a need.

Include: identify steps to follow, prepare a labelled diagram.

*GLO: C3*

4-0-3F: Develop criteria to evaluate an object, device, or system based on its function, aesthetics, and other considerations such as materials, and cost.

*GLO: C3*

4-0-5B: Estimate and measure mass/weight, length, volume, area, and temperature using standard units.

*GLO: C2, C3, C5*

## **Grade 5 – Skills (Cluster 0)**

5-0-4C: Work cooperatively with group members to carry out a plan, and troubleshoot problems as they arise.

*GLO: C7*

5-0-5A: Make observations that are relevant to a specific question.

*GLO: A1, A2, C2*

5-0-5B: Test a prototype or consumer product with respect to pre-determined criteria.

*GLO: C3, C5*

5-0-5C: Select and use tools and instruments to observe, measure, and construct.

Include: balance, thermometer, spring scale, weather instruments

*GLO: C2, C3, C5*

5-0-5D: Estimate and measure length using standard units.

*GLO: C2, C3, C5 (Math SS-I.1.2)*

5-0-5E: Estimate and measure mass/weight, length, volume, and temperature using SI and other standard units.

*GLO: C2, C5 (Math: SS-I.1.5, SS-III.1.5, SS-IV.1.5, SS-VIII.4.3)*

5-0-5F: Record and organize observations in a variety of ways.

Examples: point-form notes, sentences, labelled diagrams, charts, ordered lists of data, frequency diagrams, spreadsheets

*GLO: C2, C6 (ELA Grade 5, 3.3.1; Math: SP-III.2.5)*

5-0-7G: Communicate methods, results, conclusions, and new knowledge in a variety of ways.

Examples: oral, written, multi-media presentations

*GLO: C6 (ELA Grade 5, 4.4.1; TFS: 3.2.2, 3.2.3)*

5-0-7H: Identify, with guidance, connections between the investigation results and everyday life.

*GLO: C4*

5-0-9B: Show interest in the activities of individuals working in scientific and technological fields.  
GLO: B4

## **Grade 6 – Skills (Cluster 0)**

- 6-0-1B: Identify various methods for finding the answer to a specific question and select one to implement.  
Examples: generating experimental data, accessing information from a variety of sources  
GLO: C2 (ELA Grade 6, 3.2.2; Math: SP-I.2.6, SP-II.1.6)
- 6-0-1D: Identify various methods to solve a practical problem and select and justify one to implement.  
Examples: constructing and testing a prototype, evaluating consumer products, accessing information from a variety of sources  
GLO: C3 (Math: SP-I.2.6, SP-II.1.6)
- 6-0-2A: Access information using a variety of sources.  
Examples: libraries, magazines, community resource people, outdoor experiences, videos, CD-ROMS, Internet  
GLO: C6 (ELA Grade 6, 3.2.2; Math: SP-II.1.6; TFS 2.2.1)
- 6-0-2C: Make notes on a topic, combining information from more than one source and reference sources appropriately.  
GLO: C6 (ELA Grade 6, 3.3.2)
- 6-0-3D: Develop criteria to evaluate a prototype or consumer product.  
Include: function, aesthetics, efficient use of materials, cost, reliability  
GLO: C3
- 6-0-3E: Create a written plan to solve a problem.  
Include: materials, safety considerations, labelled diagrams of top and side views, steps to follow  
GLO: C1, C3, C6
- 6-0-7D: Propose and justify a solution to the initial problem.  
GLO: C3
- 6-0-7H: Identify connections between the investigation results and everyday life.  
GLO: C4

## **Grade 7 – Forces and Structures (Cluster 3)**

- 7-3-01: Use appropriate vocabulary related to their investigations of forces and structures.  
Include: frame, shell, solid, centre of gravity, stability, compression, tension, shear, torsion, internal and external forces, stress, structural fatigue, structural failure, load, magnitude, point and plane of application, efficiency.  
GLO: C6, D4
- 7-3-04: Identify internal forces acting on a structure, and describe them using diagrams  
Examples: compression, tension, shear, torsion  
GLO: D4, E4
- 7-3-08: Describe, using diagrams, how common structural shapes and components can increase the strength and stability of a structure.  
Examples: a triangle distributes the downward force of a load evenly between its two vertices  
GLO: C6, D3, D4
- 7-3-09: Describe and demonstrate methods to increase the strength of materials  
Examples: corrugation of surfaces, lamination of adjacent members, alteration of the shape of components  
GLO: C2, C3, D3, E3

- 7-3-10: Determine the efficiency of a structure by comparing its mass with the mass of the load it supports.  
*GLO: C1, C5*
- 7-3-11: Evaluate a structure to determine the appropriateness of its design, using the design process.  
 Examples: jacket, foot stool, local building  
*GLO: C3, C4, C8, D4*
- 7-3-12: Use the design process to construct a structure that will withstand the application of an external force.  
 Examples: a tower that will remain standing during a simulated earthquake  
*GLO: C3, D3, D4*

### **Grade 8 – Skills (Cluster 0)**

- 8-0-3E: Create a written plan to solve a problem. Include: materials, safety considerations, three-dimensional sketches, steps to follow  
*GLO: C3, C6*
- 8-0-4A: Carry out procedures that comprise a fair test. Include: controlling variables, repeating experiments to increase accuracy and reliability of results  
*GLO: C2*
- 8-0-5F: Record, compile and display observations and data using an appropriate format.  
*GLO: C2, C6 (ELA Grade 8, 3.3.1; Math: SP-III.2.8)*
- 8-0-6A: Construct graphs to display data, and interpret and evaluate these and other graphs.  
 Examples: circle graphs  
*GLO: C2, C6 (ELA Grade 8, 3.3.1; Math: SP-III.2.7; TFS: 4.2.2-4.2.6)*
- 8-0-6B: Interpret patterns and trends in data, and infer and explain relationships.  
*GLO: A1, A2, C2, C5*

### **Senior 1 – Skills (Cluster 0)**

- SI-0-1C: Identify STSE issues which could be addressed.  
*GLO: C4*
- SI-0-1D: Identify stakeholders and initiate research related to an STSE issue.  
*GLO: C4 (ELA SI: 3.1.4, SI: 4.4.1)*
- SI-0-5C: Record, organize, and display data using an appropriate format.  
 Include: labelled diagrams, graphs, multimedia  
*GLO: C2, C5*
- SI-0-5D: Evaluate, using pre-determined criteria, different STSE options leading to a possible decision.  
 Include: scientific merit; technological feasibility; social, cultural, economic, and political factors; safety; cost; sustainability  
*GLO: B5, C1, C3, C4*
- SI-0-8F: Relate personal activities and possible career choices to specific science disciplines.  
*GLO: B4*