ASD4 Action Plan for STEM Implementation

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**Big Idea:**
Apply engineering concepts to design solutions for real world problems that engage multiple disciplines and creates a passion for innovative, creative, and technological design thinking skills.

**Goals and Objectives**

1. Create lessons based on the principles of common core (ELA and Math) along with current science curriculum standards in order to create PBL opportunities that engage students and allow for global teaching in the classroom.
2. Build partnerships with community businesses and corporations in order to fund projects and act as a liaison between the classroom and the engineering career opportunities.
3. Construct relationships with caregivers that will foster an appreciation for technology beyond the classroom and the importance of STEM disciplines in the 21st century through various parent nights and school/regional competitions.

**Timeline**

1. STEM team will contact community partners, such as Lowes, Michelin, and Milliken, to guide and support project during second nine weeks. Contacts to companies will be made during first nine weeks.
2. Present STEM initiative to faculty during staff development the last Tuesday of September including the problem scenario and standards to be taught during instructional time this year. STEM Team will create interactive presentation that will engage faculty and empower them for implementation.
3. During PLC’s grade levels can meet with the instructional coach to reflect on strengths and weaknesses of project, therefore allowing dialogue between various grade levels. This will be ongoing throughout the project.
4. During Red Ribbon Week, caregivers will be invited to a family night in which the students will professionally display and present their projects and how they really to a global community. This will be in collaboration with Career Week stakeholders.
5. Throughout the year, the FLL team will be meeting to create a solution as part of the Senior Solutions problem this year that will be showcased at the regional competition in January.
Assessments:

1. Rubrics, journals and teacher observations will be used to assess students understanding of common core standards as well as science curriculum standards during PBL project.
2. Classroom presentation will take place during PBL project that will allow for students to creatively demonstrate learning to teachers and community stakeholders.
3. Parent Night during Red Ribbon week will assess classroom implementation of STEM project. This will include invitations to student caregivers and community business partners.

Resources:

1. Community Business Partners – monetary donations, classroom visits and mentorship program
2. IEEA Website and print resources
3. Common Core Standards
4. South Carolina Science Curriculum Standards
5. Anderson County Library – literacy link for building project and engineering career paths
6. Teacher Collaboration during PLC’s and Staff Development

Classroom Preparation

1. Teachers will need to order building materials such as pipe cleaners, cardboard, pvc pipe, clay, etc. approx. 4 weeks to project start. Teachers may also choose to ask for recycled materials from parents and community members, therefore would need to start the process sooner.
2. Divide rooms into quadrants for teamwork and collaboration.
3. Isolate section of the room for materials and classroom store.
4. Reserve laptop cart for project in the science classroom, although students will be working on project during all class sessions.

Learning Experiences/Examples

1. For each grade level, 4-6, the students will complete a playground assignment that will incorporate a literacy component (Handcrafted playgrounds: Designs you can build yourself), math components (geometry, measurement, place value and computation) and engineering components.
2. Students in 5th and 6th grade will be invited to participate in the school’s FLL team during the school year.
3. Students will incorporate public speaking skills during presentation to classroom peers, community members and caregivers.
Community Design Stars

Kindergarten – 2nd Grade

**ASD4:** Stacy Miller, Stephanie Brothers, Wade King, Lindsay McKay

**Content Area:** Social Studies

**Unit:** Communities

**Standards:**

- **Math:** measurement, geometry
- **Technology:** utilize design process to create buildings, fitness stations, and exercise trails
- **Social Studies:** Communities, Community workers
- **Science:** Natural Resources, Habitats, Environments, Health
- **Engineering:** Create maps including buildings, houses, fitness trails and stations in the community

**Big Ideas:**

- Understand that the knowledge of 21st Century skills – collaboration, communication and critical thinking are necessary for the future of students in the workforce
- Understand the engineering design process and how it supports content areas
- Understand that science, technology, engineering and math content is relevant to all students

**Essential Question:** How can we, as community developers, develop a community that will meet the wants and needs of citizens in that community?

**Scenario:** You and your team have been appointed community developers for your city. You have been charged to design the layout of the city square to effectively incorporate the natural habitats to meet the needs and wants of the citizens. The citizens are challenging themselves to become more health conscious and would like for the developers to incorporate walking trails, biking trails and fitness stations, which will keep the integrity of the environment.
Materials/Resources:

- Outside speakers – city planner, mayor, fitness experts
- Literature – trade books, magazines
- Maps
- Art supplies – rulers, markers, crayons, pencils, scissors, tape, glue, construction paper, butcher paper

Content Information:

We are all part of a community. Communities are comprised of buildings, homes, transportation routes, and activity centers. When communities are developed, citizens strive to maintain the integrity of the natural green space.

Maps are visual representations of communities. Maps use pictures and symbols to show locations and assist with directions.

Deliverables: Using teacher provided materials; you and your teammate will build a model of a community, incorporating the natural resources and habitats and the wants and needs of the citizens.

Parameters: The model of the community must:

- fit onto 3’ x 4’ butcher paper
- incorporate engineering design model
- include sketches, diagrams and pictures of community components
- incorporate green space

Assessment: Rubrics for map creation, presentations
Name of Problem: Playground Design  
Name of Authors: Stephanie Brothers, Wade King, Lindsay McCay, Stacy Miller (ASD4)  
Content Areas: Language Arts, Mathematics, Science, Reading  
Unit: Geometry, Simple Machines  
Standards:  
ELA Common Core  
Write informative/explanatory texts to examine a topic and convey ideas and information clearly.  
a. Introduce a topic clearly and group related information in paragraphs and sections include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.  
b. Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.  
c. Link ideas within categories of information using words and phrases (e.g., another, for example, also, because).  
d. Use precise language and domain-specific vocabulary to inform about or explain the topic.  
e. Provide a concluding statement or section related to the information or explanation presented.  
Math Common Core  
Geometry 4.G Draw and identify lines and angles, and classify shapes by properties of their lines and angles.  
1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.  
2. Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.  
3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.  
Science (SC 6th Grade)  
6-5.7 Explain how the design of simple machines (including levers, pulleys, and inclined planes) helps reduce the amount of force required to do work.  
Big Ideas:  
• understand that geometric shapes are integral in representing real-world things  
• use a variety of problem-solving strategies  
• use computation to solve real-world problems  
• be able to apply properties of geometry  
• display and interpret data using graphs  
• be able to understand and apply concepts of force and motion  
• understand the nature of science knowledge, scientific inquiry and scientific enterprise  
• be able to use the writing process to write in a variety of genres  
• be able to read for information  
• be able to use listening and speaking skills for different purposes  
• use thinking and reasoning skills in the design process  
• use strategies to work well with others  
Essential Questions:  
How can you design a play area at your school that can be used by students for recreation and by teachers for learning opportunities?
Scenario:
Your principal, Mr(s). __________, has recently received funds for new playground material. She is conducting a contest to see who can create a play area that meets the following criteria:

- provide a safe, fun area for students of all ages at our school to enjoy
- offer areas in which teachers can teach about geometry, forces/motion, simple machines, and plants/animals
- pleases all senses aesthetically
- can be accessed by students with various physical needs

Materials and Resources:
- disposable cameras
- butcher paper (for class graph of playgrounds and for the table of 3D attributes)
- pencils
- markers
- colored pencils
- crayons
- paint
- yardstick
- 3D shapes: cubes, spheres, cones, rectangular prisms, triangular prisms, square-based pyramid, triangular-based pyramid, cylinders
- 2D shapes: circles, squares, triangles, oval, pentagons, trapezoids, hexagon, octagons
- Floam
- modeling clay
- blocks
- tooth-picks
- pipe-cleaners
- wooden craft sticks
- rubber bands
- straws
- string
- glue
- drawing paper
- construction paper
- tracing paper
- movable figurines or dolls
- lined writing paper

Content Information:
1. Teacher will present scenario to students.
2. Students will use disposable cameras and be given an assignment to take pictures of a playground and playground structures. Students will discuss the. Then, students will be asked to sort pictures based on characteristics of movement: spinning, jumping, swinging, climbing, or balancing, etc.
3. Students will discuss the geometric 2D and 3D shapes they see in the playground pictures and at playgrounds. (Pre-requisite: Recognize 2D and 3D shapes.) Students will investigate the properties of interacting 3D shapes to build structures. Students will complete a table chart of the 3D qualities. (Optional homework: Students go on a shape hunt: Look for 2D and 3D shapes around their house or the school.)

4. Students will investigate typical playgrounds around the world using books and the internet. Students can take notes on their favorite playground apparatus. Students will also research the prices of the playground apparatus and record this information for use of budget.

5. Students will learn about simple machines used on the playground. The lesson starts by viewing pictures of Stone Hedge. Students are asked to think about how the large boulders were moved. Have students supply ideas and act out the ideas. For example, if students say leverage, use a board and a block to demonstrate. (seesaw = lever and fulcrum) This Web site - [http://www.mikids.com/Smachines.htm](http://www.mikids.com/Smachines.htm) - provides pictures of simple machines. Teachers/students can use their science textbooks for additional simple machines information. Students can investigate the playground pictures or school playground to find examples of simple machines. Students will add simple machine labels to the classroom display of playgrounds.

6. Students will meet in design groups to re-examine initial ideas, re-think new ideas, and focus on design problem. Students should take notes, draw pictures of the ways their group has re-defined the problem.

7. Students will create three representations of their play area:
   a. Picture – details with labeled diagram of features and parts.
   b. Written description – use your detailed picture to help you describe:
      a) What the apparatus looks like.
      b) What is it made from?
      c) How it will move, or how you will move when on it?
      d) What geometric shapes will be used to make it?
   c. 3. Model – build a model of your design (include a child or children on your model) (Possible materials available for use: Floam; modeling clay; blocks; toothpicks; pipe cleaners; wooden craft sticks; crayons; colored pencils; rubber bands; straws; string; glue; paper; construction paper; 2D shapes; 3D shapes.)

8. Students will present their play area models to the class covering the following areas:
   I. Tell the classmate about his or her playground apparatus and what it does.
   II. Explain how his or her design works.
   III. Tell the classmate about how they will move or how the apparatus will move.
   IV. Ask the classmate if he or she has any suggestions to improve the design.
   V. Have the classmate rate it for: safety, fun, and usage (high-low).
   VI. Assessment: The student should then make a table of the results.

9. Students will reflect on their play areas and make any changes/improvements based on their peer review and self-reflections.

10. Prepare final product to be turned in to teacher.
Deliverables:
• Model of play area

Parameters:
• Students will be given a set amount (determined by individual teacher) to spend on the playground model.
• Model must be free standing and fit on a student desk.
• Parameters on written pieces will be determined by grade levels.

Assessment: (use rubrics for each item)
• Drawing of play area should be a detailed, labeled diagram including a key/legend
• Written description that follows these parameters:
  o What the apparatus looks like.
  o What is it made from?
  o How it will move, or how you will move when on it?
  o What geometric shapes will be used to make it?
• Model of play area
• Final written piece (reflective composition, persuasive letter, etc)
**S.T.E.M.**

**Big Ideas**
- 21st Century Skills
- Understand and Utilize the Engineering Design Process
- Making S.T.E.M relative to all students

**Goals and Objectives**
- Teacher Objectives: cultivate quality of S.T.E.M. teaching, empower teachers as facilitators, seek outside resources for additional funding and expertise
- Student Objectives: technology literate, engaged in outside of the box thinking, increased communication skills through team work

**Timeline**
- 1 year – Engineering Lab: Flexible integrated planning times: PBL Units
- 2 year – Science Lab: Integrate more S.T.E.M. lessons: Teachers as facilitators
- 3 year – full implementation
Anderson School District Four

Mount Lebanon and Townville Elementary Schools

S.T.E.M Schools of the Future

Engineering our students’ future through science, technology, and math.
STEM