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| **Title** | Experts and Efficiency |
| **Introduction** | This lesson is part 1 of a unit on Global Collaboration that uses the topic of Water Quality to teach the skills of a modern workplace.  In this lesson, students will complete a variety of hands-on activities to discover the importance of expertise.  Each student will identify their own unique skills and, through a modified jigsaw activity, learn the importance of diverse teams that include many different skills. |
| **Curriculum Alignment** | *Eighth Grade Science Essential Standards*  8.E.1.3  Predict the safety and potability of water supplies in North Carolina based on physical and biological factors, including:   * Temperature * Dissolved oxygen * pH * Nitrates and phosphates * Turbidity * Bio-indicators   8.E.1.4  Conclude that the good health of humans requires:   * Monitoring of the hydrosphere * Water quality standards * Methods of water treatment * Maintaining safe water quality   *Eighth Grade Language Arts Common Core Standards*  SL.8.1. Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly.   * Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion. * Follow rules for collegial discussions and decision-making, track progress toward specific goals and deadlines, and define individual roles as needed. * Pose questions that connect the ideas of several speakers and respond to others’ questions and comments with relevant evidence, observations, and ideas. * Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented. |
| **Learning Outcomes** | Students will explore the science concepts of water quality and environmental stewardship while developing the 21st century skills of collaboration and teamwork. Students will learn to identify expertise in themselves and others, and to value that expertise in completing complex group activities.  By working in groups and individually, students will develop their own understanding of the importance of team diversity and demonstrate their knowledge as they struggle to accomplish a task using the specialized skills of each team member. |
| **Time Required and Location** | Two consecutive class periods (90-120 minutes total) |
| **Materials Needed** | * One Build Kit for each Construction Team, composed of various Lego™ type building blocks (each Kit must have the same array of blocks); Kit may be a plastic bin with blocks and list of blocks or photos * One laminated set of Build Kit Instructions for each Construction Team, see attached or make your own with photos of a complex item (as seen from various angles) constructed from the pieces in the Build Kit (ideally the item is composed of several smaller modules or units, such as a vehicle with wheels, axles, and a cargo area). * One timer per group, or one for the teacher to use * One copy of the Exploration Reflection sheet per Construction Team (see attached) * One complete set of Specialty Name Tags (see attached) * One Training Bin per Specialty Group, each composed of 5-6 copies of the pieces needed for one component of the larger construction (such as the wheels for a vehicle or the tower of a building) * One laminated set of Training Bin Instructions (same as first 6 pages of Build Kit instructions) for each Training Bin, see attached or make for own with steps for building the component in the bin * One copy of the Teamwork Assessment sheet for each Construction Team (see attached; to be completed by teacher) * One copy of the Challenge Reflection sheet for each Construction Team (see attached) * One copy of the "Water Quality Team" reading for each student (see attached) * One copy of the Expertise Scenario sheet per student (see attached) * One copy of the Collaboration Rubric for each student (see attached) |
| **Facilitator Preparations** | Make necessary paper copies (see below) and prepare the Build Kits and Training Bins with appropriate building blocks.  Any building materials may be used, but these instructions refer to Lego™ type blocks.  To clarify, each Build Kit contains the pieces and instructions to complete a complex object with several smaller “modules”. Each Training Kit contains only the pieces and instructions needed for one of these modules.  During the initial exploration the Construction Teams are just trying to build a vehicle. After struggling with this task, they split up into Specialty Group who train in the construction of one piece (module) of the vehicle. Then, the Construction Teams come back together and attempt to construct another vehicle with the same modules. |
| **Activities** | *Exploration*   1. Send students to their Construction Teams (which you have already chosen for them), and give one Build Kit to each group. 2. Give each team two minutes to examine the instructions in the Build Kit, without touching any of the building blocks. 3. Start the timer and allow students to begin building.  Note the time that each team finishes their build successfully.  If their final construction is not a match to the pictures, they must disassemble and fix the problem. 4. After construction is complete, direct each team to complete the Exploration Reflection sheet, working together to answer the questions.  Collect these sheets from each team. 5. Engage students in a discussion about their responses on the Exploration Reflection sheet. Ask each group to summarize any insights that they have gained from this Exploration, by asking the question “What is the value of a diverse team?” and eliciting responses.   *Model System*   1. Hand out the Specialty name tags, and ask each group member to put one on.  Send all of the members of each Specialty Group to one location in the classroom for training. 2. Give each Specialty Group a Training Bin, and direct each Group to complete the tasks on the laminated instruction sheets in their bin.  The members of each Specialty Group need to practice the construction of their module repeatedly for approximately 30 minutes until every member can complete the task in one minute or less. 3. After this "training" phase, send students back to their Construction Teams.  Before returning their Build Kit to them, remind students that they are going to attempt to complete a different construction project.  When everyone is ready, let each Team open its Challenge Envelope.  Allow them 10 minutes to complete the construction, while the teacher moves around the classroom monitoring the equitable participation by all members of each team.  Complete the Teamwork Assessment while monitoring to evaluate student collaborative skills. 4. After they have successfully completed the second build, instruct each Construction Team to fill out their Challenge Reflection Sheet.  Collect these sheets from each team.   *Content Wrap-up*   1. Distribute copies of the "Water Quality Team" reading.  Based on the needs of this class, either read aloud to them, let them read aloud in turns (“popcorn” reading), or direct them to read independently and quietly. 2. Lead a discussion about the similarities between the team from the reading and the Construction Teams, and record the results in a Venn diagram.   **Guided Practice**  Use the Expertise Scenario handout to give students an opportunity to explore the importance of building diverse teams with a variety of skill sets in order to solve a problem in the most effective way.  Ask guiding questions (e.g., What might happen if the members of a team were too similar? What more would you want to know about these students?  How might their skills be useful for this task?) to ensure that students recognize the importance of finding and recruiting diverse experts on a collaborative team. |
| **Assessment** | Present students with a new building challenge, using the same materials in the Build Kit, in the form of a fully constructed model or photograph.  Give students ten minutes to plan and practice.  Beginning with no pieces connected, time and observe each team as they complete the new challenge.  Use the Collaboration Rubric to assess the performance of each student. |
| **Critical Vocabulary** | *expertise*: the skill of an expert; an uncommon ability achieved through experience or training  *collaboration*: working with others |
| **Modifications** | For academically gifted students, consider having them devise a further challenge using the skills that their Construction Team has already developed.  Below grade-level students may have difficulty with the written portion of this activity, so consider reading aloud the Scenario sheets. The hands-on portions of this activity and the non-verbal instructions work especially well for struggling learners. |
| **Alternative Assessments** | If a performance-based assessment is not feasible, or not appropriate for your students, consider a paper-based assessment.  Be sure to include open-ended questions that require application of the skills of recognizing and valuing expertise. For example,  “Imagine that you have been asked to form a team of students to create a new logo for your school’s sports team. What qualities/abilities would you be looking for in the students that you considered for the team?”  “Imagine that you are in a group in class, and your best friend wants to join. You and her like most of the same things and are good at many of the same activities. Why might it not be a good idea for her to join the team, and how would you explain this to her?”  Score student responses with the following rubric:   |  |  |  | | --- | --- | --- | | Proficient | Developing | Novice | | Describes in detail how the diversity of skills within a team allow it to work more efficiently and react to new situations. | Response shows familiarity with the concept of “strength through diversity”, but does not seem clear on the supporting details. | Ignores the benefits of group diversity, instead focusing on one particular skill or interest. | |
| **Supplemental Information** | Consider reminding students of this activity when conducting group activities later in the school year, and allowing them to choose their own groups.  Emphasize the benefits that come from forming diverse groups for collaborative activities. |
| **Comments** | This lesson is the first in a four-lesson unit designed to teach collaborative skills within the context of the 8th grade science curriculum, culminating in a Project-Based Learning activity that involves a partnership with a foreign classroom. |
| **Author Info** | Paul Cancellieri is a middle school science teacher at Durant Road Middle School in Raleigh, North Carolina.  He spent several years as a marine biologist before realizing his passion for teaching and transitioning to education in 2001.  He earned his National Board certification in 2007, and a Kenan Fellowship in 2010. |