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| **Title** | **Students Journey through Human rather than Butterfly Metamorphosis**  |
| **Introduction** | Second grade students focus on understanding animal life cycles by observing caterpillars changing into butterflies. They are actually observing an animal change their form and function into a completely different version in a relatively short period of time. Form and function are foundational elements in every field of engineering. In this lesson, students will take the journey of the caterpillar and will have the opportunity to change their form and function upon leaving their chrysalis. This STEM lesson will have students create a PowerPoint presentation to share with their classmates the journey that they have taken. The instructional techniques of this lesson are rooted in 21st Century Skills Framework and use rigor and relevancy to reach all learners.  |
| **Learning Outcomes** | Students will be able:1. To explain and apply the life cycle of a butterfly in their own words and apply it in another context
2. To estimate and measure themselves in both systems to be able to create their personal chrysalis
3. To use PowerPoint to create a multimedia presentation
4. Understand how form and function are foundational with the field of engineering
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| **Curriculum Alignment** | Second Grade NCSCOSScience Goal 1The learner will conduct investigations and build and understanding of animal life cycles.MathGoal 2 Measurement2.01: Estimate and measure using appropriate unitsa. Length (meters, centimeters, feet, inches, yards)Receptive Literacy3.07: conduct research with the help of a teacher3.03: explains and describes new concepts and information in own wordsTechnologyCompetency Goal 2: The learner will demonstrate knowledge and skills in the use of computer and other technologies2.01 Recognize, discuss and use the features/functions of computing devices (e.g., creating, retrieving, saving, printing data).2.09 Identify and use multimedia tools to combine text and graphics as a class/group assignment.Framework for 21st Century Skills1. 1.Core Subjects (mathematics, science, social studies)
2. 3.Learning and Innovation Skills (creativity and innovation skills, critical thinking and problem solving skills, communication and collaboration skills)
3. 4.Information, Media & Technology Skills (information and communication technology skills (ICT))
4. 5.Life and Career Skills (flexibility and adaptability, initiative and self direction, leadership and responsibility)
5. 6.21st Century Support Systems (curriculum and instruction, standards and assessment, learning environment)

Engineering componentFocus on *form* and *function* and how it is foundational in the understanding, learning and practice of all engineers |
| **Classroom Time Needed** | 5 classes: 45-60 minutes per class |
| **Materials Needed** | Rubric for PowerPoint presentationsForm and Function handoutPersonal Metamorphosis handoutMaterials for chrysalis creation: paper, tape, scissors, newspaper, string, etc (the greater the variety of resources the more imaginative the students will be with their creation)Rulers (both standard and metric systems)Tape measures (both standard and metric systems)10-15 brown bags (one for each pair of students)10-15 items for brown bags (used for form and function activity, anything found around the house that has a form and function of to it: could be can opener, flashlight, nail clippers, scissors, water bottle, spork, straw, etc.) |
| **Technology Resources** | SMART Board (with LCD projector)Computer and internet access: need one computer per studentMicrosoft PowerPoint softwareDocument camera |
| **Pre-Activities** | Unit done with animal life cycles with focus on butterfly metamorphosis. Students need to understand how caterpillar to chrysalis to butterfly and the stages that applies. This would be a perfect lesson to be done after using the science kits taught at this grade level. In addition, take a lesson to show students how to navigate and create a PowerPoint presentation. Show them how to create new slides, use different formats, import pictures and apply background/theme templates. (if not sure how to use PowerPoint: refer to software instructions and YouTube is a wonderful resource)Briefly show them how to copy and save pictures from the internet to be used with their presentation. Pre-activities for teachers:Gather supplies to be used for creation of chrysalis. Put objects that demonstrate form and function into a brown bag (one object per bag, to be used in day 1 of lesson plan) |
| **Activities** | Day 11. Quick open discussion of the life of a caterpillar (be sure the group explains the different stages they go through in becoming a butterfly)
2. Pass out the form and function handout ( as a group, go through the two different elements and make sure everyone knows what the words form and function mean)
3. Break students into pairs
4. Each pair receives a brown bag (ones created in pre-activity section)
5. Allow students to work in groups and complete the form and function handout
6. Have each group put their object under the document camera and explain to the group the form and function of their object. Have every group share.
7. Conclude the lesson with asking students: “Does everything in this room have form and function?” (discuss until there is group understanding that there is, even humans have form and function)

Day 21. Pass out the personal metamorphosis handout (go through the handout as a group and make sure everyone understands each part of it)
2. Have students work to complete their handout to explain the metamorphosis they want to go through
3. Upon completion, have them draw a design of what their chrysalis will look like

Day 31. Ask students about the chrysalis of butterflies and what happens within them (focus on the changing of form and function)
2. Ask: “How big would your chrysalis have to be and how would you figure it out? “(Focus on measuring your height and width !Important!! make sure they understand that is cannot be skin tight because when would be able to move around)
3. Discuss the handout they completed the previous day and let them know an expectation is to create a chrysalis that would allow them to meet the changes they described. (make sure they include room for the different things they would need to bring with them if applicable)
4. Remainder of the lesson: students work on measuring themselves and/or each other and create their chrysalis. (their creations will be used in their presentation)

Day 41. Handout the rubric for their PowerPoint presentations (review each section and make sure there is a group consensus to it before proceeding
2. Have students create their PowerPoint presentation

Day 5 1. Students present their chrysalis and PowerPoint presentations to the class
2. Teacher could grade them using the rubric, or have the class vote after each presentation (depending on the group)

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| **Assessment** | Math 2.01: Measurements completed for chrysalis design and creation (Day 3)Science Goal 1, Receptive literacy 3.03 & 3.07, Technology Goal 2: PowerPoint presentations (formal-rubric) Observational objectives (informal throughout the 5 days of work)Engineering component: form and function handout and activity, personal metamorphosis handout |
| **Modifications** | 1. This task is meant for any style of learner. The SMART Board template or PowerPoint of same material supports learners with ELL, LD restrictions because it provides visual representation of material being covered.
2. Working in teams, allows for different levels of learners to share and understand together. With grouping students, make sure to create heterogeneous groupings to allow for students to help teach and learn from each other.
3. Using different ways of responding to the discussions questions is a modification to be used to meet various IEP or ELL needs. If students struggle with written responses, use a version of the webcam or oral discussion of answers to questions.
4. This is a real world activity that is built upon 21st century learning format and environment which enables for modifications to be built within and tailored to each learning style
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| **Alternative Assessments** | 1. The notebook could be given through one on one verbally
2. The format of this lesson does not allot for the need for an alternative assessment. There are plenty of opportunities for students to show you what they learn as they are working in small groups. If they struggle with written documentation, modeling expected results could help.
3. Verbal questioning groups and students in particular with questions that are aligned with the standards covered could also be used as a supplement
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| **Supplemental Information** | Wikipedia on Form and Function: <http://en.wikipedia.org/wiki/Form_follows_function>Butterfly Metamorphosis: <http://www.butterflyschool.org/new/meta.html>Could use KidPix to have students draw their metamorphosis and share with their classmatesMany excellent videos are found on YouTube and Discovery Education formally United Streaming from Discovery Channel (Paid site) |
| **Critical Vocabulary** | MetamorphosisLife CycleFormFunctionMultimedia presentation |
| **Websites** | Engineering design process from EiE (Engineering is Elementary) Boston Museum of Science: <http://www.mos.org/eie/engineering_design.php>SMART Board free download of software: <http://www2.smarttech.com/st/en-US/Support/Downloads/SBS/Windows/SBSv97Win.htm> Rubric development website (free and could be put into Spanish): <http://rubistar.4teachers.org/>  |
| **Comments** | 1. Good idea to use this lesson during the spring. I feel that students need time to grow as a group together before sharing on topics that could get personally deep
2. Student responses could range, expect some to get personal and talk with students about trust and sharing as a member of the class
3. Rubric can be created and modified using the website above (rubistar)
4. Do not try to shorten the lesson by taking out the first day in the lesson, the form and function activity is pivotal in the learning and understanding of the field of engineering and the world around them
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| **Author Info** | Justin OsterstromA.B. Combs Leadership Magnet elementary school in Raleigh, NCSTEM/21st Century Skills Specialist teaching grades K-57 years teaching (3 in 4th grade, 2 in 5th grade, 2 as a specialist)NBCTClass of 2011 Kenan FellowThis is part of my unit being developed for my Kenan Fellowship implementing problem solving skills with focusing on engineering curriculum and STEM applications in grade K-5Mentors of Kenan Fellowship: Dr. Laura Bottomley and Liz Parry, NC State Department of Engineering |