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Water Budget Modeled using Stella

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Generic Lesson Plan Template

You should submit this form in addition to any computer generated files/documents/models to your group folder on Angel. Please create a .zip file and upload the group of files as a single archive.

Name: Suzanne Wade
Grade level(s)/Subject taught: Earth Science (9), Living Environment (10), and Envirothon Team (all)
Objectives: Give students a tool that will allow them to easily calculate the values in a water budget so they can understand when usage, recharge, deficit and surplus occur without struggling with getting overwhelmed by the mathematics.

Please provide a rich **one-page, single-spaced**, description or a *vision* of your best thinking on a way or ways you might teach the planned lesson. (approximately ½ page for the teacher role, ½ page for the student role). Also, construct a tentative rubric that you might use with your students (see example)

Items to include in your lesson plan: (Choose your discipline/concepts from your own area).

1. *Write* the Mathematical Concept or "key idea" that modeling will be used to teach: (e.g. Students use mathematical modeling/ multiple representation to provide a means of presenting, interpreting, communicating, and connecting mathematical information and relationships)

and/or…

1b. *Write* the Science Concept or "key idea" that modeling will be used to teach: (e.g. Organisms maintain a dynamic equilibrium that sustains life).

Water Budgets…understanding usage, recharge, surplus and deficit

Materials:

The unit will begin with the introduction of the variable in a water budget. There will be a question and answer discussion about what happens when there is too much rain? What happens if there is not enough rain? Where does water come from in a well? What is ground water? Terms such as zone of aeration and zone of saturation, water table and water cycle will be taught to students. Then students will be given a water budget which the group will work through together. The problem comes when students are trying to complete water budgets on their own. Many students quickly become frustrated and give up on water budgets. While this is a skill that all students should be able to acquire, not all students do. Since the calculation of the water budget itself is not what is required, but the analysis of the data is, this program will provide students with the correct data for the water budget so they can graph the data and analyze the graphs for recharge, surplus, deficit and usage. Students can look at three data values, P, Ep, and the previous month's storage, to predict whether they would expect any surplus or deficit, usage or recharge. Then using the model students will be able to discover whether or not their predictions were correct.

DAY 1	Students will receive a diagram of the water cycle and the following terms will be Identified. • Precipitation • Evaporation • Transpiration • Potential Evapotranspiration • Actual Evapotranspiration • Zone of Aeration • Zone of Saturation • Storage • Groundwater • Infiltration • Permeability • Runoff • Surplus • Deficit
Day 2	Students will receive a hard copy of a water budget that I will work through with the students To complete the entire water budget while reminding students what is happening to the water. By the end of class students will have worked through one water budget and homework will involve Students plotting the precipitation, potential and actual evapotranspiration.
Day 3	Using an excel graph on the smart board, students will complete the shading on their graphs symbolizing times of recharge, surplus, deficit and usage. IF P>Ep AND St=100 then SURPLUS IF P>Ep AND St<100 then RECHARGE until St=100 IF P<Ep AND St>0 then USAGE until St=0 IF P<Ep AND St=0 then DEFICIT
Day 4	Students will be given sets of P, Ep, and previous month's storage and asked to make predictions about which of the 4 (Surplus, Recharge, Usage or Deficit) is expected during the month. Students will record their predictions then enter the data into the model, run it… and record the answers on their worksheet. Students will be given 10 points to predict
Rubric	Students will be graded based on their % ACCURACY of their predictions Students who correctly predict 10 out of 10 will receive 100% Students who correctly predict 9 out of 10 will receive 90% Students who correctly predict 8 out of 10 will receive 80% Students who correctly predict 7 out of 10 will receive 70% Students who correctly predict 6 out of 10 will receive 60% Students who correctly predict 5 out of 10 will receive 50% Students who correctly predict 4 out of 10 will receive 40% Students who correctly predict 3 out of 10 will receive 30% Students who correctly predict 2 out of 100 will receive 20% Students who correctly predict 1 out of 10 will receive 10% Students who correctly predict 0 out of 10 will receive 0%

However, if students miss the first few they will have the opportunity to receive remediation before continuing on with the predictions. Hopefully students will use the program to quickly learn that they need a review before they will achieve success. It is unlikely that students will receive below 70% on the activity.

Still need to design a template for predictions.

Example: "I was thinking about beginning the class on [modeling X] by using the overhead to ask students what they know about X. From this brainstorming session, I might ask them to get into groups and discuss one or more of the ideas they gave me. After about ten minutes, I would have the students give their ideas on X and write them down on a transparency so they would be able to see them for the entire hour. From here, I would provide a 10 to 15 minute demonstration of the basics of using _____modeling software. I would use an conceptual example that they would find familiar with such as getting a cold and how it is transmitted. From here, I would have students at the computer stations using a prepared guide or tutorial to get them started on basic software usage. I expect that is a short time a number of students would "catch on" rather quickly and be able to help others. …….. By the third lesson, I suspect that most would be well on their way to development of their own or small group models using the _____software. My plan of assessment would probably be a group model so they would gain more confidence in using the software in a meaningful way. After the second or third lesson, I would ask them to choose from a list of thematic or topic areas that fit the software nice and develop a model using the technology. As a product, I may have partners share their model and describe to other small groups how it works. The rubric I design would be general at first so that I might see what kinds of the products the student were capable of creating. From the prototypes, I would hone my rubric to make the modeling product as challenging as possible without making it too difficult." Etc…