**Facilitator Learning Progression Immersion Activity**

**Facilitator guide to accompany Learning progression immersion activity**

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**Culturally relevant ecology, learning progressions and environmental literacy Long Term Ecological Research Math Science Partnership**

**2012**

Disclaimer: This research is supported by a grant from the National Science Foundation: Targeted Partnership: Culturally relevant ecology, learning progressions and environmental literacy (NSF-0832173). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



**Learning Progression Immersion Activity**

**Water in Socio-ecological Systems**

**Facilitator Guide**

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| Activity | Description | Purpose | Time | Materials |
| Introduction to Learning Progressions | Have teachers work in groups of 2-5. Provide teachers with an overview to learning progressions. Make the following points. Could use some slides from last summer if you would like.   * Describes changes in student reasoning about water as students develop more sophisticated understandings of big ideas. * Spans grades – learning from middle to high school * Is anchored on one end by what we want students to know and be able to do by the end of high school related to understanding water in socio-ecological systems. * Is anchored on the other end by the ways that students make sense of the world. * Is not about right or wrong but is about tracking student progress as they develop more sophisticated understandings. * We look at how student thinking changes as they learn about water and substances in water moving through connected systems (natural & environmental) * Today we are going to play with some data to look for patterns in student responses to assessment items. These patterns are the basis for a learning progression. We develop a learning progression by going through many rounds of this process. | Engage – Provides an overview of what learning progressions are. | 10-15 mins | Powerpoint slides |
| Dana Analysis | Provide teachers with data for three items. Have teachers   1. Rank responses to Soccer Game Items (1 lowest, 10 highest). Teachers may choose to cut paper into strips to play with various arrangements of rankings. 2. After ranking items, group items into 3-5 groups according to similar features of responses. 3. Repeat with the remaining items (River Maps, Fertilizer) | Explore – Teachers look for patterns in student data | 30-45 mins | * 3 sets of item responses * Item Levels Table (3) * Scissors |
| Looking for patterns across items | Have teachers synthesize their levels across all three items | Explore – Teachers look for patterns in student data and begin developing their learning progression | 15 mins | * Learning Progression Table |
| Share Learning Progressions | Allow teachers to share and compare their overall learning progressions. What patterns did they notice? Who else saw a similar pattern? | Explain – Teachers share the patterns they noticed | 10 mins |  |
| Introduce Water Levels of Achievement | Provide teachers with rubrics for each item. Allow them to revisit and revise their rankings, groupings and levels. What do they notice that is similar or different? | Explain – Teachers learn about water levels of achievement and compare to their rankings | 15-20 mins | * Rubrics for each item |
| Introduce Overall LP framework | Introduce teachers to overall water LP framework. Discuss main features of each level of achievement. | Explain | 10 mins | * Teacher versions of LP framework * Powerpoint slides. |

**Soccer Game Items**

Your soccer game gets canceled at half time due to a massive down pouring of rain. As you run for cover you notice large puddles forming on the grass covered playing field, but no puddles forming in the sand covered playground just a few steps away.

Item 1: Where could the water landing on the sandy playground be going?

Item 2: How does the water on the sandy playground get to where its going?

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| Rank  1 = lowest  10 = highest | Student Answer (Answers to both items are together. Consider both answers together when ranking) |
| 2 | 1. The sand is absorbing the water and is taking it beneath the ground. 2. Because the rain travels through the sand and into the soil that will carry it to other parts of the field. |
| 3 | 1. The water would go underground because it seeped through the sand. 2. It infiltrates the ground. |
| 2 | 1. the sand could be absorbing the water so that it looks like it is disapeering but really the sand is just expanding and absorbing the water. 2. It is absorbed by the sand or slips through to the bottom of the sandy playground. |
| 4 | 1. It is infiltrating into the ground because sand is more permeable than soil/grass. 2. It moves through the spaces between sand grains as a result of gravity and capillary action. |
| 2 | 1. It sinks down below the sand and makes the puddles bigger on the grass. It sinks down below the sand and makes the puddles bigger on the grass. 2. the water flowtation moves onto the grass from the sand. |
| 3 | 1. It could be going to an underground resovior. 2. By seeping through the sand and going underground |
| 4 | 1. It is soaking into the ground and could end up being absorbed by plant roots or eventually soaking deep enough to reach groundwater. 2. First, it is effected by gravity which will continue to pull it towards the center of the earth. It will slowly seep through the space between components of the soil. |
| 2 | 1. The water on the sany playground goes into the sand because the sand absorbs it. 2. The heat makes it evaporate. |
| 3 | 1. The water is infiltrating the loose sands and going underground. 2. The water infiltrates the layer of sand, meaning it slowly drifts downward through the loose sand particles. |
| 1 | 1. The water on the playground is all evaporated. 2. It evaporates. |

**River Maps Item**

a. Can pollution in the river water at point B get to point C? b. Explain why or why not.

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| Rank  1 = lowest  10 = highest | Student Answer |
| 2 | a. Yes.  b. The polluted water will reach point C because water never stops traveling. For example,if you put some dye in a big pool of water and give it a current I am sure that the water will turn the certain color of the dye. |
| 3 | a. No.  b. Because the pollution cant go up stream the pollution cant swim so it just follows the water to where it ends and just follows the water anywhere. |
| 1 | a. Yes.  b. The pollution in the river water at point B can get to point C because all water lines are connected as seen on the map. |
| 4 | a. No.  b. Point C is upstream from B and is in a different valley/tributary. |
| 3 | a. Yes.  b. Because a tributary runs into a larger river which I am assuming is A then to C. This is hard to tell since there are no contour lines showing elevation? Now I am not sure if the river is moving to the lake I would think not. |
| 2 | a. Yes.  b. the pollution in the river at point b may spread to point c because, of the way the water is flowing or the pollution getting into the water cycle there for the polluted water eventually precipitates down onto point C. |
| 1 | a. Yes.  b. Because they connect, so they will have the same pollutions |
| 2 | a. Yes.  b. The water current can push the pollution down the river |
| 2 | a. Yes.  b. If there is pollution at point B, the dirty water could evaporate into the air and be carried back to the point of origin, (the lake,) then run it's course all through points A and C. |
| 3 | a. Yes.  b. Pollution in river B can get to river C because C is a river and B is a tributary that leads (flows) into the river C. |

**Fertilizer Item**

If the playing fields were treated with fertilizer, do you think that some of the fertilizer could get into the river? If you think yes, describe how fertilizer could get into the river. If you think no, describe why fertilizer would not get into the river.

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| Rank  1 = lowest  10 = highest | Student Answer |
| 4 | YES This is most likely true - but not necessarily. The fertilizer will be in water, some of which will run off downhill, into the river. Some will enter the earth and can still reach the river from underground. In a few exceptions, there could be geologic features, such as bentonite that separate the underground area of the field from the underground area beneath the river. |
| 3 | Yes. The fertilizer would get into the river because the fertilizers will seep down in the grass, and into the ground water and will eventually hit the river. |
| 2 | YES When the water has a high tide, the fertilizer could get into the water. When it rains, the water from the rain that gets in to the fertiliizer get be collected by te river. |
| 3 | Because of the close proximity of the fields to the river, there would be some runoff if there was precipitation in the area or as the fertilizer gets broken down into the soil it could eventually get into the ground water supply. |
| 2 | NO because there is a street to seperate the field from the water |
| 3 | Based on the green appearance of the field, I do not think it is highly probably for fertilizer to get into the river. It seems the groundwater flows south into the field from the river. However, there is a small chance fertilizer could get into the river by animal/people transmission. Even still, those amounts would be very small and probably would not have a substanital impact on the ecosystem. |
| 1 | NO The grass is not touching the water. |
| 2 | YES. the fertilizer can get into the river when it rans and it would get carried to the river by the runoff |
| 1 | YES. I think the fertilizer could get into the river because the river is practically connected to the football fields. |
| 2 | YES When it starts to rain, the runoff from the water will get into the river. |