Evaluating Sustainability Competencies through Green Infrastructure Design

Daniel Cronan
University of Idaho
GIS Day, November 15, 2017

The purpose:

To provide a systematic approach for evaluating student learning within a LANDSCAPE ARCHITECTURE STUDIO with **two forms of evidence of learning**:

SELF-REPORTED EVIDENCE
- Questionnaires

SPATIALLY EXPLICIT EVIDENCE
- Designs via GIS

This approach may provide educators (including myself) with guidance for developing instructional courses to aid student learning.

STEP 1
Instruct

Studio Instruction and Workshop Instruction

STEP 2
Assess

Tools and Methods for Gathering Evidence of Learning (Questionnaires and SUSTAIN)

STEP 3
Evaluate

Comparing Quantitative and Qualitative Evidence

STEP 4
Diagnose

Roadblocks and difficulty in learning process (Cognitive load theory)

STEP 5
Prescribe

Courses instruction and material needs revision

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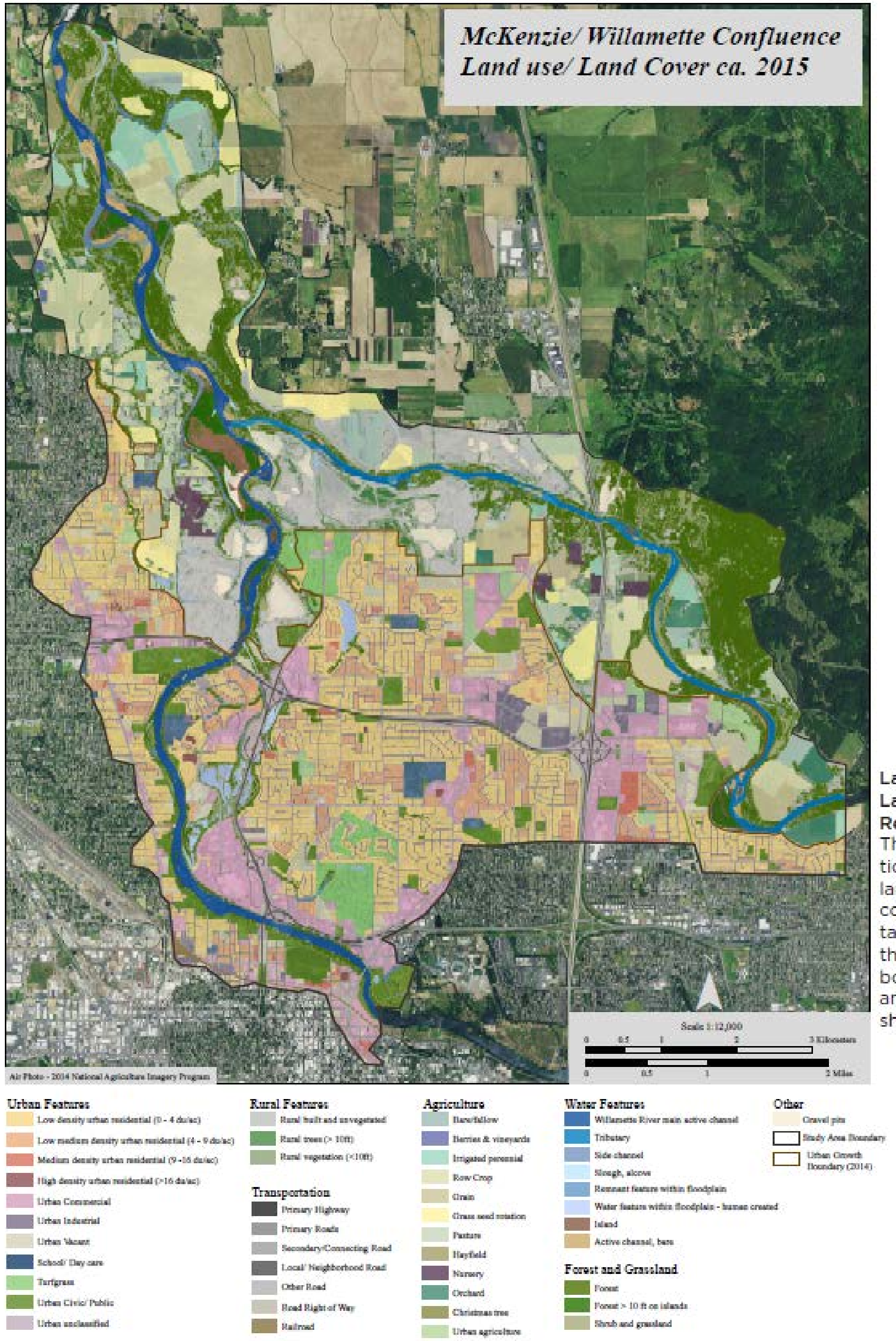
Land Use/Land Cover Representation



Land Use/ Land Cover Representation. The representation depicts the land use and land cover representation model that was used for both the Studio and the Workshop.

Step 1
Instruct

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2.3 Site Suitability Criteria

Table 2-4 shows a site suitability criteria matrix and is populated with default criteria that you can change to your preference or local knowledge. The default criteria in the tool are derived from two EPA reports (USEPA 2004a, 2004b). You can modify these criteria using the Siting Tool interface.

Table 2-4. Default criteria for BMP suitable locations used in BMP Siting Tool

BMP type	Drainage area (acre)	Drainage slope (%)	Impervious (%)	Hydrologic soil group	Water table depth (ft)	Road buffer (ft)	Stream buffer (ft)	Building buffer (ft)
Bioretention	< 2	< 5%	> 0%	A–D	> 2	< 100	> 100	--
Cistern	--	--	--	--	--	--	--	< 30
Constructed Wetland	> 25	< 15%	> 0%	A–D	> 4	--	> 100	--
Dry Pond	> 10	< 15%	> 0%	A–D	> 4	--	> 100	--
Grassed Swale	< 5	< 4%	> 0%	A–D	> 2	< 100	--	--
Green Roof	--	--	--	--	--	--	--	--
Infiltration Basin	< 10	< 15%	> 0%	A–B	> 4	--	> 100	--
Infiltration Trench	< 5	< 15%	> 0%	A–B	> 4	--	> 100	--
Porous Pavement	< 3	< 1%	> 0%	A–B	> 2	--	--	--
Rain Barrel	--	--	--	--	--	--	--	< 30
Sand Filter (non-surface)	< 2	< 10%	> 0%	A–D	> 2	--	> 100	--
Sand Filter (surface)	< 10	< 10%	> 0%	A–D	> 2	--	> 100	--
Vegetated Filterstrip	--	< 10%	> 0%	A–D	> 2	< 100	--	--
Wet Pond	> 25	< 15%	> 0%	A–D	> 4	--	> 100	--

Step 1
Instruct

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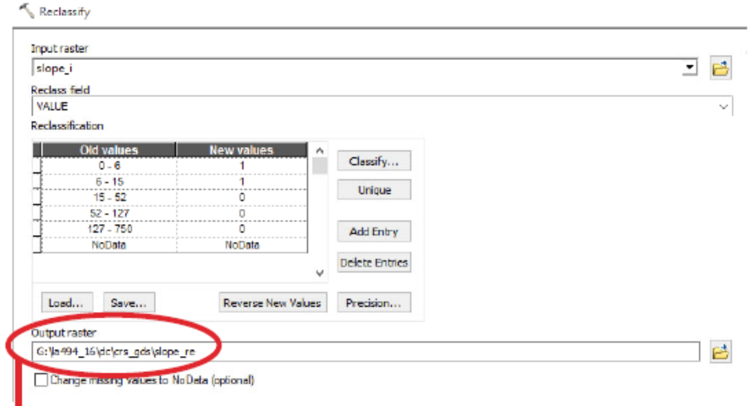
1. Slope: reclassify



a) reclassify to a binary map ≤ 15% = 1, >15%= 0
b) Specify and note output name: e.g. slope_re

c) slope output binary map

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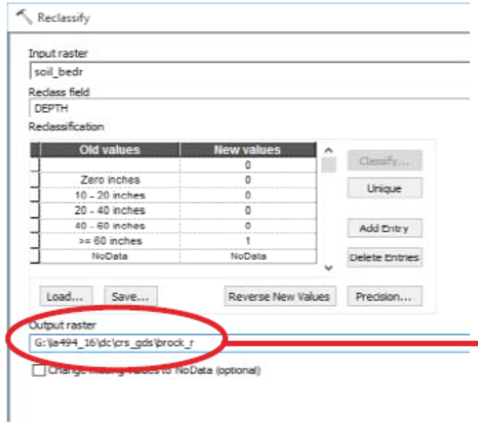
2. Depth to Bedrock: reclassify: ≥ 60 inches

Create a binary map of depth to bedrock for the study area.

≥ 60 inches= 1, <60 inches =0



a) reclassify tool -change new values to 0 and ≥ 60 inches to 1
b) set output raster name

*depth to bedrock-output example

Step 1
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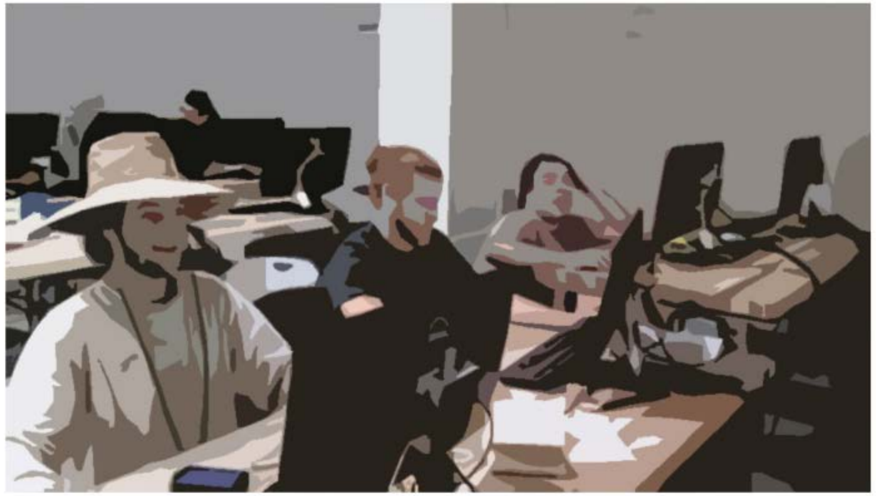

Step 1
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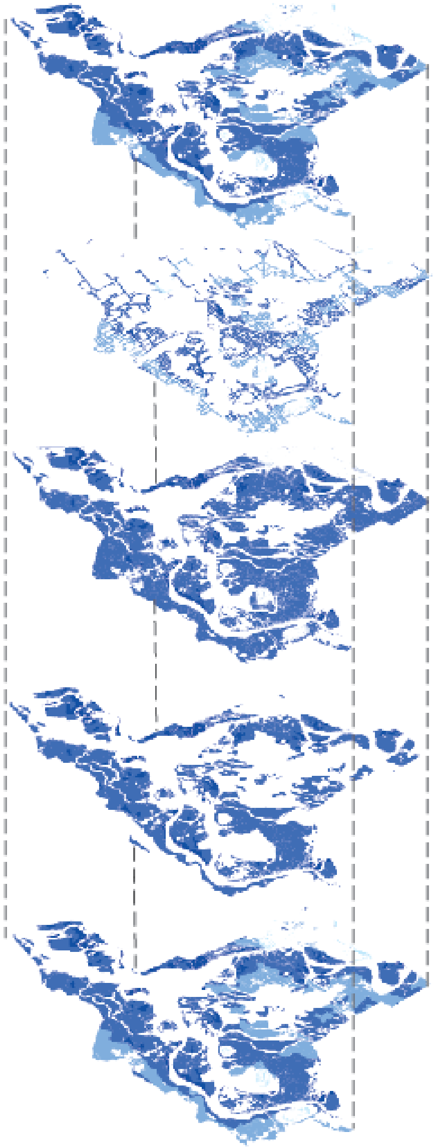

Initial Design

(beginning of course)

Final Design

(end of course)

Step 1
Instruct

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STEP 2) ASSESS:

GATHERING EVIDENCE OF LEARNING BY RELEVANT FACTOR:

Questionnaires and GIS tools addressing the following factors:

SYSTEM FACTORS:

1) Terrain
2) Impervious Cover
3) Land Use

RUNOFF FACTORS:

4) Reduction and mitigation of Runoff

FLOODING FACTORS:

5) Flooding and Design Storms

Step 2
Assess

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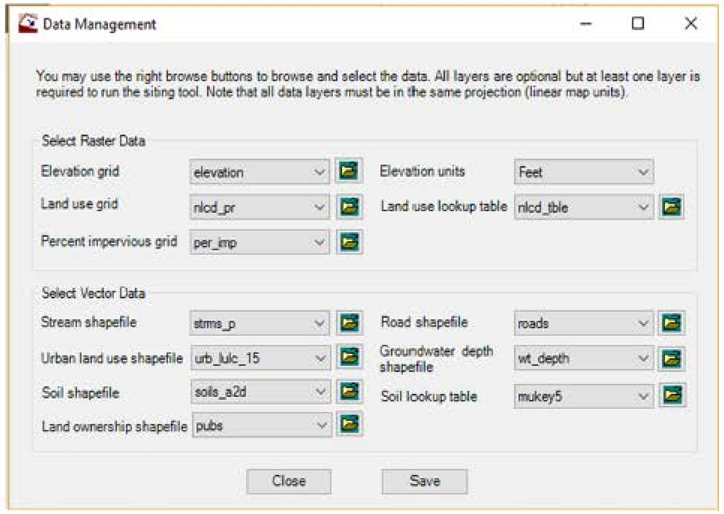

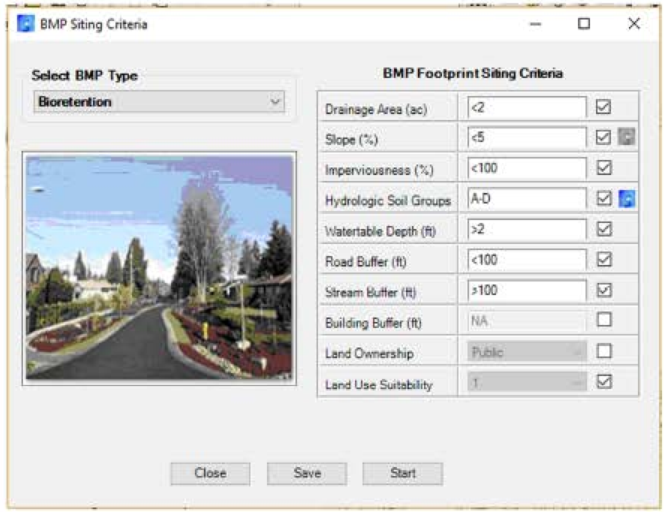

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Green Roof	–	–	–	–	–	–	–	–
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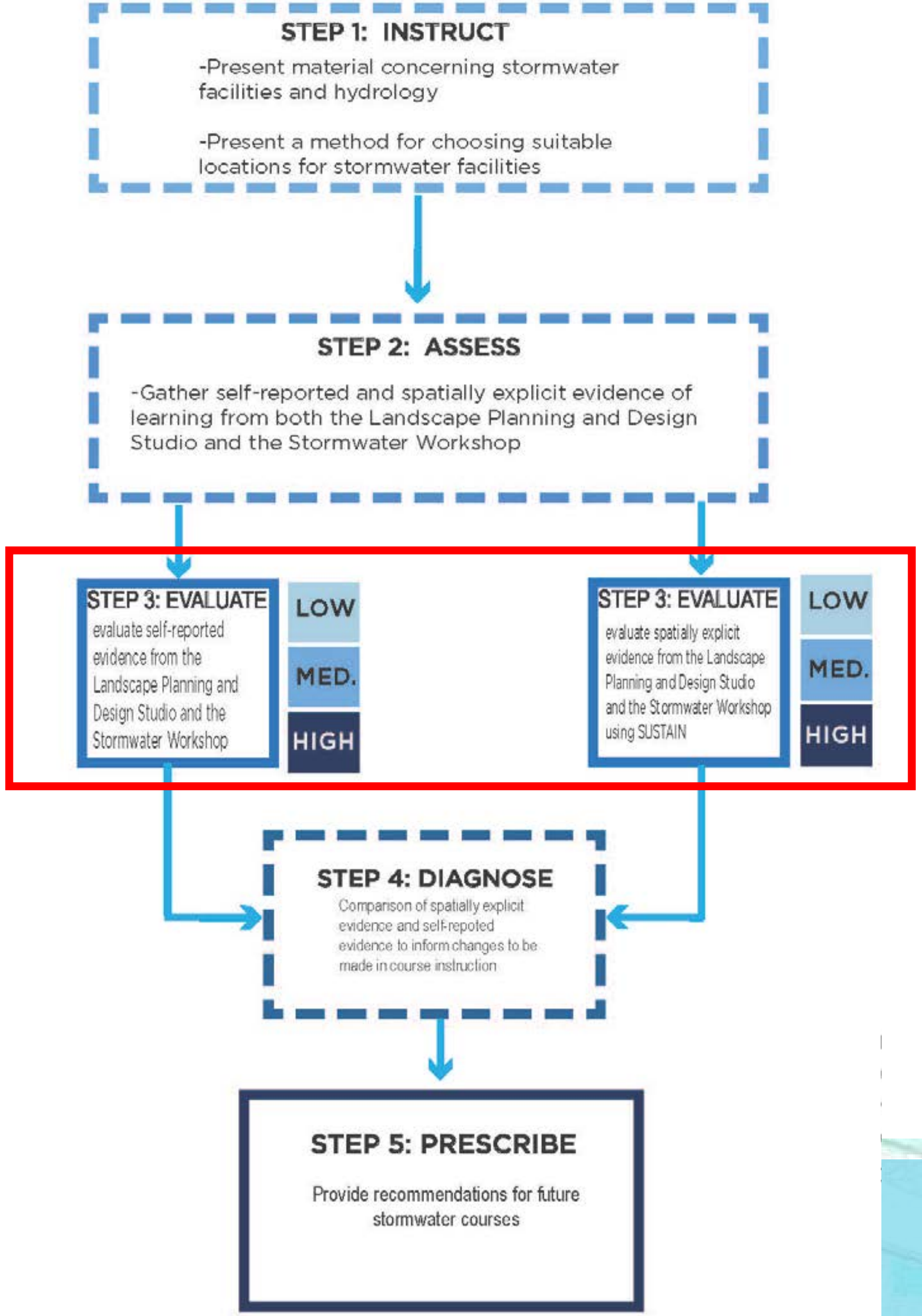

Step 3
Evaluate

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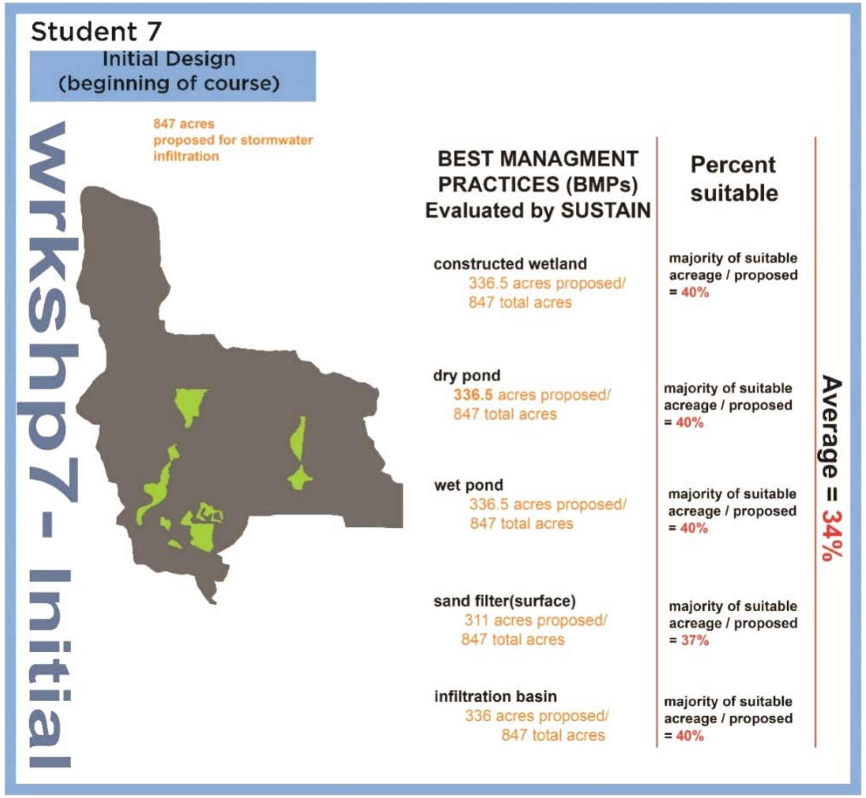
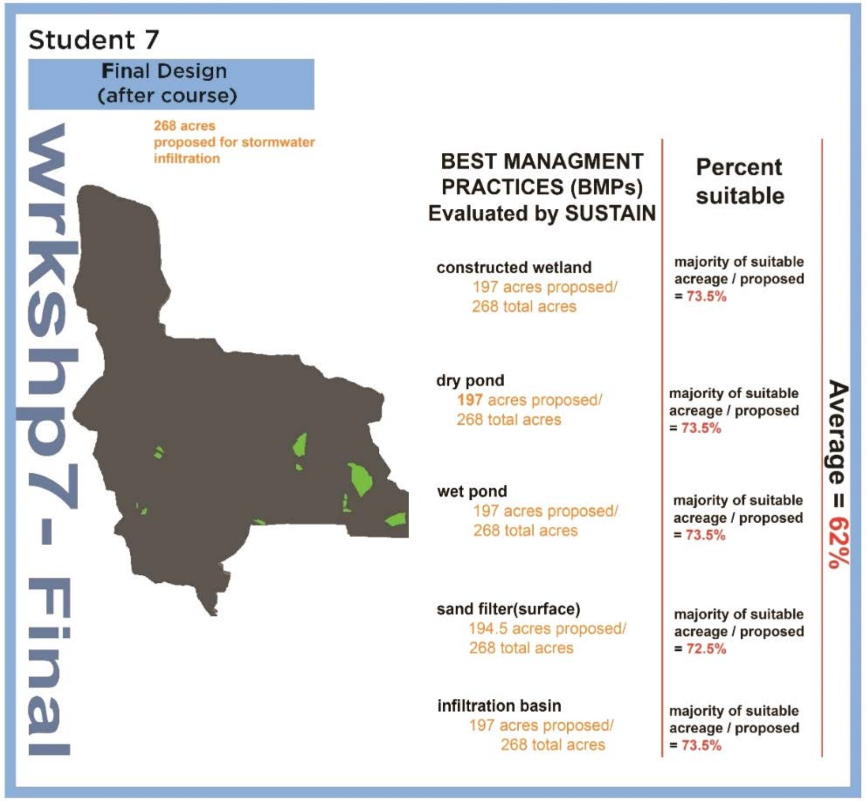




Design Algorithm:

BMPs improved

if < 2 improved =LOW
2-3 improved = MEDIUM
>4 improved = HIGH

5 improved = HIGH

LOW

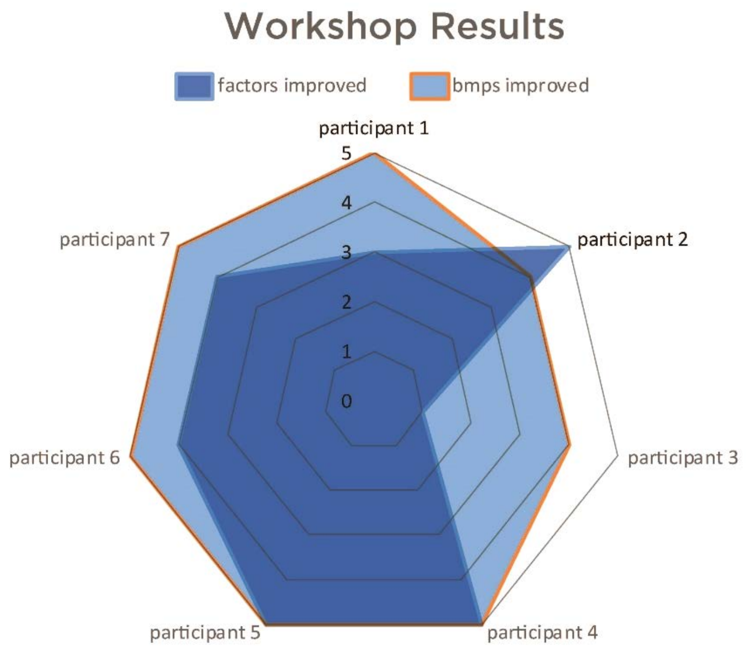
MEDIUM

HIGH

Step 3
Evaluate

WORKSHOP							
	Self-Reported			Spatially Explicit			Learning
	positive change	no change	negative	pos.	no change	negative	
student 1	3 factors improved			5 BMPs improved			Medium to High
student 2	5 factors improved			4 BMPs improved			Medium to High
student 3	1 factor improved			4 BMPs improved			Low to Medium
student 4	5 factors improved			5 BMPs improved			High
student 5	5 factors improved			5 BMPs improved			High
student 6	4 factors improved			5 BMPs improved			Medium to High
student 7	4 factors improved			5 BMPs improved			Medium to High

- High
- Medium to High
- Medium
- Low to Medium
- Low



Step 3
Evaluate

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DIAGNOSIS:

a) **INTRINSIC LOAD**:

too much information + not enough time
= too little processing

b) **EXTRANEOUS LOAD**:

the material was not activated adequately
within an exercise

c) **GERMANE LOAD**:

a method of organization was not
presented to Student 7

Step 4
Diagnose

DIAGNOSIS:

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c) **GERMANE LOAD**:

a method of organization was not presented to Student 7

PRESCRIBE:

a) REDUCE INTRINSIC LOAD

-Adding discussion topics and a particular case study focused solely around reduction of runoff
-an exercise to be completed on Student 7's own time

b) REDUCE EXTRANEOUS LOAD:

an exercise using the EPA's stormwater calculator to show the benefits of using stormwater facilities to reduce runoff

c) REDUCE GERMANE LOAD:

an exercise to explain a method for runoff reduction

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