

Augmented Realities: Richly Contextualized Learning throughout Life:

Chris Dede

Harvard University

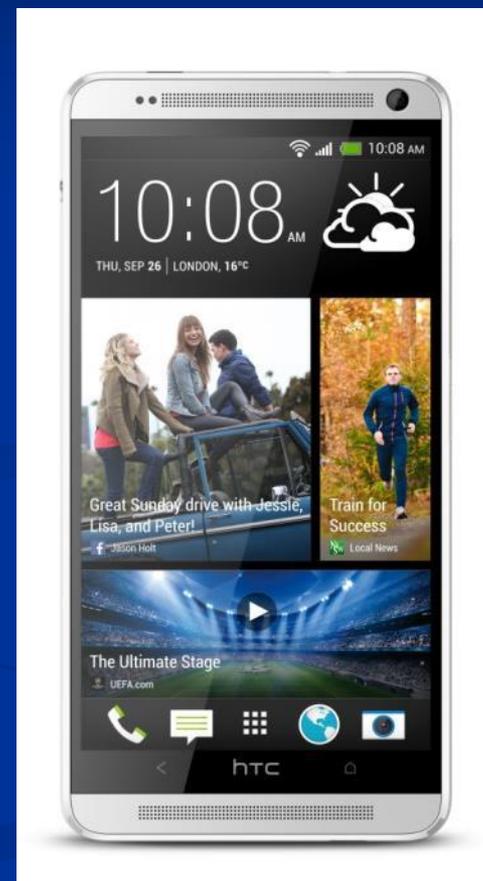
Chris_Dede@harvard.edu

http://isites.harvard.edu/chris_dede

1976



2014





MINECRAFT



representation



(Conner Flynn)

Augmenting Real World Ecosystems

<http://ecomobile.gse.harvard.edu>

EcoMOBILE

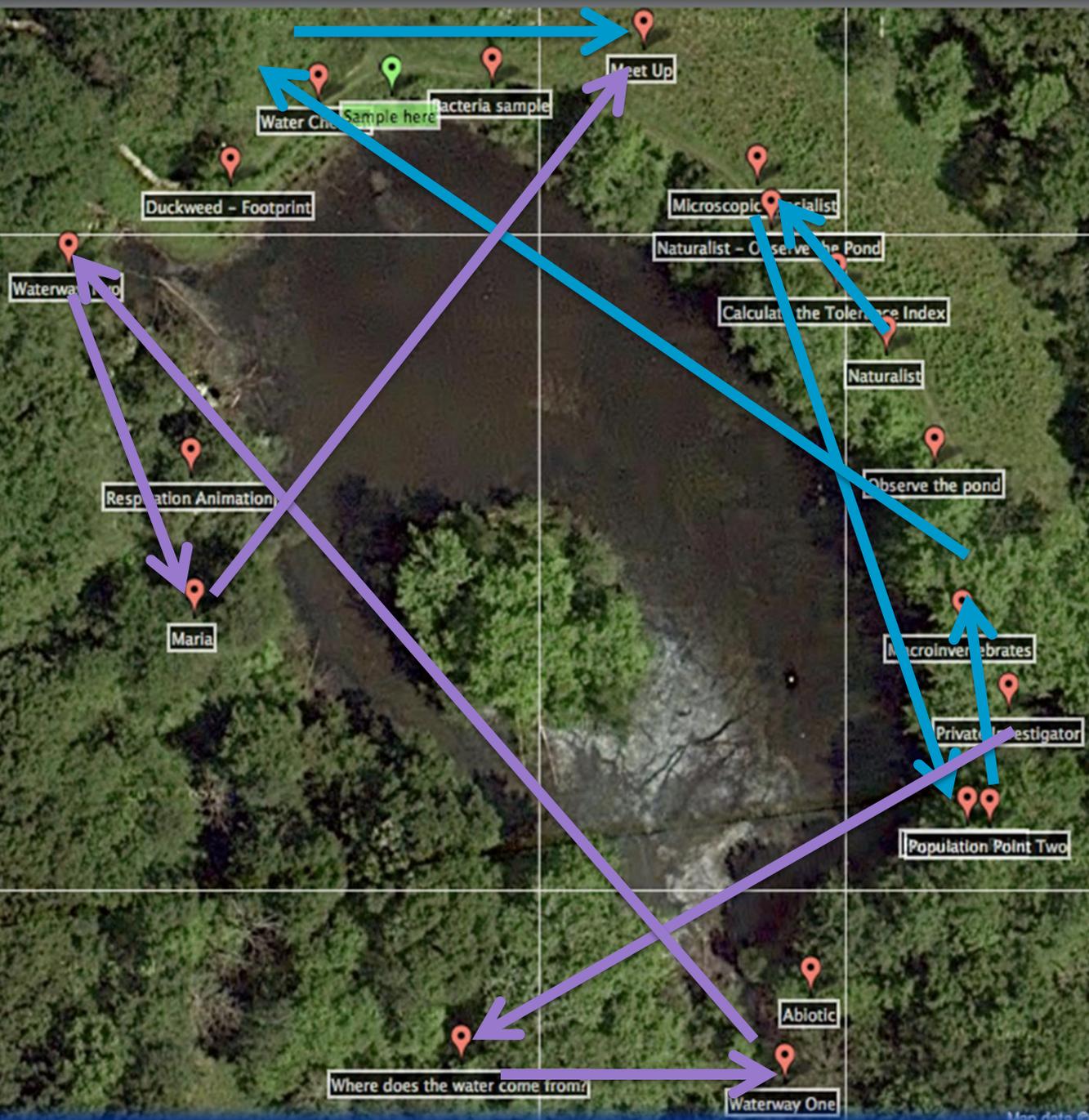


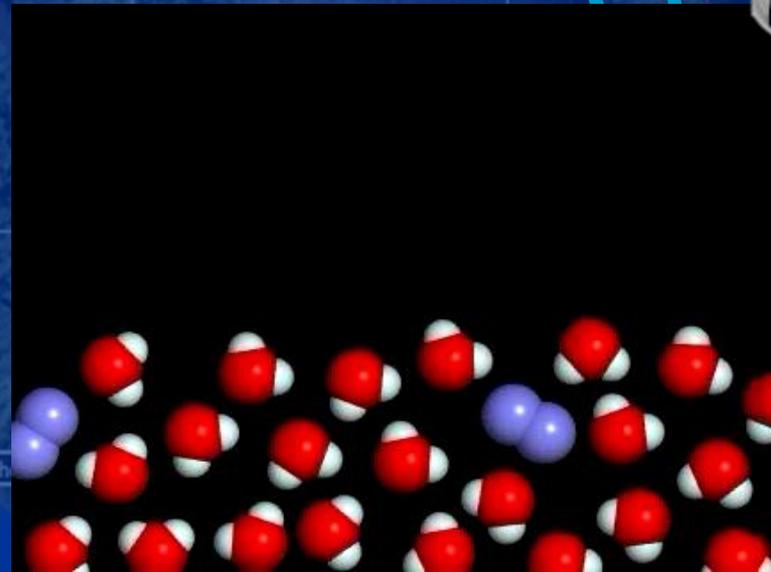
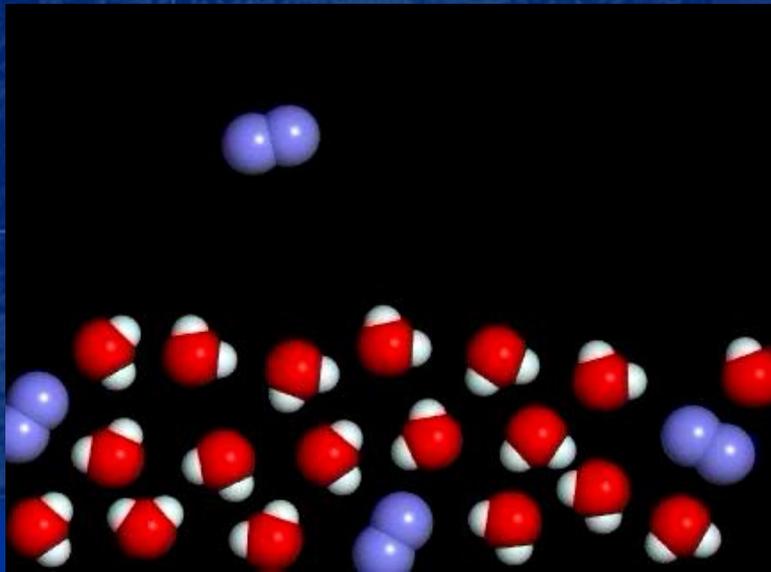
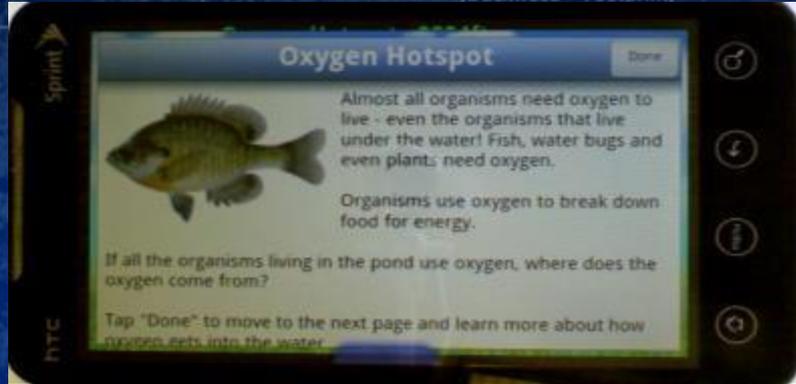
Minuteman Connector Bikeway

Minuteman Connector Bikeway



Parker Meadow





GoPro Cameras Capture EcoMOBILE Experience



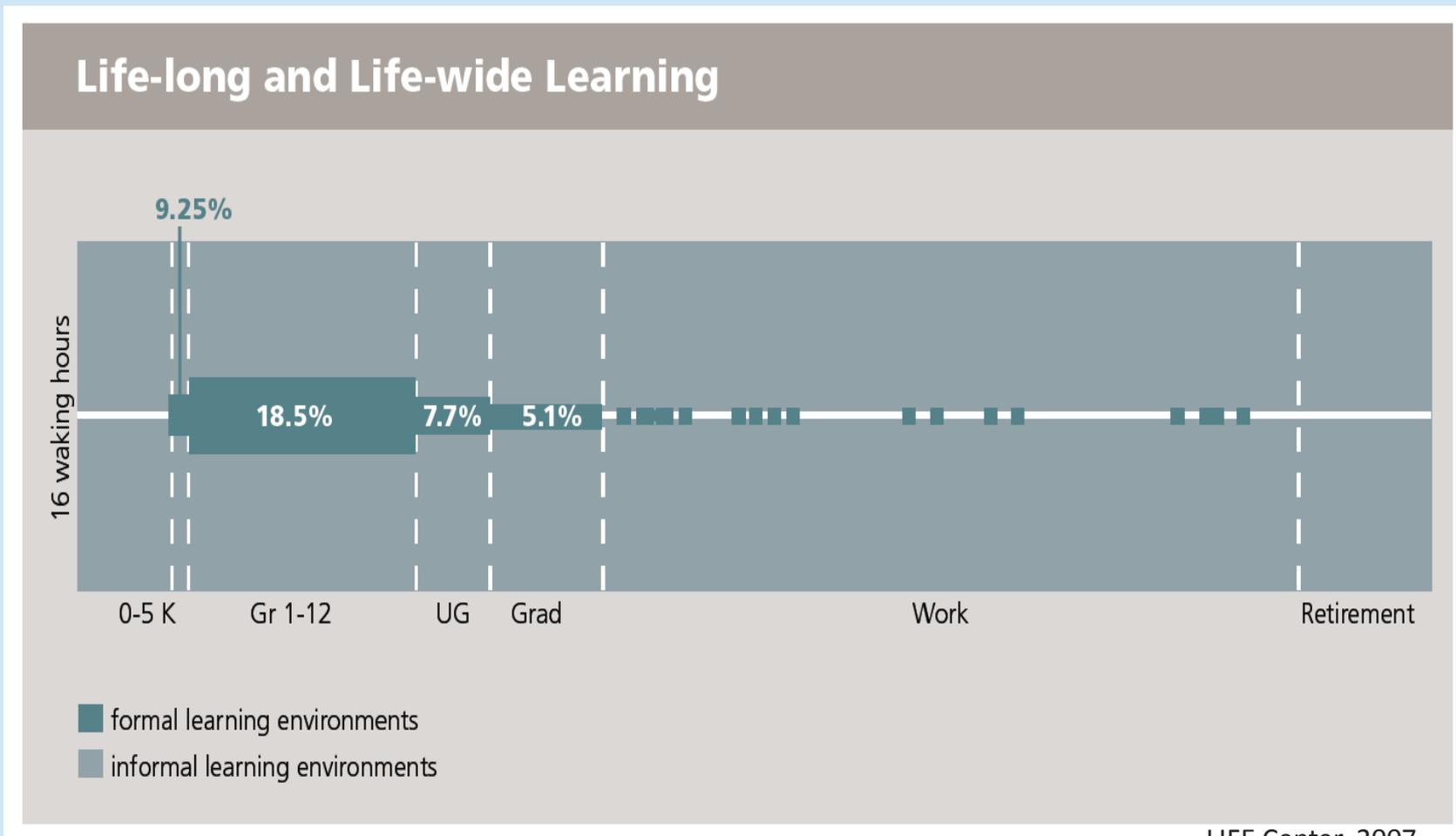


Interface for Your Digital Life

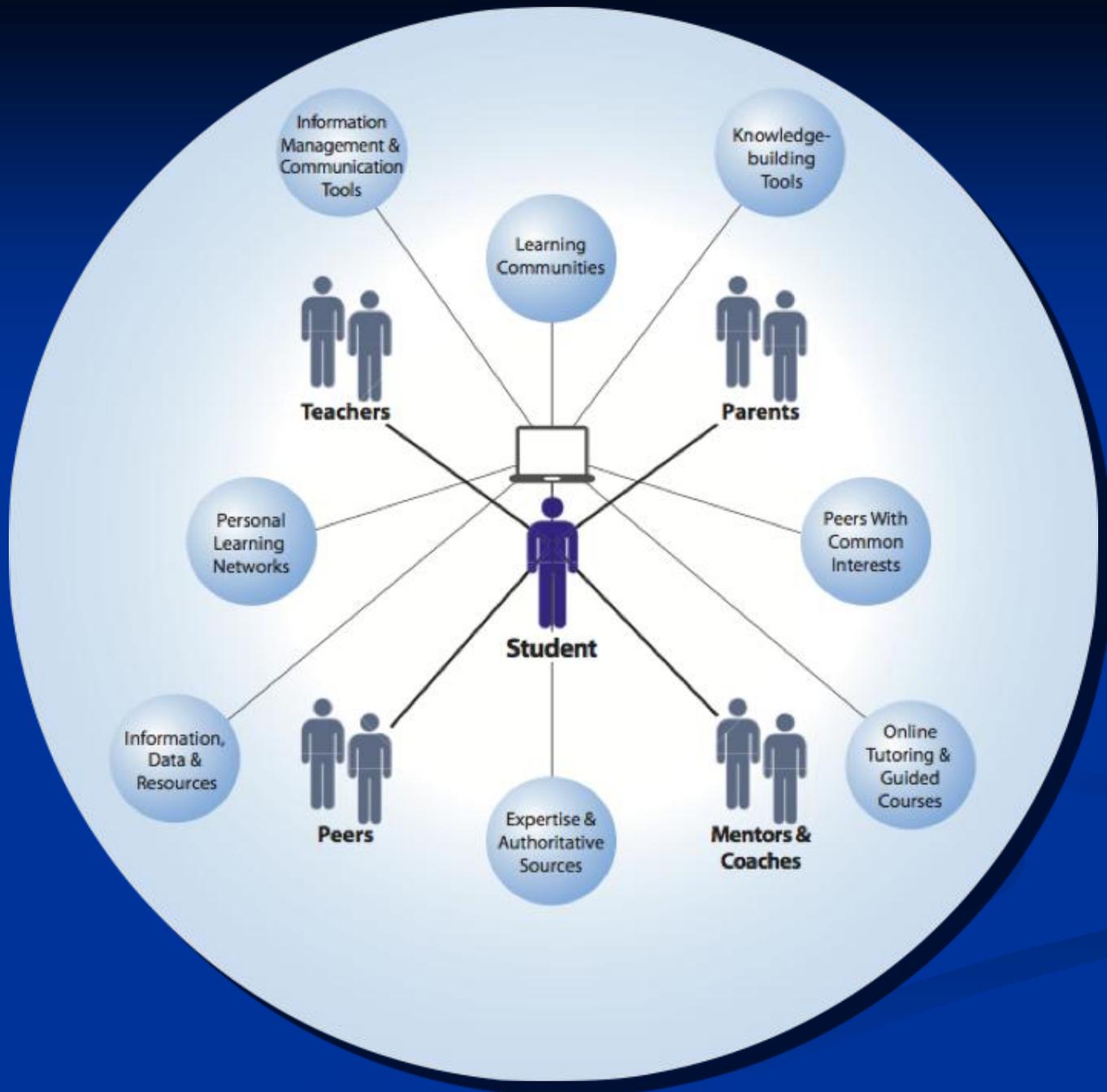
IN THE FUTURE YOUR MOBILE PHONE WILL ACT AS YOUR DIGITAL “6TH SENSE”



The Plan Treats Learning as Life-long and Life-wide



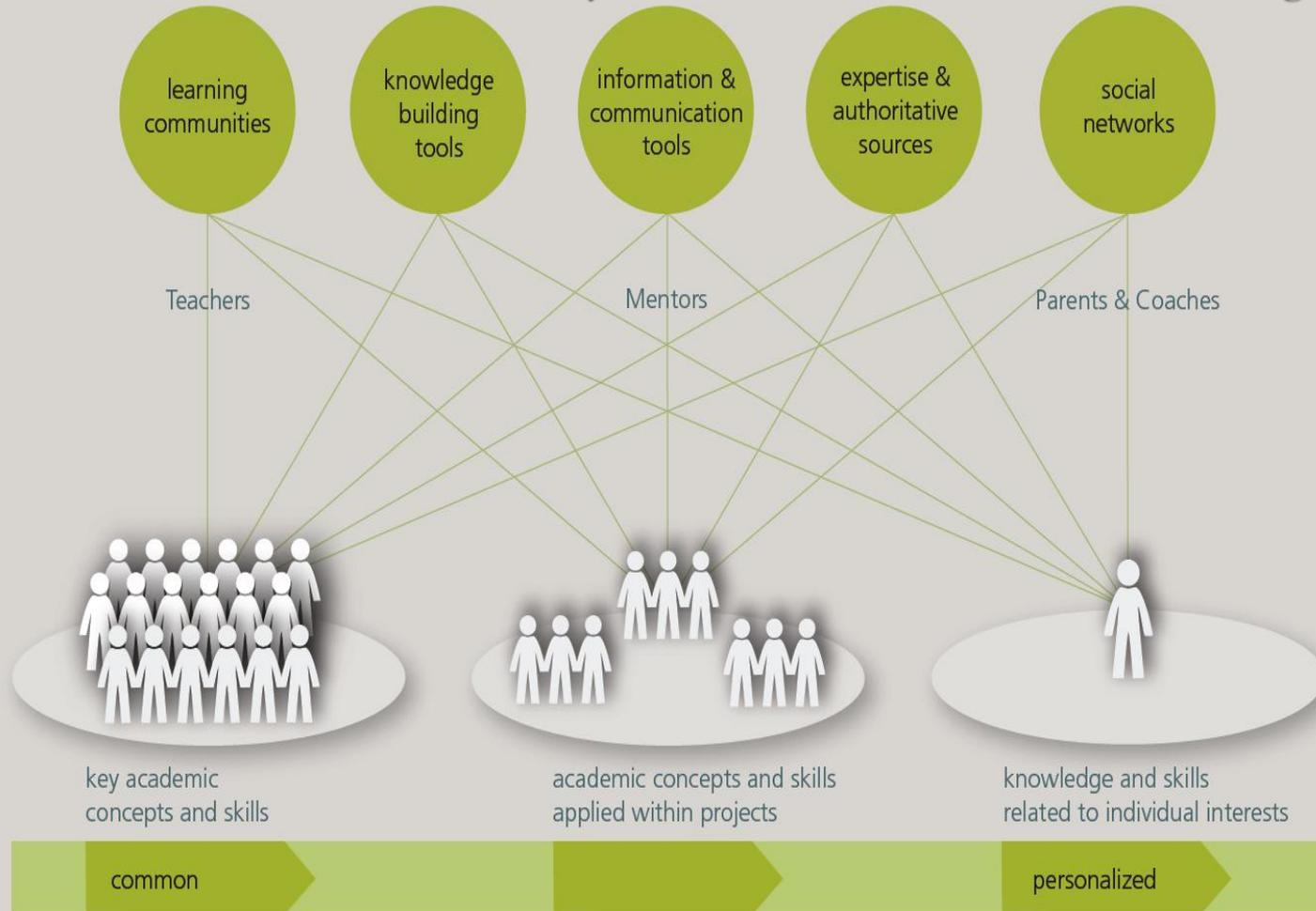
LIFE Center, 2007





Connected Teaching

Teachers will engage students and provide personalized learning with 24/7 teacher support. Online environments will ensure that every student has access to effective teaching.



Learning Experience

Module 1: Pond Ecosystem

Modeled after Black's Nook Pond in Cambridge, MA



<http://ecomuve.gse.harvard.edu>



EcoMUVE is a **MODEL** of a natural environment



- simplified components and interactions
- emphasis on space and time
- takes advantage of technological affordances





Non-obvious causes

A submarine tool explores the microscopic organisms in the pond, helping students understand that organisms that they cannot see play a critical role in the pond ecosystem.



Carbon Atom

Hi, I'm a CARBON atom! I'm a part of a starch molecule in this duckweed plant. Whoa! My duckweed plant just got eaten by a duck! Now I'm in the duck's stomach.

OK

Atom Tracker

Atom tracker allows students to track three specific simulated atoms over time – oxygen, carbon, and phosphorus – these anthropomorphized atoms give students an “atom’s-eye-view” of conservation of matter.

TI Nspire



X

- Temp
- SO₂
- PH₂
- NO₂
- Turbidity
- pH
- OIL &

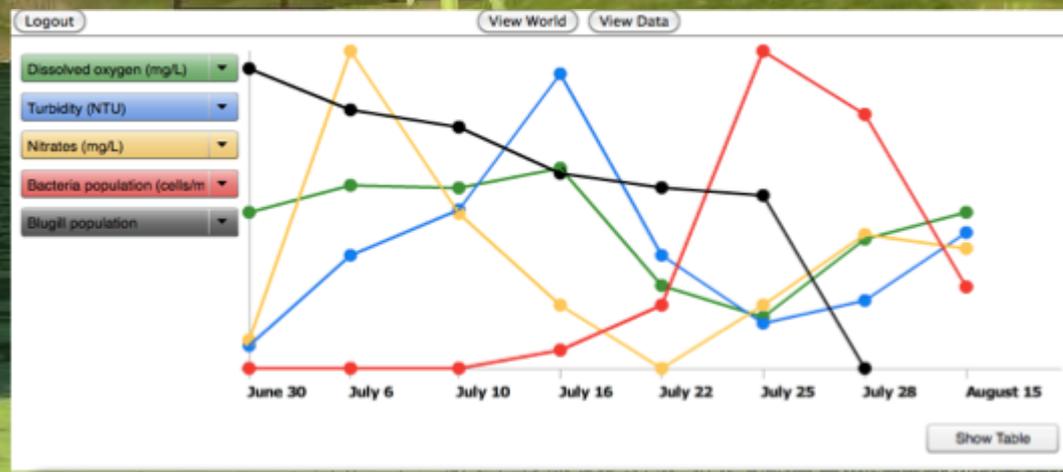
TI-nspire cx

8:53 12 8.83 NOAA Belle Isle, CO

Calculator interface showing a keypad and various function buttons. The keypad includes a numeric keypad (0-9), function keys (ctrl, caps, var, clear), and a QWERTY keyboard layout. The Texas Instruments logo is visible at the bottom.

X

- Temp
- DO
- pH
- NH₄
- NH₂
- Turbidity
- pH
- CHL a



Texas Instruments NSpires with Vernier Environmental Probes

Population Jun 30

Naturalist	Microscopic Specialist	Water Chemist	Private Investigator
Observe pond for similarities to EcoMUVE	Observe duckweed	Observe pond for similarities to EcoMUVE	Talk to virtual golfer
Observe virtual fish	View 3D model of duck	Measure dissolved oxygen	Observe storm water pipe overlay
Calculate fish population size	Video of starch decomposition by bacteria	Video of how oxygen dissolves in water	Find inlet and outlet of pond
Collect macroinvertebrates	Observe virtual bacteria	Measure water temperature	Talk to young girl about what a watershed is
ID macroinverts and calculate tolerance index	Measure pH	Measure phosphates	Measure turbidity

Work together to create video that summarizes the health of the pond based on whole team's observations

Logfiles: Events, Chats, Notebooks...

Database of Logdata - Track students' behaviors: where they went, what data they collected, path to solve problem

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	administra	testID	eventID	stage	timestamp	locationX	locationY	locationz	locationYa	assetID	detail	studentID	Description
2	3141592	497	0	0	2009-12-06	0	0	0	0	1	1	102282	assessment started
3	3141592	497	1	1	2009-12-06	364	23	-76	0	2	10	102282	stage started
4	3141592	497	2	1	2009-12-06	263	10	-6	270	2	10	102282	stage started
5	3141592	497	3	1	2009-12-06	263	8	-6	270	14	1	102282	notebook opened
6	3141592	497	4	1	2009-12-06	263	7	-6	270	14	2	102282	nitrate tab clicked in notebook
7	3141592	497	5	1	2009-12-06	257	8	-397	0	143	20	102282	Arrow selection of Surface of the bay in front of the tent
8	3141592	497	6	1	2009-12-06	0	0	0	0	2	11	102282	stage ended
9	3141592	497	7	1	2009-12-06	0	0	0	0	2	13	102282	stage ended ungracefully
10	3141592	497	8	1	2009-12-06	0	0	0	0	1	3	102282	
11	3141592	498	0	0	2009-12-06	0	0	0	0	1	1	102282	assessment started
12	3141592	498	1	1	2009-12-06	364	23	-76	0	2	10	102282	stage started
13	3141592	498	2	1	2009-12-06	263	10	-6	270	2	10	102282	stage started
14	3141592	498	3	1	2009-12-06	263	8	-6	270	14	1	102282	notebook opened
15	3141592	498	4	1	2009-12-06	263	7	-6	270	14	2	102282	nitrate tab clicked in notebook
16	3141592	498	5	1	2009-12-06	263	7	-6	270	14	3	102282	pop density tab clicked in notebook
17	3141592	498	6	1	2009-12-06	263	7	-6	270	14	4	102282	salinity tab clicked in notebook
18	3141592	498	7	1	2009-12-06	263	7	-6	270	14	2	102282	nitrate tab clicked in notebook
19	3141592	498	8	1	2009-12-06	263	7	-6	270	14	1	102282	notebook opened
20	3141592	498	9	1	2009-12-06	0	0	0	0	2	11	102282	stage ended
21	3141592	498	10	1	2009-12-06	0	0	0	0	2	13	102282	stage ended ungracefully
22	3141592	498	11	1	2009-12-06	0	0	0	0	1	3	102282	
23	3141592	499	0	0	2009-12-06	0	0	0	0	1	1	102282	assessment started
24	3141592	499	1	1	2009-12-06	364	23	-76	0	2	10	102282	stage started
25	3141592	499	2	1	2009-12-06	263	10	-6	270	2	10	102282	stage started
26	3141592	499	3	1	2009-12-06	263	8	-6	270	14	1	102282	notebook opened
27	3141592	499	4	1	2009-12-06	263	7	-6	270	14	2	102282	nitrate tab clicked in notebook
28	3141592	499	5	1	2009-12-06	233	4	-5	291	3	4	102282	teleport KB kelp
29	3141592	499	6	1	2009-12-06	236	6	-4	291	2	11	102282	stage ended
30	3141592	499	7	4	2009-12-06	129	10	125	0	2	10	102282	stage started
31	3141592	499	8	4	2009-12-06	124	2	117	108	212	20	102282	Arrow selection of Striped surfperch
32	3141592	499	9	4	2009-12-06	123	0	123	0	107	22	102282	Population density reading for Bull kelp
33	3141592	499	10	4	2009-12-06	129	10	118	180	209	22	102282	Population density reading for Sea otter
34	3141592	499	11	4	2009-12-06	137	0	121	37	200	22	102282	Population density reading for Corraline algae
35	3141592	499	12	4	2009-12-06	133	0	117	0	111	24	102282	Temperature reading for Bay floor
36	3141592	499	13	4	2009-12-06	133	0	117	0	111	25	102282	Turbidity sample taken of Bay floor
37	3141592	499	14	4	2009-12-06	108	0	107	37	200	23	102282	Salinity reading for Corraline algae
38	3141592	499	15	4	2009-12-06	122	0	117	0	111	24	102282	nitrate reading for Bay floor

Match In-world Interactions to Rubrics

Question	Skill	observable variable	Evidence	score
question 1 final	Claim/Reasoning	20	55 claim pollution	0
question 2 final	Evidence	21		
add item for 21	Evidence	31	1 dead bee	5
add item for 21	Evidence	31	4 green bee	5
add item for 21	Evidence	31	8 green larvae	5
add item for 21	Evidence	31	10 lab nectar	5
add item for 21	Evidence	31	13 green nectar	5
question 3 final	Experiment: Water	22	13 green nectar	5
question 3 final	Experiment: Water	22	10 lab nectar	2
question 4 final	Experiment: DNA	23	60 no DNA results	5
question 4 final	Experiment: DNA	23	4 green bee	2
question 4 final	Experiment: DNA	23	1 six bee	2
question 5 final	Experiment: Blood	24	1 six bee	2
question 5 final	Experiment: Blood	24	4 green bee	5
question 6 final	All data: Evidence Tadpole	25	6 green larvae	5
question 7 final	All data: Evidence Frogs	26	4 green bee	5
question 8 final	All Data: Experiment: Wat	27	13 green nectar	5
question 9 final	All Data: Experiment: DNA	28	60 no DNA results	5
question 9 final	All Data: Experiment: DNA	28	4 green bee	2
question 9 final	All Data: Experiment: DNA	28	1 six bee	2
question 10 final	All Data: Experiment: Bloc	29	1 six bee	2
question 10 final	All Data: Experiment: Bloc	29	4 green bee	5

Formative/Diagnostic

- Formative diagnostic assessment provides *more leverage for improvement* than summative measures
- Formative diagnostic assessment is *richer and more accurate* than summative measures
- Potentially, formative diagnostic assessment *could substitute for* summative measures.

What Can We Inculcate and Assess?

- Inquiry skills?
- Collaboration?
- Leadership?
- Self-efficacy?
- Metacognition?