BRIDGING THE PATHWAY FROM INSTRUCTION TO RESEARCH

AAAS/AIBS Summit
15 May 2008

Diane Ebert-May
Michigan State University
www.first.ecoinfomatics.org

Engage

- What are your reasons for conducting educational research or not doing so?

1. Think individually
2. Write three reasons on the card provided.
3. Take a minute to discuss your reasons with a neighbor.

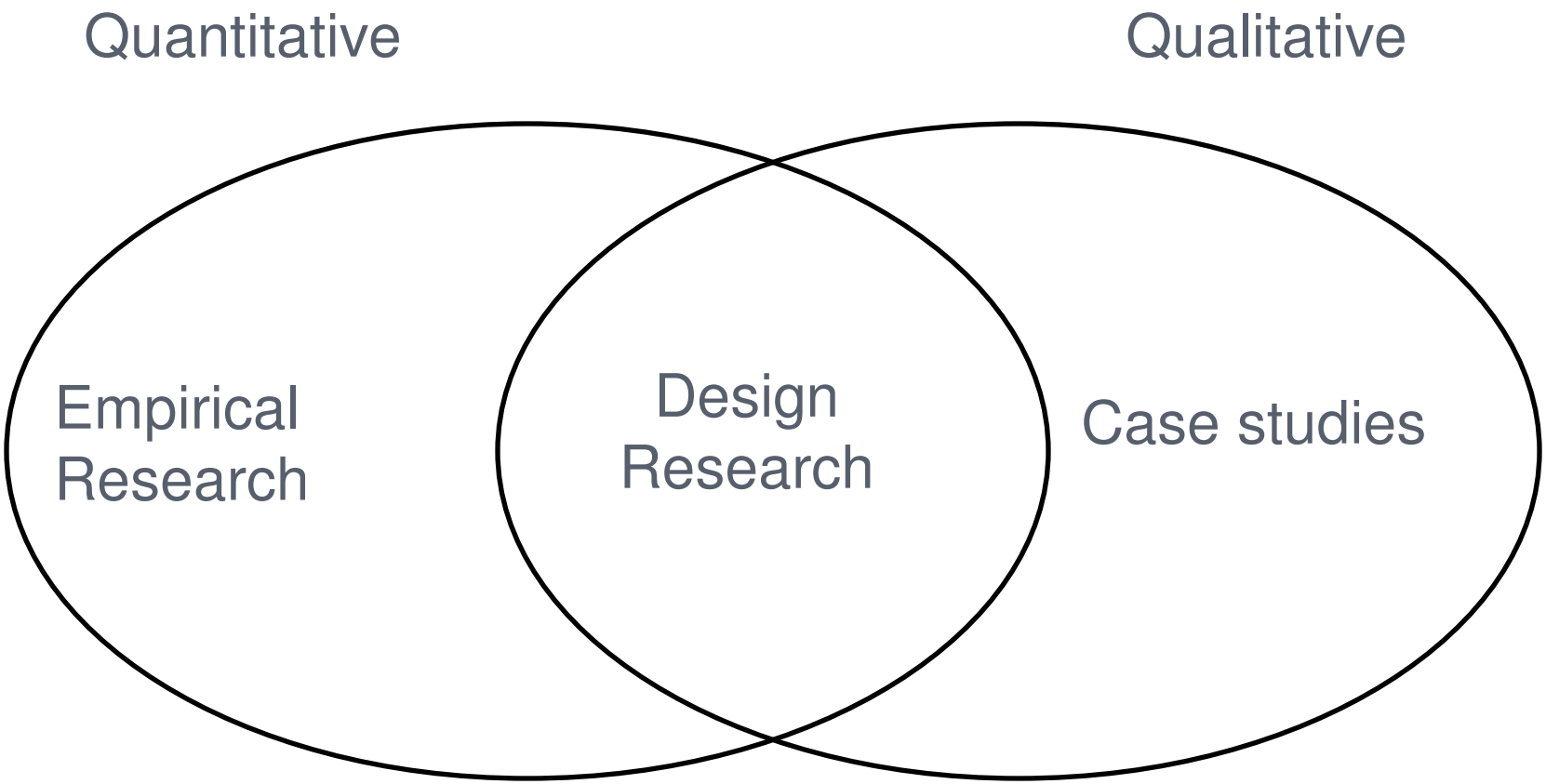
From expert teacher to teacher scholar/researcher

- Effective teacher - reflects on why students are not learning
- Designs the most stimulating and inspiring learning environment to help students overcome difficulty in learning
- Teacher scholar takes the next step…..

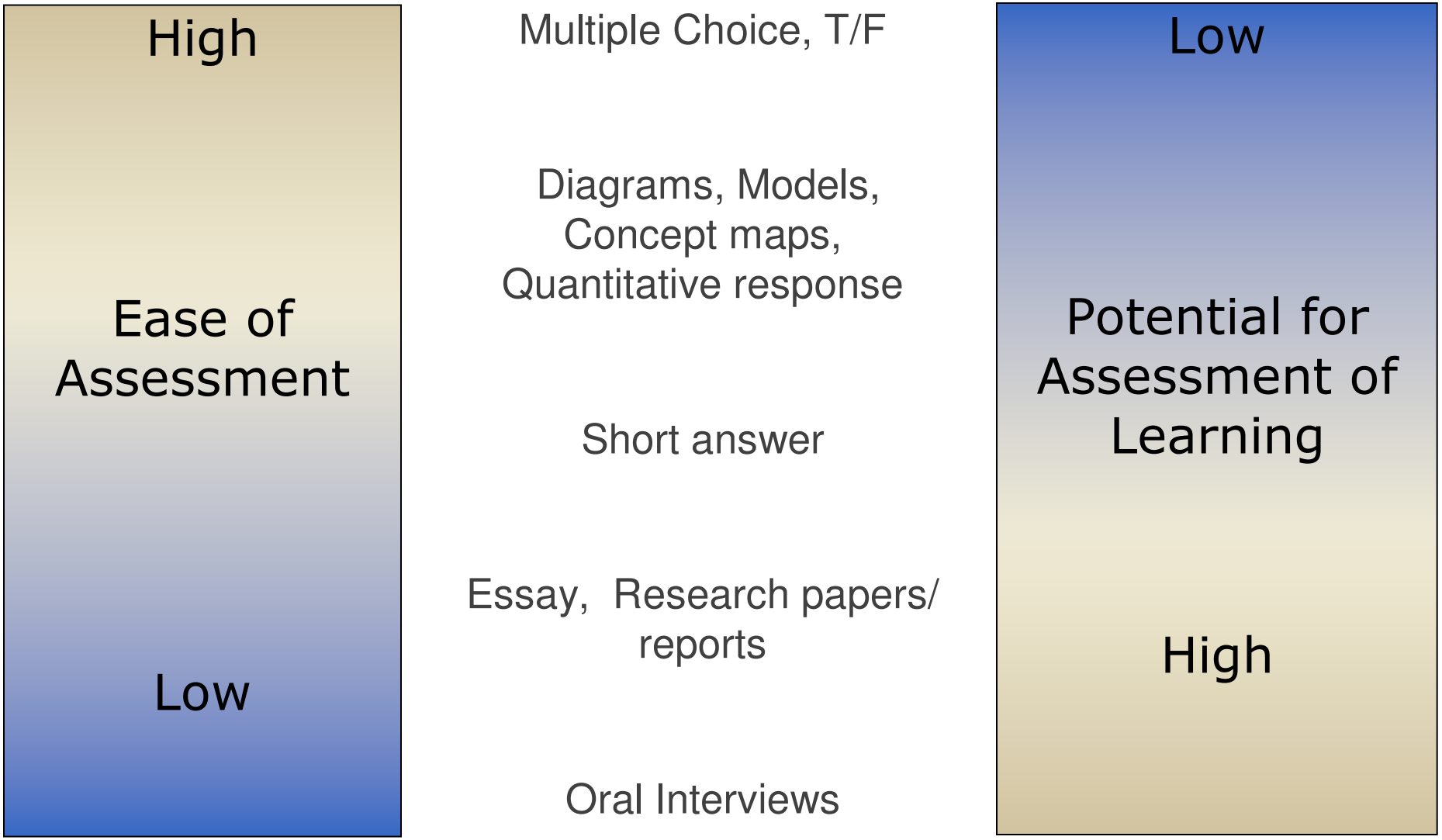
…Inquire into students' learning

- What is the question?
  - What does students' work tell you about their learning?
  - What are the assumptions and the variables you need to recognize to effectively interpret their work?
  - Observing and listening in classrooms….

What is the research design?



Data collection, what types?



How to analyze data?

Quantitative data - statistical analysis

Qualitative data

- break into manageable units and define coding categories
- search for patterns, quantify
- interpret and synthesize

Valid and repeatable measures

Reporting the results…

- Statistical and PRACTICAL significance
- How results fit into the literature
- Problems and limitations of the study
- Is this research repeatable?
- Generalizable to another course? …another year? …another population of students?

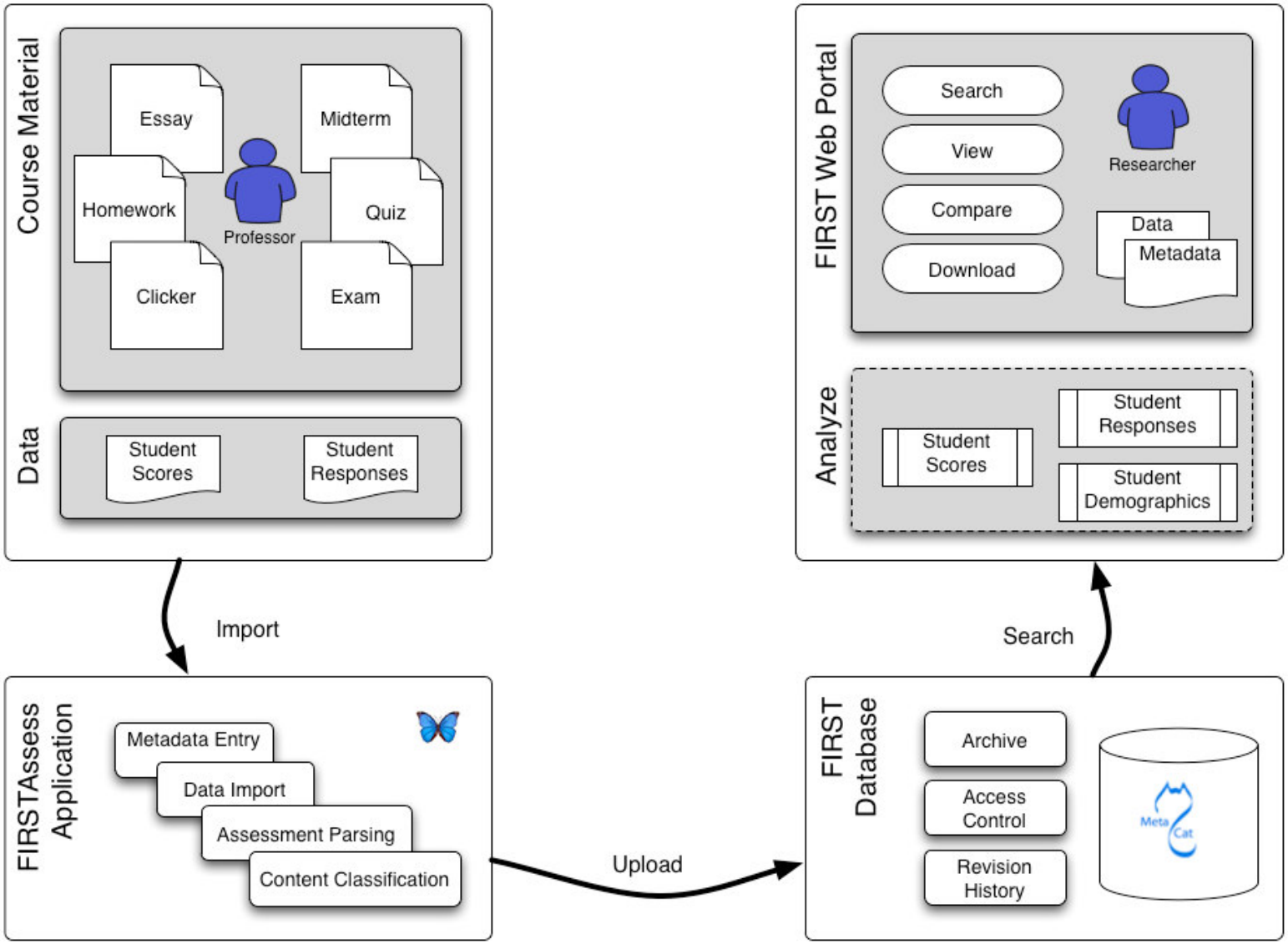
Biology education is not local…

"Why do we never seem to share and pass down to succeeding generations anything we learn in physics education?

What can we do to change this?"

Edward F. Redish
Milliken Award Lecture 1998

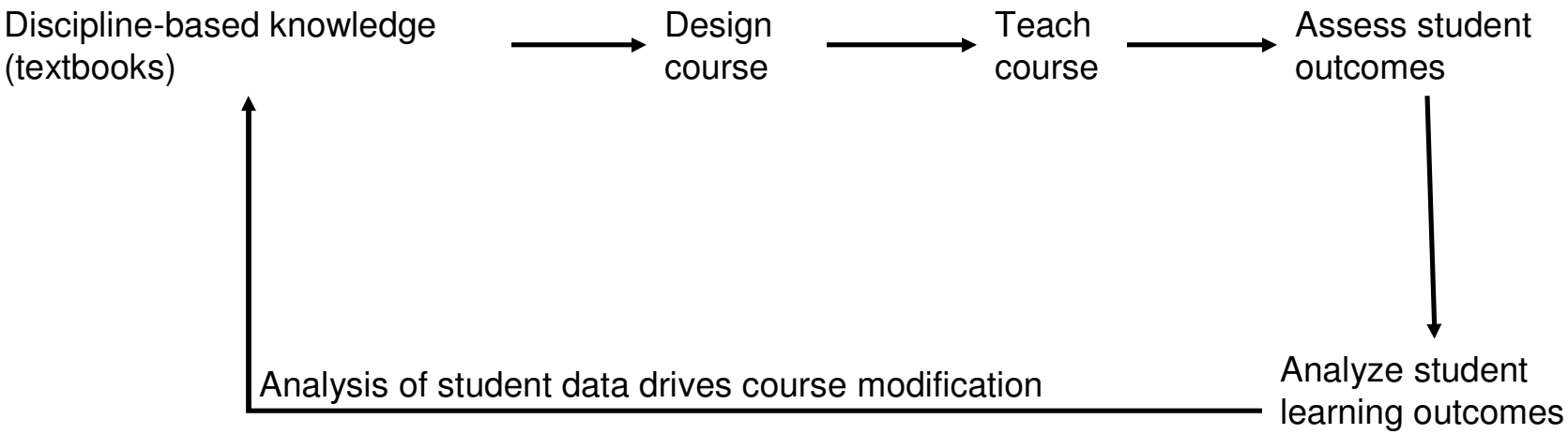
Overview of the FIRST Assessment Database



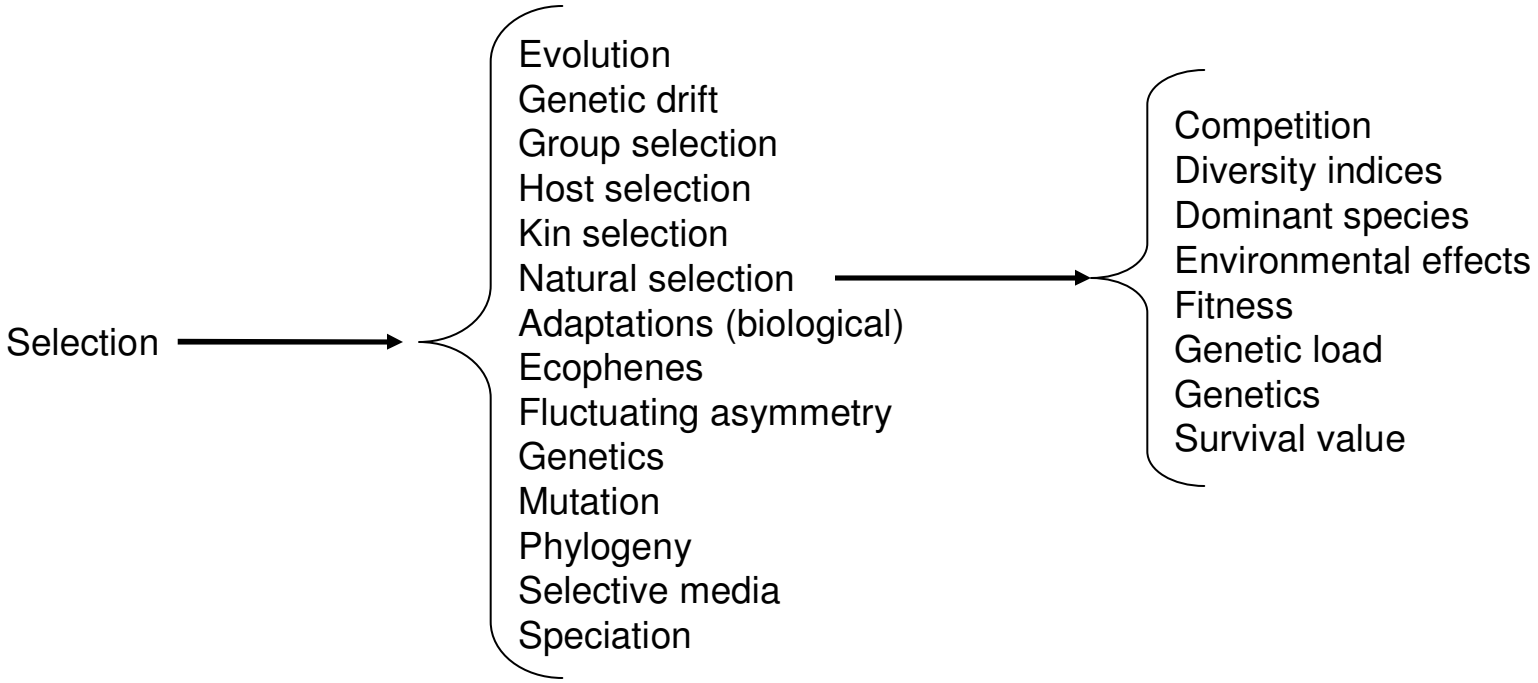
Two models of instructional design

Traditional pedagogy: informed by discipline-specific content knowledge

Reformed pedagogy: informed by student-generated data



Biocomplexity Thesaurus (http://thesaurus.nbii.gov)



Examples of course- and assessment-level metadata captured by the FIRST Database

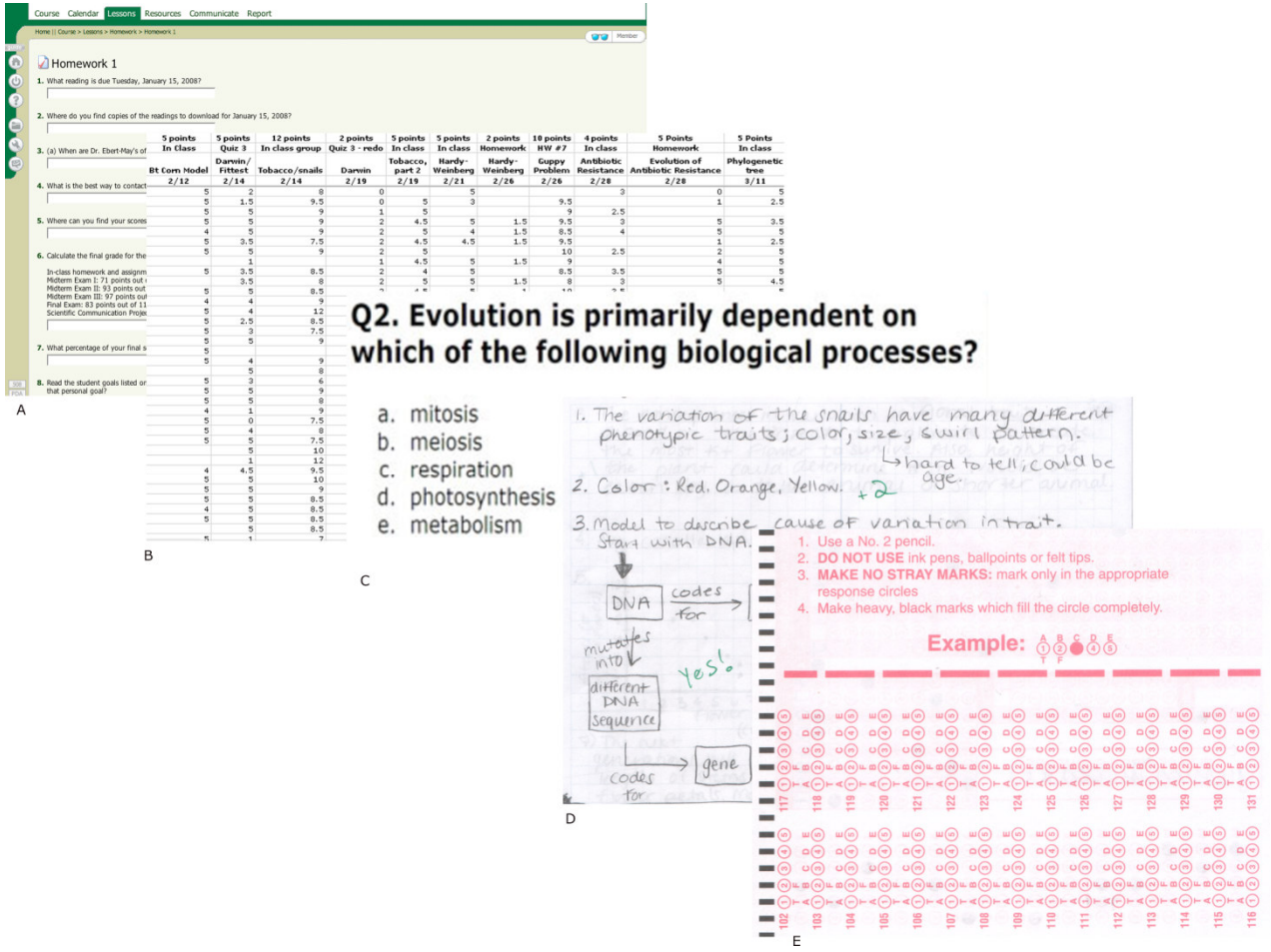
Course-level Metadata

Institution type/size
Course format (lab, lecture, discussion, etc)
Course size
Targeted students (majors, non-majors, lower or upper level)
Course Syllabus

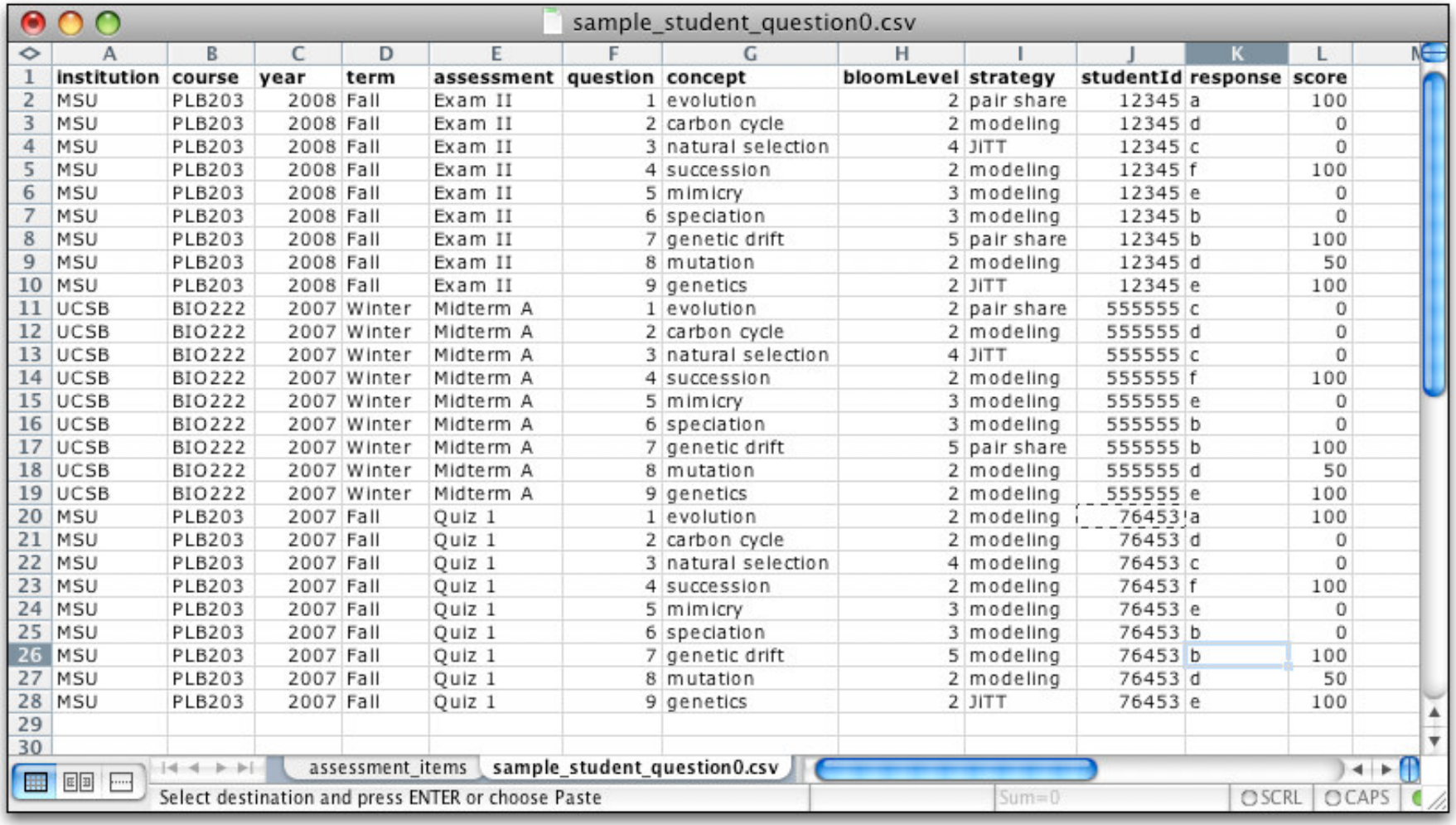
Assessment-level Metadata

Type of assessment (e.g., in-class, open book, exam)
Proportion of final grade
Bloom's level of understanding
Concept category

Data sources



Database output



sample_student_question0.csv

	A	B	C	D	E	F	G	H	I	J	K	L
1	institution	course	year	term	assessment	question	concept	bloomLevel	strategy	studentId	response	score
2	MSU	PLB203	2008	Fall	Exam II	1	evolution	2	pair share	12345	a	100
3	MSU	PLB203	2008	Fall	Exam II	2	carbon cycle	2	modeling	12345	d	0
4	MSU	PLB203	2008	Fall	Exam II	3	natural selection	4	JiTT	12345	c	0
5	MSU	PLB203	2008	Fall	Exam II	4	succession	2	modeling	12345	f	100
6	MSU	PLB203	2008	Fall	Exam II	5	mimicry	3	modeling	12345	e	0
7	MSU	PLB203	2008	Fall	Exam II	6	speciation	3	modeling	12345	b	0
8	MSU	PLB203	2008	Fall	Exam II	7	genetic drift	5	pair share	12345	b	100
9	MSU	PLB203	2008	Fall	Exam II	8	mutation	2	modeling	12345	d	50
10	MSU	PLB203	2008	Fall	Exam II	9	genetics	2	JiTT	12345	e	100
11	UCSB	BIO222	2007	Winter	Midterm A	1	evolution	2	pair share	555555	c	0
12	UCSB	BIO222	2007	Winter	Midterm A	2	carbon cycle	2	modeling	555555	d	0
13	UCSB	BIO222	2007	Winter	Midterm A	3	natural selection	4	JiTT	555555	c	0
14	UCSB	BIO222	2007	Winter	Midterm A	4	succession	2	modeling	555555	f	100
15	UCSB	BIO222	2007	Winter	Midterm A	5	mimicry	3	modeling	555555	e	0
16	UCSB	BIO222	2007	Winter	Midterm A	6	speciation	3	modeling	555555	b	0
17	UCSB	BIO222	2007	Winter	Midterm A	7	genetic drift	5	pair share	555555	b	100
18	UCSB	BIO222	2007	Winter	Midterm A	8	mutation	2	modeling	555555	d	50
19	UCSB	BIO222	2007	Winter	Midterm A	9	genetics	2	modeling	555555	e	100
20	MSU	PLB203	2007	Fall	Quiz 1	1	evolution	2	modeling	76453	a	100
21	MSU	PLB203	2007	Fall	Quiz 1	2	carbon cycle	2	modeling	76453	d	0
22	MSU	PLB203	2007	Fall	Quiz 1	3	natural selection	4	modeling	76453	c	0
23	MSU	PLB203	2007	Fall	Quiz 1	4	succession	2	modeling	76453	f	100
24	MSU	PLB203	2007	Fall	Quiz 1	5	mimicry	3	modeling	76453	e	0
25	MSU	PLB203	2007	Fall	Quiz 1	6	speciation	3	modeling	76453	b	0
26	MSU	PLB203	2007	Fall	Quiz 1	7	genetic drift	5	modeling	76453	b	100
27	MSU	PLB203	2007	Fall	Quiz 1	8	mutation	2	modeling	76453	d	50
28	MSU	PLB203	2007	Fall	Quiz 1	9	genetics	2	JiTT	76453	e	100
29												
30												

assessment_items | sample_student_question0.csv

Select destination and press ENTER or choose Paste | Sum=0 | SCRL | CAPS

Rethinking of the Biology We Teach

- Requires interdisciplinary activities
  - Doing biology and understanding the cognitive psychology of understanding biology
- Conducting the research
- Disseminating the research

Instructional Research and Development Teams

- Who? senior faculty, junior faculty, postdoctoral and graduate students - intergenerational teams.
- What? scholarship of science teaching and learning is fully integrated into the professional culture along with discipline-based activities.
- Data (assessment) is critical to both practices.

Thanks and appreciation …

- Database Development Team
- Jenni Momsen - MSU
- Mark Urban-Lurain - MSU
- Elena Bray Speth - MSU
- Ryan McFall - Hope College
- Matt Jones - NCEAS
- Ben Leinfelder - NCEAS

- Faculty - throughout the US

- National Science Foundation

Research Question on Evolution

Obtain reliable and consistent measurements of students' understanding of evolutionary concepts.

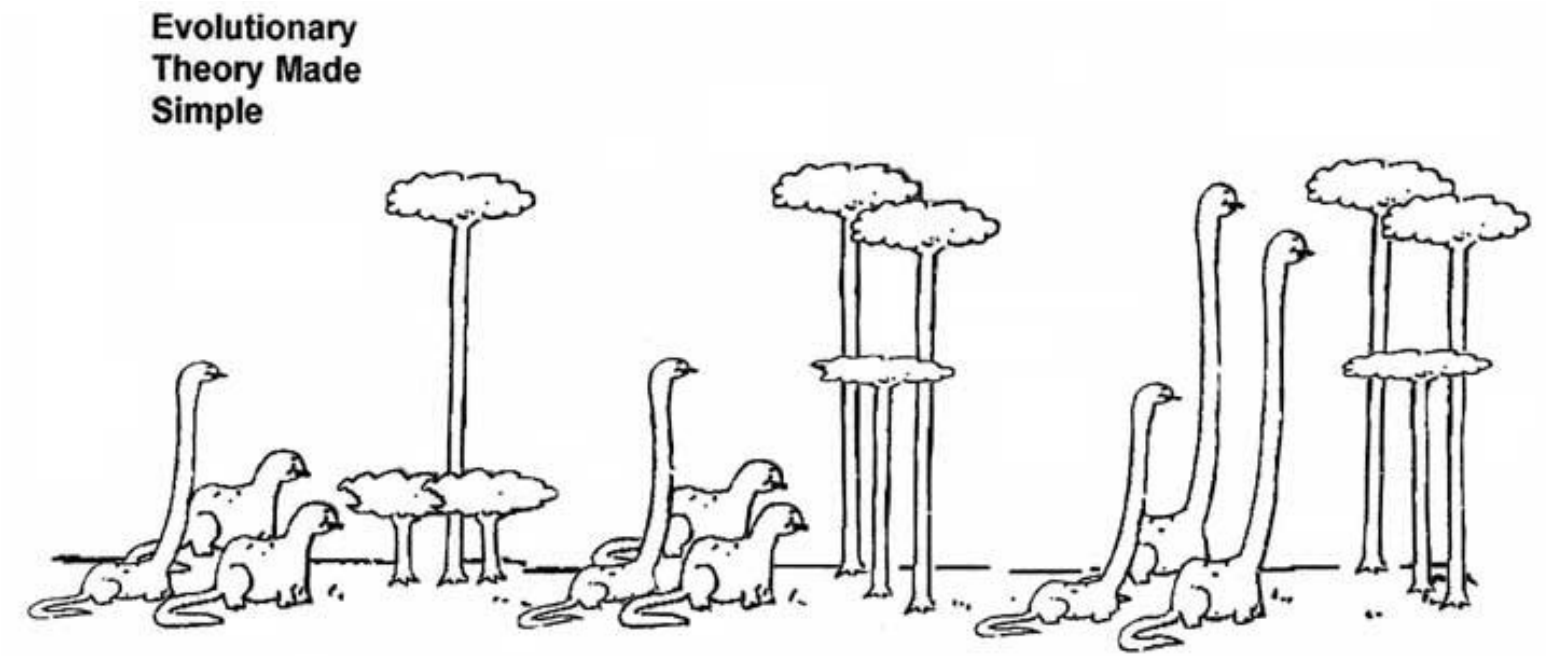
Assumption: use of multiple types of assessment provides a more powerful tool for analyzing the richness and complexity of student learning outcomes than a single type of assessment.

Elena Bray Speth,
Postdoctoral Fellow
Plant Biology, MSU

Assessment Framework

	Assessment	
Evolution Concepts	CINS (multiple choice)	Dino/tree (short answer)
Variation in a population		
Origin of variation		
Variation is inherited		
Fitness		
Change in a population		

Assessment Question



Explain the changes that occurred in the trees and animals.
Use your current understanding of evolution by natural selection.