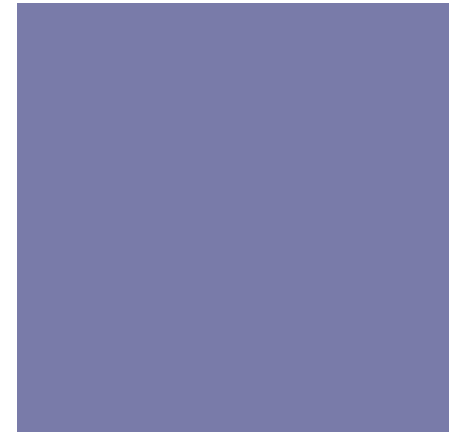




REFORM 4
CREATIVITY
+
INNOVATION



PREPARING
THE NEXT
GENERATION
OF STEM
INNOVATORS

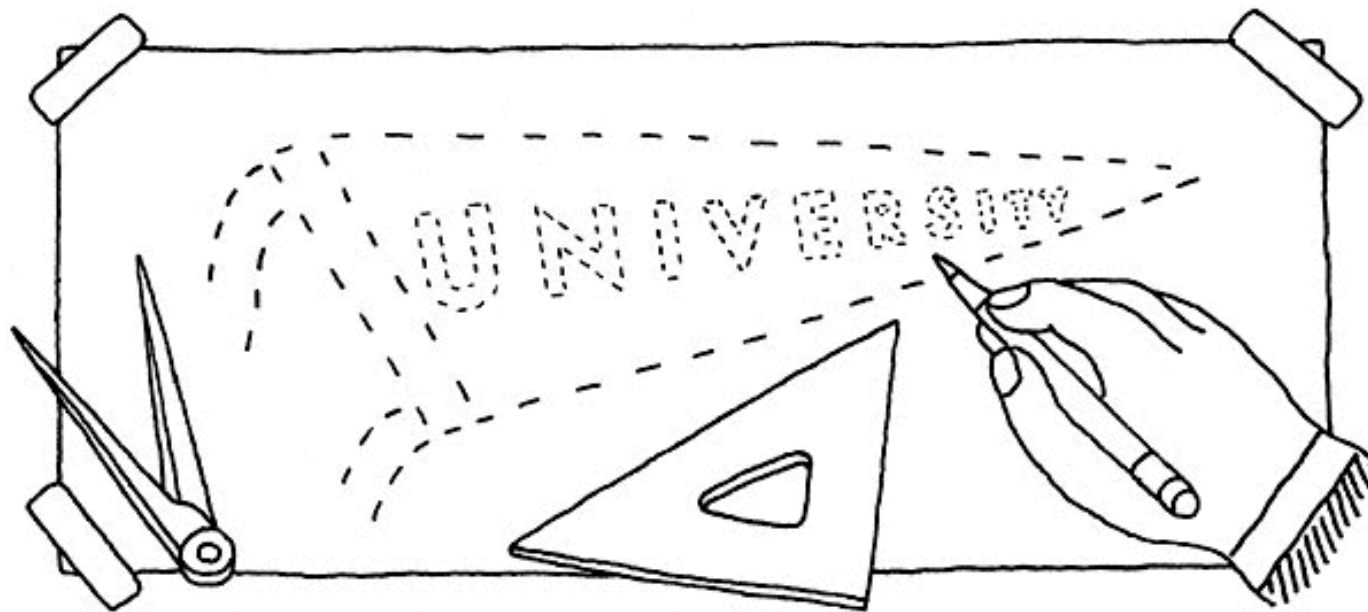
National Science Board
August 24, 2009

Diana Rhoten, PhD
Social Science Research Council

The New York Times

OP-ED CONTRIBUTOR

End the University as We Know It



By MARK C. TAYLOR
Published: April 26, 2009

COMMENTS (437)

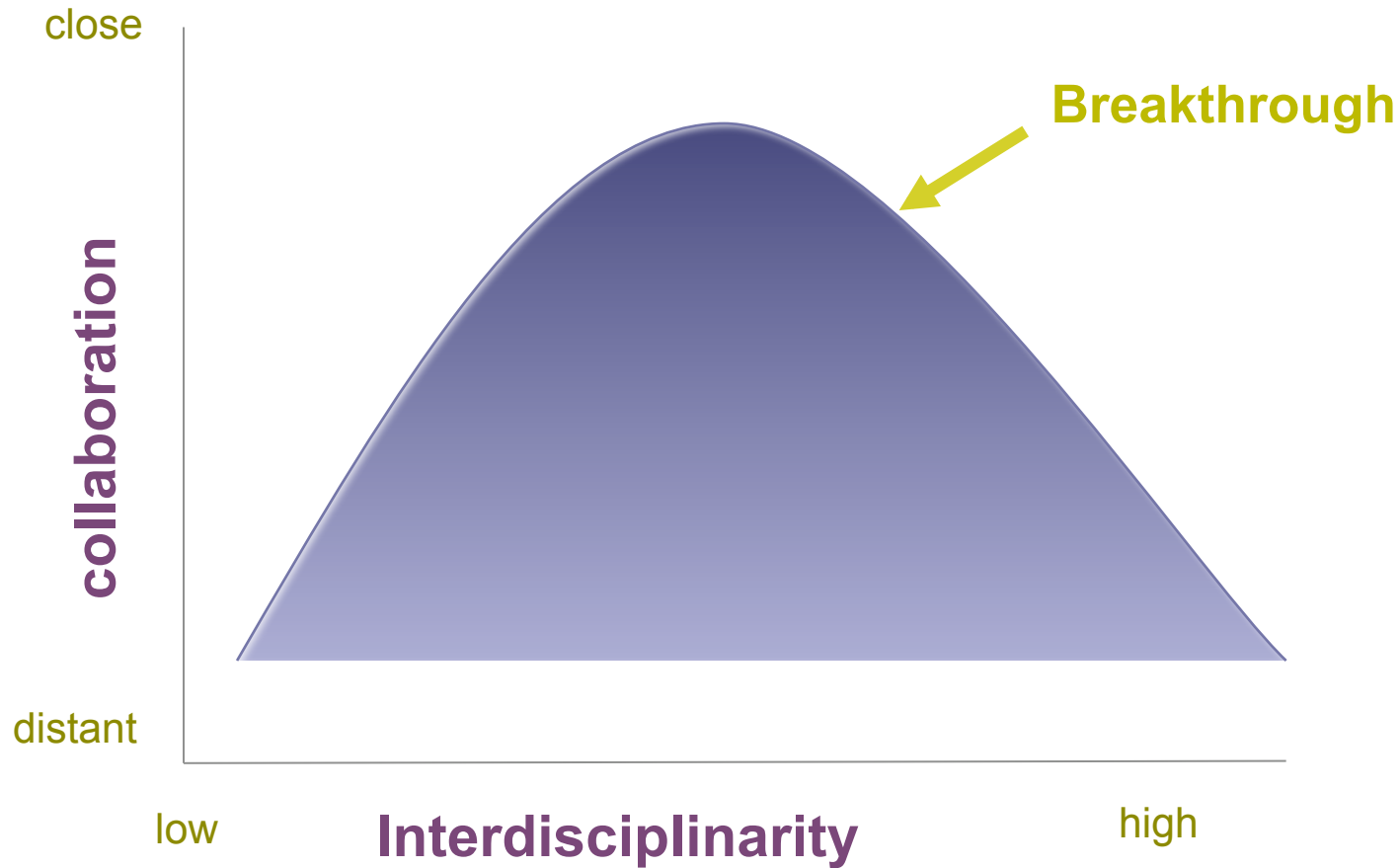
GRADUATE education is the Detroit of higher learning If American higher education is to thrive in the 21st century, colleges and universities, like Wall Street and Detroit, must be rigorously regulated and completely restructured ...

Education Reform Strategies



- Interdisciplinary Scholarship
- Interorganizational Collaboration
 - Multi-Media Dissertations
 - Alternative Professions
 - Abolish Departments
 - Abolish Tenure

Interdisciplinarity & Collaboration



Modified from: Hollingsworth (2001). *Research Organizations and Major Discoveries in Twentieth Century Science: A Case Study of Excellence in Biomedical Research*. Research Paper 02–003. Berlin: Wissenschaftszentrum Berlin für Sozialforschung.



SNOWBIRD
CHARRETTE

environmentalresearch



design

	IGERT students	Non-IGERT students
<p>Junior graduate students <i>(early - stage)</i></p>	<p>Ecology Ecology Ecology Agronomy/soil science Geoscience Atmospheric science</p>	<p>Ecology Ecology Ecology Agronomy/soil science Geoscience Atmospheric science</p>
<p>Senior graduate students <i>(later - stage)</i></p>	<p>Ecology Ecology Ecology Social science Geoscience Atmospheric science</p>	<p>Ecology Ecology Ecology Social science Geoscience Atmospheric science</p>

Interdisciplinary Collaboration: Process



Interdisciplinary Collaboration: Outcomes

A. HAAG



Grad idol: a multidisciplinary panel of experts questions the students about their research proposals.



Assessment Protocol

CATEGORY 3: INTERDISCIPLINARY INTEGRATION OF PROPOSAL						
Rating for individual criterion	Poor 1	Fair 2	Good 3	Very Good 4	Excellent 5	<i>SCORE</i>
Diversity (literature) Does the proposal draw from different disciplinary literatures relevant to the proposed study?	The proposal is grounded in the literature of only one discipline.	The proposal draws from the literature of two or more disciplines, but does not attempt to justify the inclusion of each or the connections between them. Some of the included disciplines may not be relevant ...	The proposal draws from the literature of two or more disciplines but does not manage to justify or explicate ... Some of the disciplines may be only be tangentially related to the proposed study, and/or crucial disciplines may be missing.	The proposal draws from the literature of two or more disciplines, and clearly articulates and justifies the inclusion of each and the connections between for the purposes of the study. All of the included disciplines are relevant to the proposed study, and no crucial disciplines are missing.	In addition to meeting the “very good” criteria, the proposal includes an original combination of disciplines that hold much promise for the proposed study. The proposal applies an truly inter-disciplinary knowledge structure to the proposed study	
Integration Does the proposal address a holistic topic and present an integrated framework to approach to that topic?	The proposal makes no obvious attempt to create an integrated framework by combining different disciplinary knowledge and methods in the proposed study. Or, a language of integration may be present but is very mechanistic or superficial at best.	The proposal attempts to develop an integrated framework by ... However, it does not integrate the elements of that framework in a generally coherent and effective way. In some instances, disciplinary concepts, theories, methods, etc don't fit	The proposal develops a framework by drawing from different disciplinary knowledge bases and methods, but some opportunities to advance the proposed study with this framework may be overlooked or undeveloped.	The proposal ... clearly brings disciplinary insights together in a coherent and effective way and takes advantage of opportunities presented by the integration of disciplinary knowledge and methods to comprehensively address the proposed study.	In addition to meeting the “very good” criteria, the integrated framework employs an imaginative, or well-articulated integrative device (e.g., a metaphor, a model, a complex causal explanation) and/or seems likely to yield novel or unexpected insights.	
Synthesis Is there a sense of balance in the overall composition of the proposal with regard to how the disciplines are brought together?	The proposal shows an imbalance in the way particular disciplinary perspectives are presented in light of the proposed study (e.g., particular disciplinary perspectives are given disproportionate weight for no obvious reason).	The proposal attempts to balance perspectives but this is built on artificial or algorithmic grounds rather than substantive ones (e.g. giving equal weight to each discipline studied irrespective of its substantive relevance to the problem at hand).	Disciplinary contributions to the proposal are generally balanced on substantive grounds in light of the purpose of the work. However, one or more aspects of the argument may be weakly addressed.	Disciplinary contributions to the proposal are delicately balanced to maximize the effectiveness of the proposal in light of the purpose of the work.	In addition to meeting the “very good” criteria, the presentation is elegant and coherent and there are no distractions in the building of the argument.	

Hypotheses

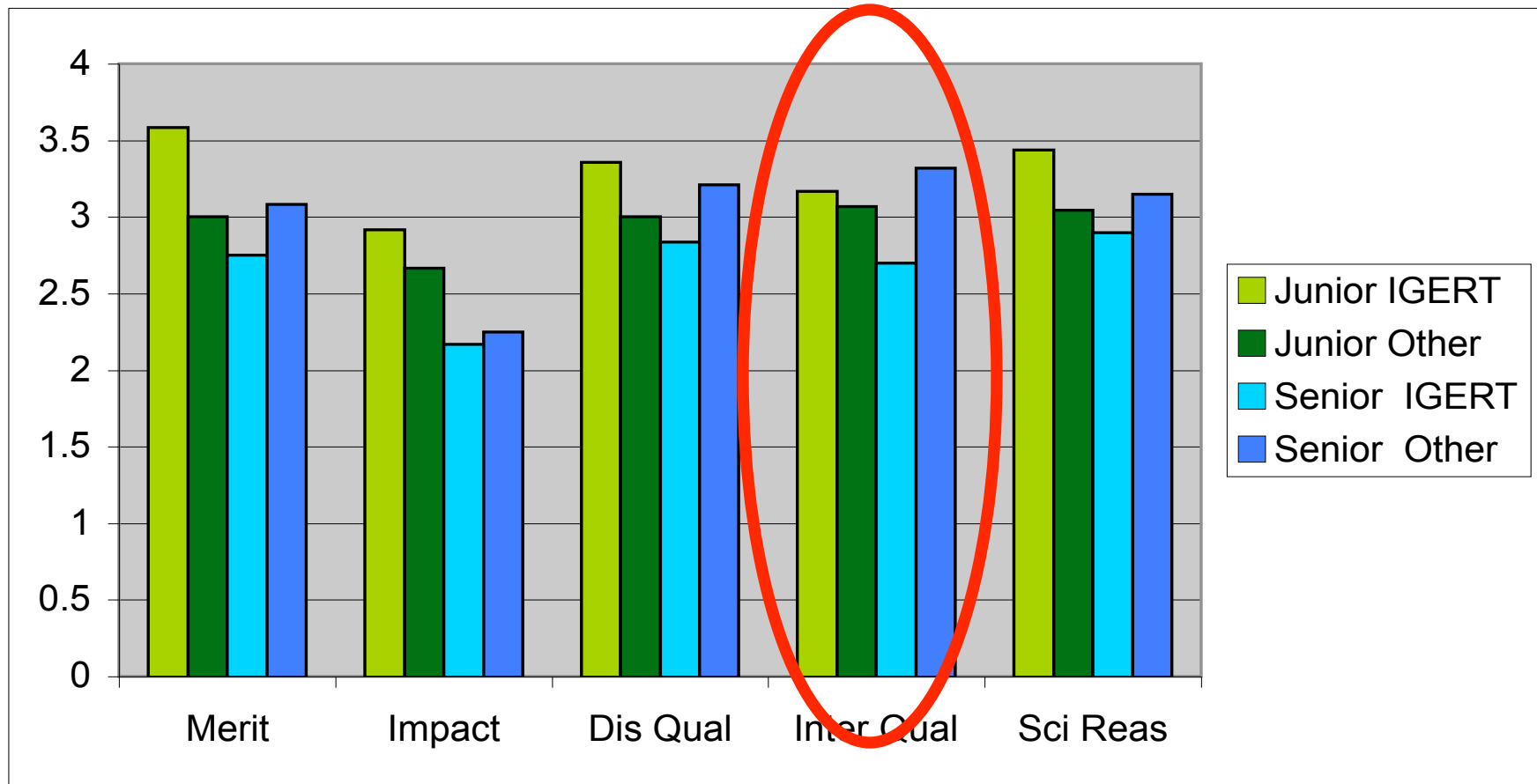


Groups were compared across type (IGERT, non-IGERT) and stage (junior, senior) of graduate school education

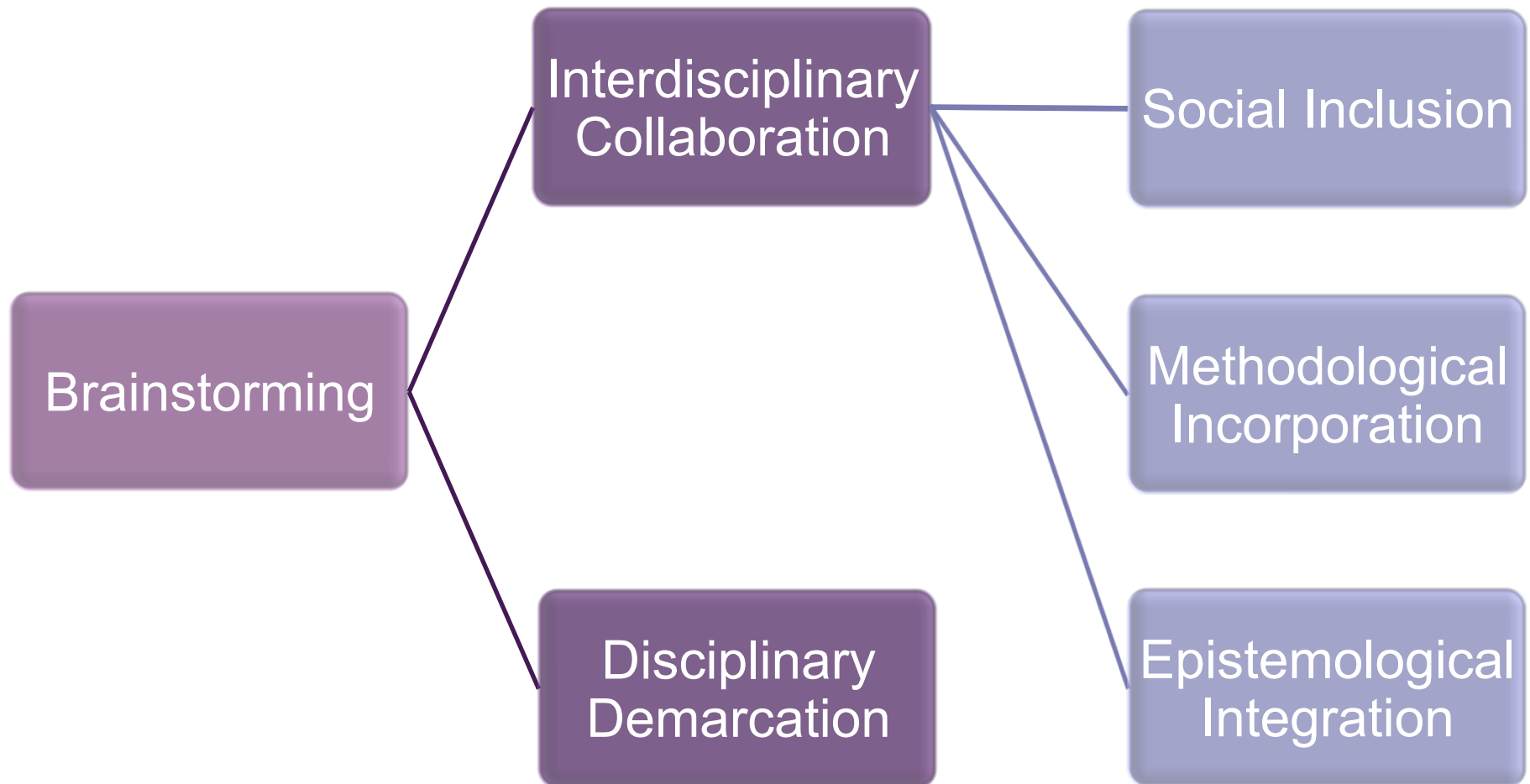
H₁: IGERT groups will outperform non-IGERT groups at both stages of graduate school because of the graduate student “disposition” effect

H₂: There will be larger differences in process and outcome measures between the senior IGERT and senior non-IGERT groups because of the graduate school “intervention” effect

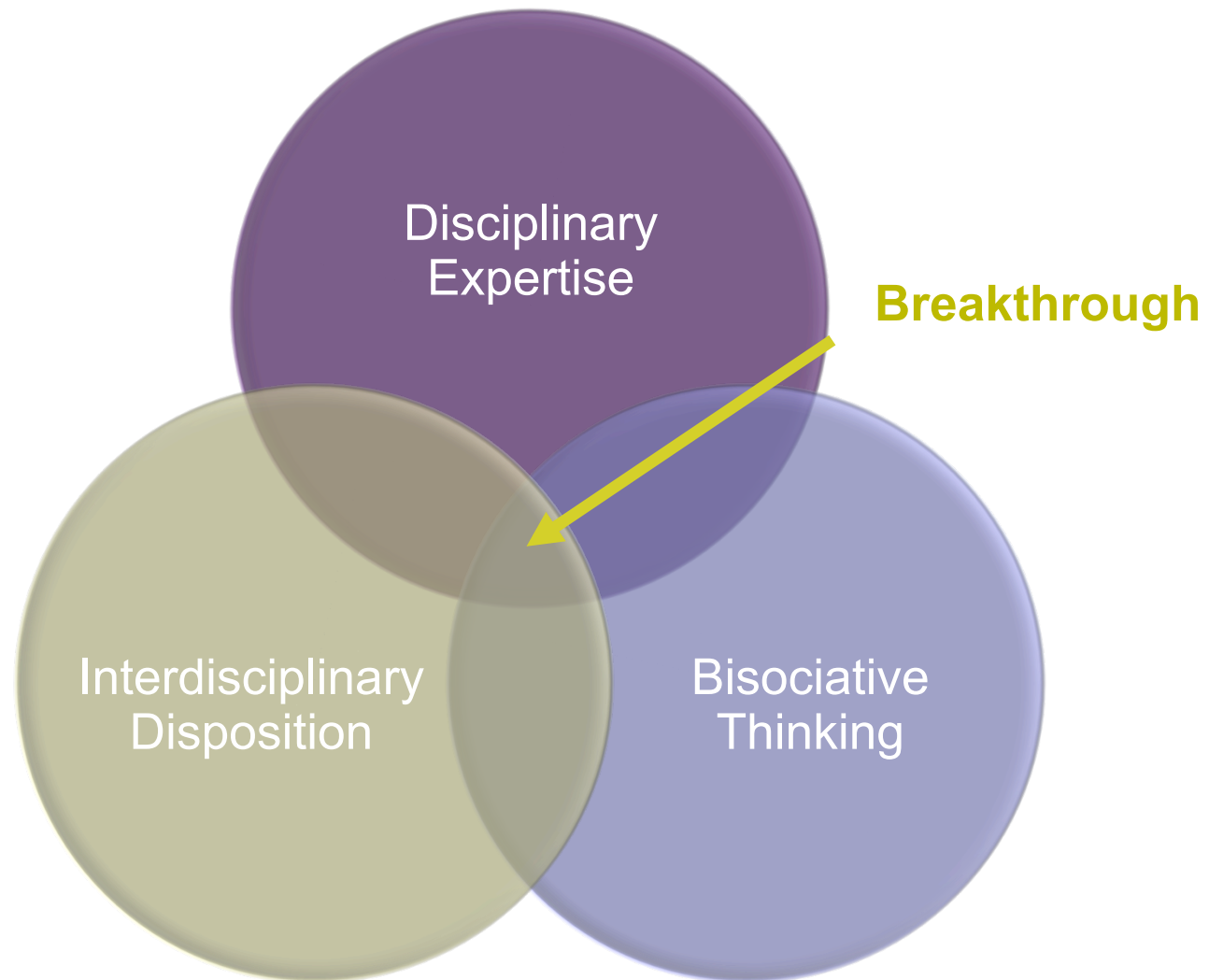
Outcome Results: Interdisciplinarity



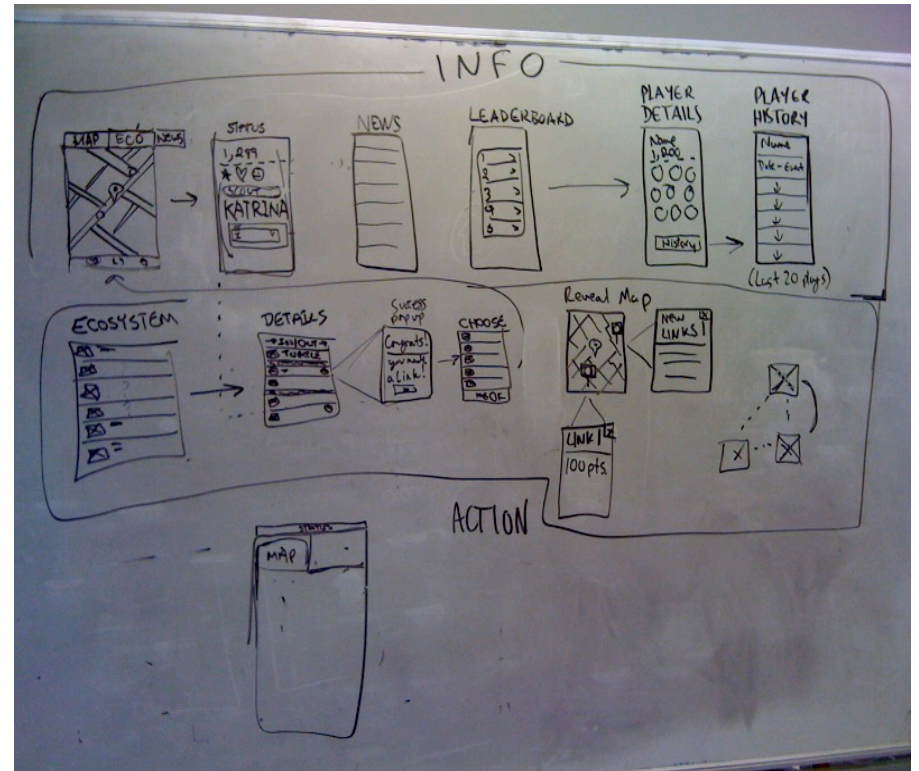
Process Results: Collaboration



Conclusions



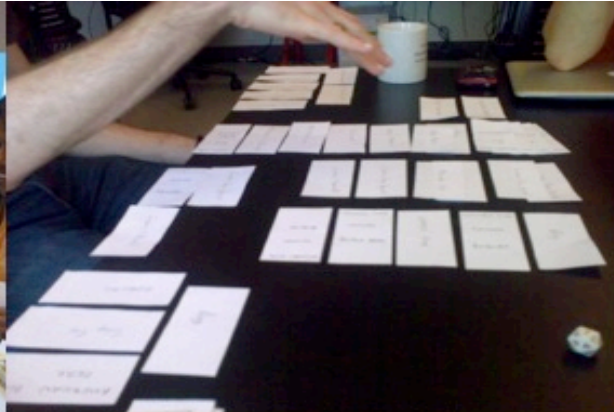
Learning x Design / Design 4 Learning



Ideation




Iteration



Consultation





In the past we had punctuated evolution. Things changed abruptly and after the abrupt change, there were decades of stability. ... It is the stability that has enabled us to build really deep institutional models based upon these types of infrastructures and technologies thereafter. But maybe for the first time ever in the history of civilization we are entering a new techno-economic paradigm, a new type of infrastructure, a digital infrastructure that may just not asymptote out. It may just keep on going and going. It is exponential in very interesting ways... institutions have to fill in and respond.

— John Seely Brown, Chicago, May 2008

Readings

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2. Hackett, E. J. Parker, D. Conz, D. Rhoten, and A. Parker. 2008. Ecology Transformed: NCEAS and Changing Patterns of Ecological Research. In G. Olson, A. Zimmerman, and N. Bos, eds., *Collaborative Science on the Internet*, Cambridge, MA: MIT Press.
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5. Vastag, B. Assembly Work. *Nature*. 453: 422-423. (May 15).
6. Rhoten, D. The Dawn of Networked Science. *Chronicle of Higher Education*. Vol 54, No 2: B12 (September 7).