RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

Interdisciplinary Investigations (IDIs) for Use in the First-Year Chemistry Classroom and Lab




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Project Overview

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

Interdisciplinary Investigations

IDI-Class
IDI-La
IDI-Nov

2 year - 4 year Collaboration

- *Centered at 2-year campus*
- *Expertise*
- *Global Environmental Research Platform*

Undergraduate Research

-generated
ar-long
s focused
ecognition

Why IDI? Theoretical Framework

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

P R O J E C T
Z E R O


Veronica Boix Mansilla *David Perkins*

"Interdisciplinary understanding is a hallmark of contemporary problem solving and discovery, and a primary requirement of relevant education today."

- Visible Thinking
- Interdisciplinary
- Global Competence

Related Projects

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

The Center for Authentic Science Practice in Education (CASPiE)
Purdue University

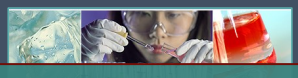
Community College Undergraduate Research Initiative (CCURI)
Finger Lakes Com. College

Interdisciplinary Teaching of Geoscience for a Sustainable Future (InTeGrate)
Carlton College

Our Work

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

The Center for Authentic Science Practice in Education (CASPiE)



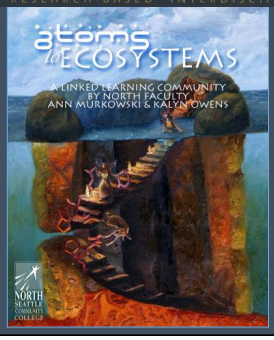
RISE

- Small-scale
- Interdisciplinary: Chemistry, Biology, and Environmental Science
- Focused on Two-Year Colleges

Future (InTeGrate)
Carlton College

Our Prior Work

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION



Year-long interdisciplinary program for science majors that coordinates General Chemistry, Majors Biology, and Undergraduate Research

Our Prior Work

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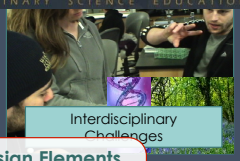

Curriculum Design Elements
Co-construction
Representing to Learn
Documentation

Current Question

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How can we use the materials and pedagogical ideals from Atom to Ecosystems to design effective, interdisciplinary curriculum that can be widely used in more traditional chemistry classrooms and labs?

InterDisciplinary Investigations

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OUR MODEL: THE IDI

IDI Classroom
IDI Lab
IDI Now!

InterDisciplinary Investigations

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CONNECT.
EXTEND.
CHALLENGE.

IDIᶜ Example: Aquaporin

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

CONNECT.
EXTEND.
CHALLENGE.

Pre-Drawing

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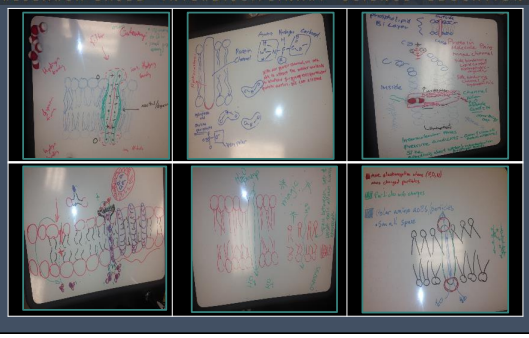

Post-Drawing

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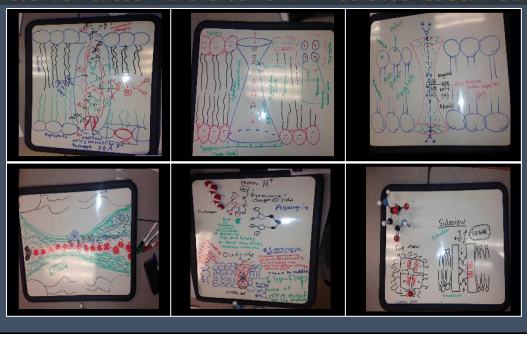

Pre/Post Comparison

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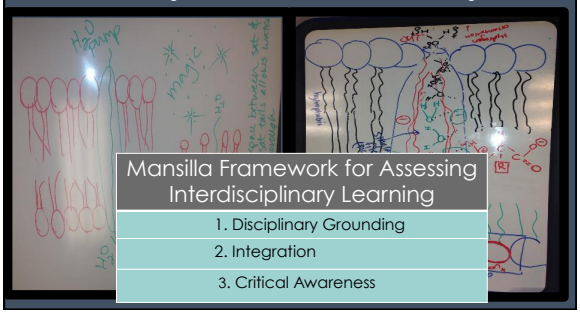
Pre-Drawing | Post-Drawing



Mansilla Framework for Assessing Interdisciplinary Learning

1. Disciplinary Grounding
2. Integration
3. Critical Awareness

Student Learning

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Capturing/Documenting Thinking
drawing, video, writing

Student Learning Gains (Cognitive & Affective)
written responses, pre/post-interventions, interviews

Iterative Design

Student Perspectives from Pilot Implementation:
- drawings
- biology content
- seminars
- interdisciplinary challenge

IDIc Student Perspectives

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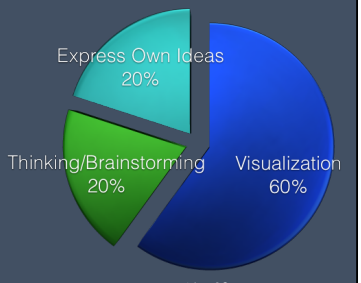
How does the drawing component of the activities help you learn chemistry?



N = 19

IDIc Student Perspectives

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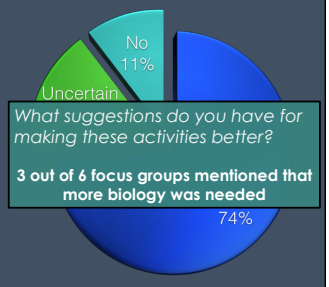
Was there enough depth to the biology content provided in the activity to make this a meaningful and interesting experience?



What suggestions do you have for making these activities better?

3 out of 6 focus groups mentioned that more biology was needed

N = 19

IDIc Student Perspectives

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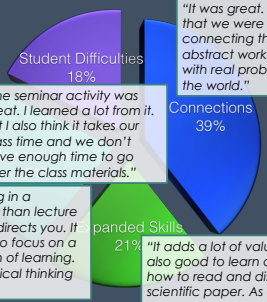
How does the seminar activity add to your learning experience in General Chemistry?



"It was great. I liked that we were connecting the more abstract work in class with real problems in the world."

"The seminar activity was great. I learned a lot from it. But I also think it takes our class time and we don't have enough time to go over the class materials."

"It got you thinking in a different direction than lecture and text reading directs you. It allows your brain to focus on a separate direction of learning. Helps develop critical thinking skills."

"It adds a lot of value. It was also good to learn about how to read and discuss a scientific paper. As a scientist later, this will be a useful skill."

N = 2

IDI^C Student Perspectives

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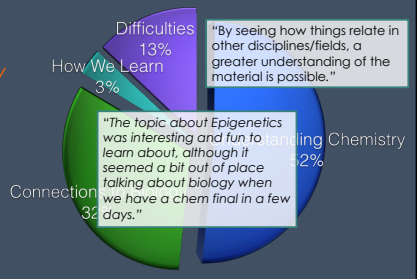
How does working on interdisciplinary problems or issues add to your learning experience in General Chemistry?



IDI^C Pilot Conclusions

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- While most students are positive about the activities, a few do not recognize the value and importance of using class time to engage in activities that involve higher level thinking
- There is a need to help students become more aware of themselves as learners and to shift the culture and routines of the traditional chemistry classroom throughout implementation
- Opportunity exists to use drawing activities to shift student perspective towards awareness of the value of deeper thinking
- Developing "just in time" biology content for the IDIs that is accessible and extends learning is a challenge

General Chemistry IDI^C Vision

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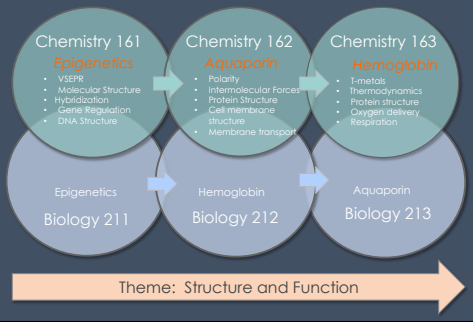

Discussion

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Would this model work in your classroom? Would it engage your students? What resources would you need to successfully implement an IDI?

InterDisciplinary Investigations

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OUR MODEL: THE IDI

IDI Classroom
IDI Lab
IDI Now!

General Chemistry IDI^L (Lab) Vision

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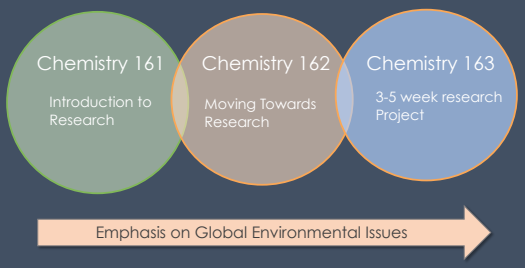

General Chemistry IDI^L (Lab) Vision

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- ✓ *Global Environmental/Interdisciplinary Issue*
- ✓ *Investigative*
- ✓ *Grounded in the Literature*
- ✓ *Instrumentation/Quantification*
- ✓ *Communication in Science*
- ✓ *Reflection on implications to Society*

IDIs Prepare Students for Research

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

Transform 1st year Chemistry & Biology: Interdisciplinary and Investigative

Skill-Focused **Undergraduate Research** for 2nd year Students

RISE

Capture Student Learning and Thinking in Interdisciplinary Context

Dissemination

RISE Research Model

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2nd Year Research Program (UGR 294)

Lab Modules (IDI^L) for General Chemistry

Undergraduate Research Program

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Fall
- Lab Notebook
- Pilot Project
- Formal Report
- Scientific Poster

Winter
- Journal Club
- Research Proposal
- Research Presentation

Spring
- Scientific Poster
- Research Presentation
- Research Symposium

Next Steps

RESEARCH-BASED INTERDISCIPLINARY SCIENCE EDUCATION

Transform 1st year Chemistry & Biology: Interdisciplinary and Investigative

Skill-Focused **Undergraduate Research** for 2nd year Students

RISE

Capture Student Learning and Thinking in Interdisciplinary Context

Dissemination

Acknowledgements

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CWU

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Faculty Colleagues

RISE

NORTH SEATTLE COLLEGE
One of the Seattle Colleges

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Questions and Conversation?

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IDI Now! An Example

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