

**An Inquiry-based
Lab Science Course**
Earth Resources & Environment

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Background & Incentives

- **CETP-PA Conference at Millersville**
 - **Emphasis on inquiry-based learning & assessment**
- **Addressing the PDE, NCATE, INTASC Standards for Secondary Ed. Programs at LHU in the context of Reflective Decision Maker model**
 - **What to teach**
 - **How to teach**
 - **Caring communications**
 - **Self assessment**

Set Goals

- **To develop a course-model where I could incorporate some of the standards and assessment issues in laboratory exercises**
- **To get students feedback on course content**
- **To collect artifacts as assessment tools**

Approaches Taken

- Prepared inquiry-based labs for a newly developed geology honors course – Earth Resources & Environment
- Selected a traditional geology lab course-- Earth Science with similar level and content for comparison
- Selected four lab topics that are common to both courses for students evaluation

Selected Lab Topics

- **Minerals**
- **Rocks**
- **Soils**
- **Topographic Maps**

How were the laboratories different?

Earth Science

- Large student population (115 in lecture, max of 26 in lab)
- Used a commercial lab manual
- General Education students
- Labs taught by several faculty members
- No field trips
- No research assignments

Earth Resources & Env.

- Small student population (9 students)
- Designed all laboratory exercises
- Students with above average GPA (Honors or 3.2)
- Lecture & lab by same instructor
- Two field trips
 - 1) an AMD remediation site
 - 2) a proposed CAFO site
- Term paper & presentation with peer evaluation of presentation using a rubric

How were the minerals labs different?

Earth Science

- Identified 14 common minerals
- Learned their chemical & physical properties
- Listed some of the uses of minerals from the text and manual

Earth Resources & Env.

- Identified 20 minerals
- Learned their chemical & physical properties
- Researched both on-line and in library their uses
- Wrote an investigative report on a mineral of student's choice

How were the rocks labs different?

Earth Science

- Identified 18 common igneous, metamorphic, and sedimentary rocks
- Learned terms used to describe textures

Earth Resources & Env.

- Identified 34 common igneous, metamorphic, and sedimentary rocks
- Examined 10 sites on campus where rocks are used
- Designed a project plan, detailing uses of rocks, cost, and sources of rocks for the project

How were the soils labs different?

Earth Science

- Examined three different soil samples
- Determined their porosity & permeability
- Studied relationships between soil types and infiltration-runoff

Earth Resources & Env.

- Collected soil samples outdoor
- Described various soil horizons
- Identified soil textures
- Determined nutrient levels and suitability for different crops

How were the topographic maps labs different?

Earth Science

- Studied map scales, lat/long, relief, gradient, profiles
- Constructed a simple contour map using given spot elevations
- Used maps to study landforms

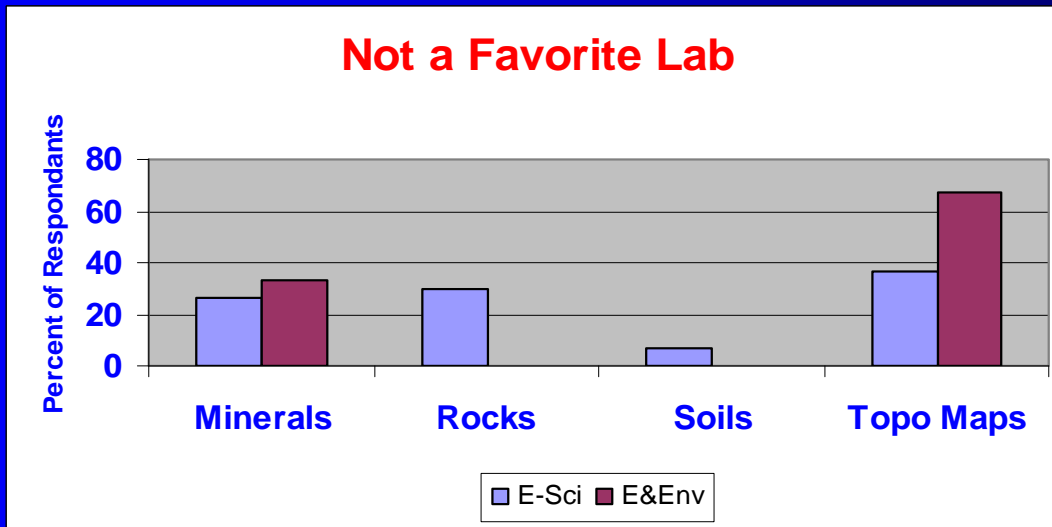
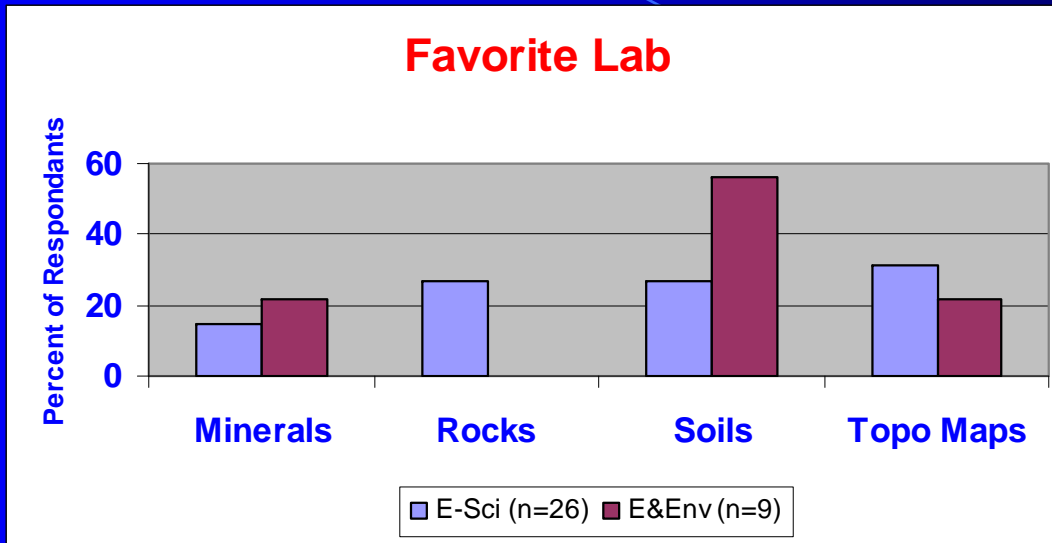
Earth Resources & Env.

- Studied map scales, lat/long, relief, gradient, profile
- Used an architectural model of LHU and selected a suitable location for a new dorm
- Collected elevation data to construct contour maps and topographic profiles

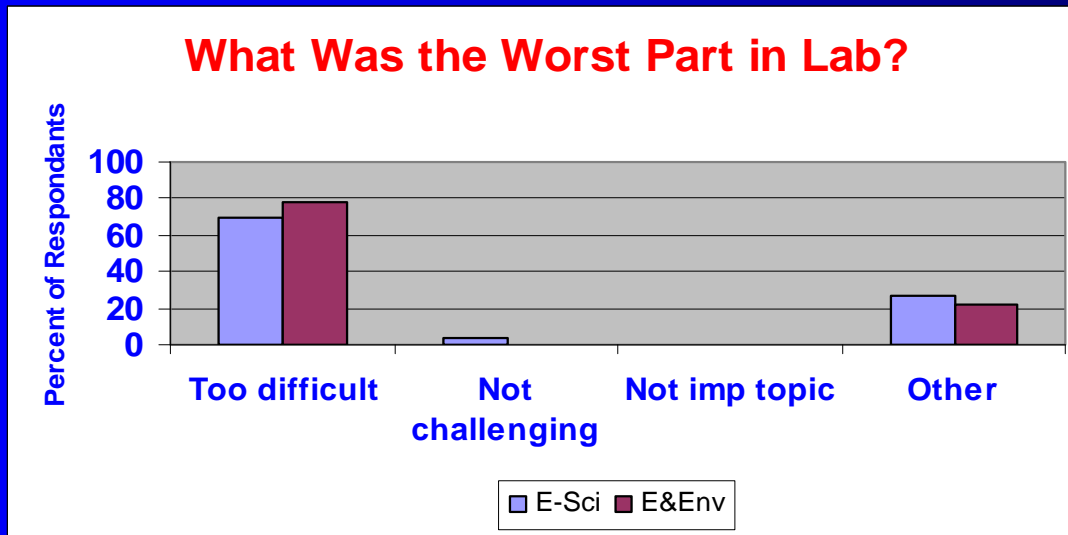
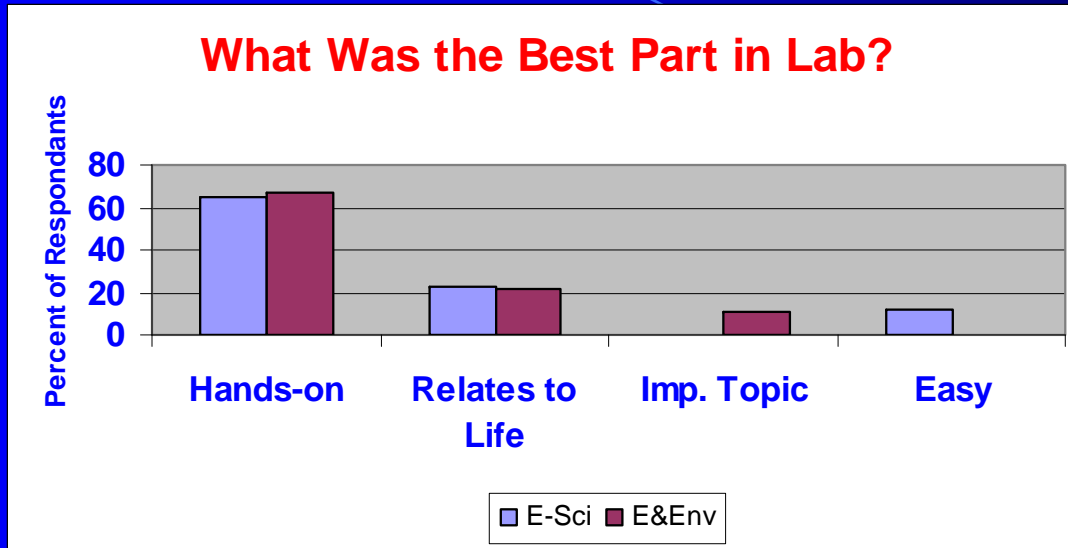
Field Trips & Hands-on Labs in Earth Resources & Env.



Student Evaluations of the Labs

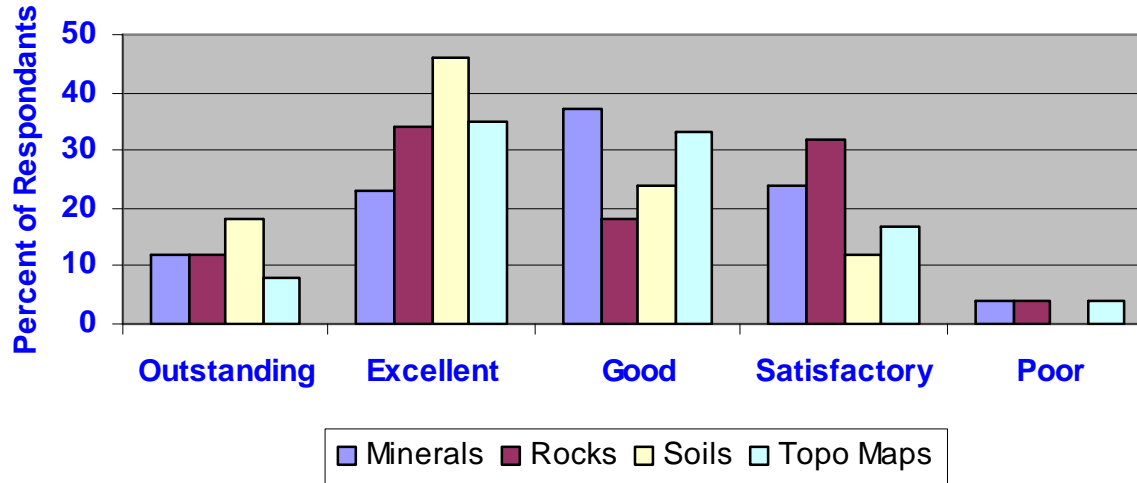


Student Evaluations (continued)

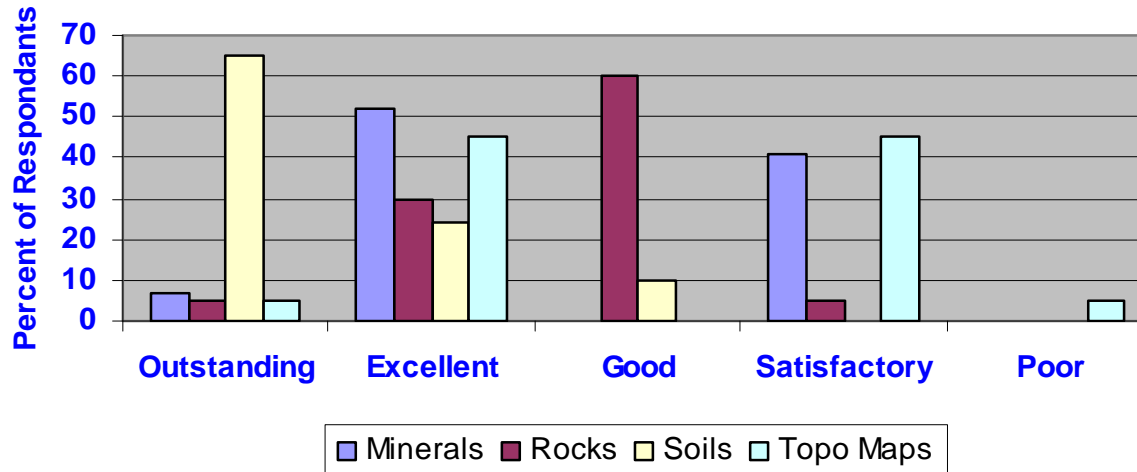


Student Evaluations (continued)

Over All Evaluation of Labs (E-Sci)



Over All Evaluation of Labs (E&Env)



Evaluation Rubric

Evaluation Rubric for Presentation of Term Paper (title):

Name of the student being evaluated _____

Your Name _____

Circle one grade from each row for each of the three categories.

Grades/Criteria	Excellent	Good	Satisfactory	Could be better	Need improvements	Comments
Selection of Topic (i.e. it's relevance, appropriateness, timeliness, and importance to the locality, region, nation, and the world)	9 or 10	8	7	6	0, 1, 2, 3, 4, 5	
Content (i.e. how the topic is analyzed, discussed or evaluated, concerns addressed, and solutions proposed or future directions outlined)	18, 19, 20	16 or 17	14 or 15	12 or 13	0, 1, 2, 3, 4, 5 6, 7, 8, 9, 10, or 11 (hard to distinguish)	
Quality of presentation (i.e. preparation of audio-visuals, effectiveness in delivery, adhering to allocated time, answering questions, etc.)	18, 19, 20	16 or 17	14 or 15	12 or 13	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or 11	
Total of each column →						Grand total =

Additional comments:

Science from a Non-Scientific Perspective

By Nicole Verardi

This semester I am taking my last Gen Ed requirement, and it happens to be a science lab, Honors Geology. As an English major, I was not really sure what to expect from this class, but it has turned out to be quite an experience.

A topic that has come up pretty often in the Honors house is that of the importance of Gen Ed's. I have always been a supporter of this rich variety in education so that we become well-rounded people in our own lives, not just ready for a specific job. However, as much as I champion this belief, I have never really found a passion for science or math. Last semester, I had Biology Seminar, which was great for an English major because we had class discussions and worked individually researching, writing about, and presenting our topics.

Although Geology has also

involved a lot of writing and research, we also looked in-depth at environmental issues. Our field trips, especially, have really emphasized to me the importance of everyone being educated outside their own fields. We went to an acid mine drainage affected area and learned about treatment plans. Being from Pennsylvania or going to school here, coal mining and its effects are part of our heritage. It is important that we all understand this process so that in the next generations we will be able to mine in the best way for the environment. How will we be able to vote about environmental issues if we are completely uneducated about them?

Our last field trip took us to the Nipponese Valley to see first-hand the springs, caves, sinkholes, and disappearing streams of the unique area. However, this beauty is in jeopardy

because of proposed CAFO's (basically, pig factories). Without knowing about the specific environmental effects in this area, how would we know how to react to this proposition? If you would like to see some pictures of these trips, check our Dr. Khalequzzaman's website at <http://www.lhup.edu/~mkhalequ/home.htm>.

Basically, I am saying that our Earth's resources and the effects of retrieving them are important for everyone to understand. Maybe we do not need to fully comprehend the small details, but we do need to be able to appreciate these resources enough to come together to make informed decisions about our future. Now coming to the end of my general education requirements, I am sure that they have been valuable for me, and hopefully for everyone else too.



What Standards Were Covered in the Inquiry-based Course?

- **INTASC:**

Standard 1. Content Pedagogy

Standard 4. Multiple Instructional Strategies

Standard 5: Motivation and Management

Standard 8: Assessment

Standard 9: Reflective Practice

Standard 10: School & Community Involvement

What Standards Were Covered in the Inquiry-based Course?

- **NSTA:**

Standard 1: Content

Standard 3: Inquiry

Standard 7: Social Context

Standard 8: Assessment

What Standards Were Covered in the Inquiry-based Course?

- **PDE:**

Standard I.B.C.H.I: Knowing the Content

- Interaction among lithosphere, hydrosphere, and biosphere
- Physical Geology
- Environment, natural resources & social context
- Scientific instrumentation & technology

What Have We Learned?

CONCLUSION: Students learn more from an inquiry-based course that has hands-on labs and that relates to everyday life

Evidence:

- a) Better student evaluations
- b) Survey results
- c) Written comments and newsletter article

Where Should We Go From Here?

- **Apply similar approach to other courses**
- **Make changes in laboratories (e.g. rocks, topographic maps) for the honors course to incorporate students' concerns**
- **When and if possible, organize field trips and hands-on exercises for other courses**
- **Collect more artifacts for assessment purposes**

THANK YOU

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