

Redesigning Structural Geology labs (GEOL 3120) to promote critical thinking and skill transfer using inquiry and local geology

Ex. Fold Analysis

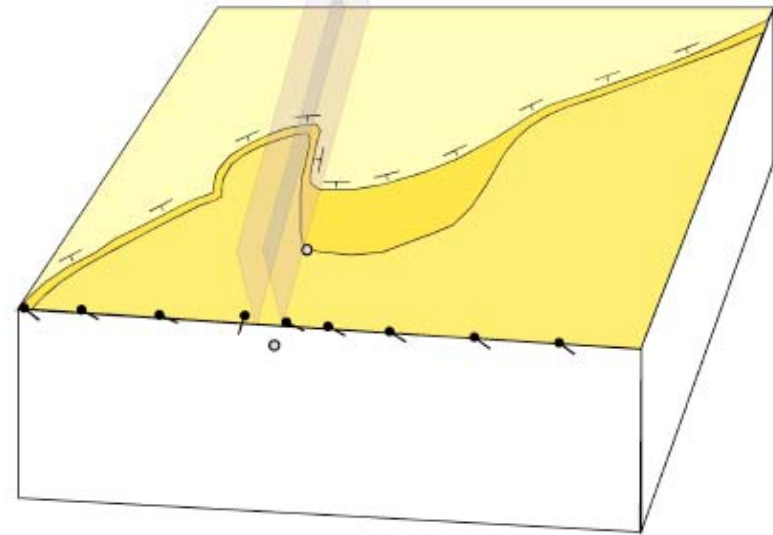
Old lab: “plug-n-chug”, no interpretation

“On separate overlays on a Schmidt net construct:

- A π diagram for veins
- A π diagram for joint
- A plot of all stylolites”

- **2 instructors, 2 graduate TAs, + STF**
- **Working group meets weekly to discuss labs and overall goals**

New lab: Focus on spatial reasoning in context & interpretation



“Using the block diagram above and field observations, sketch and describe the relationship between the veins, joints, and stylolites at Six Mile Fold.”

A working group met weekly to discuss transformation.

The faculty



Identified key ideas/goals that need to be covered in the labs

Provide initial ideas, guidance, materials and proofing for labs.



The graduate assistants

Draft the potential labs building off of work completed in previous years, textbooks, and faculty

Make comments on how labs worked in classroom



The STF

Review material with faculty to ensure that the goal/purpose of the lab is being achieved.

Report on any student difficulties, misconceptions, misinterpretations to addressed in future labs.

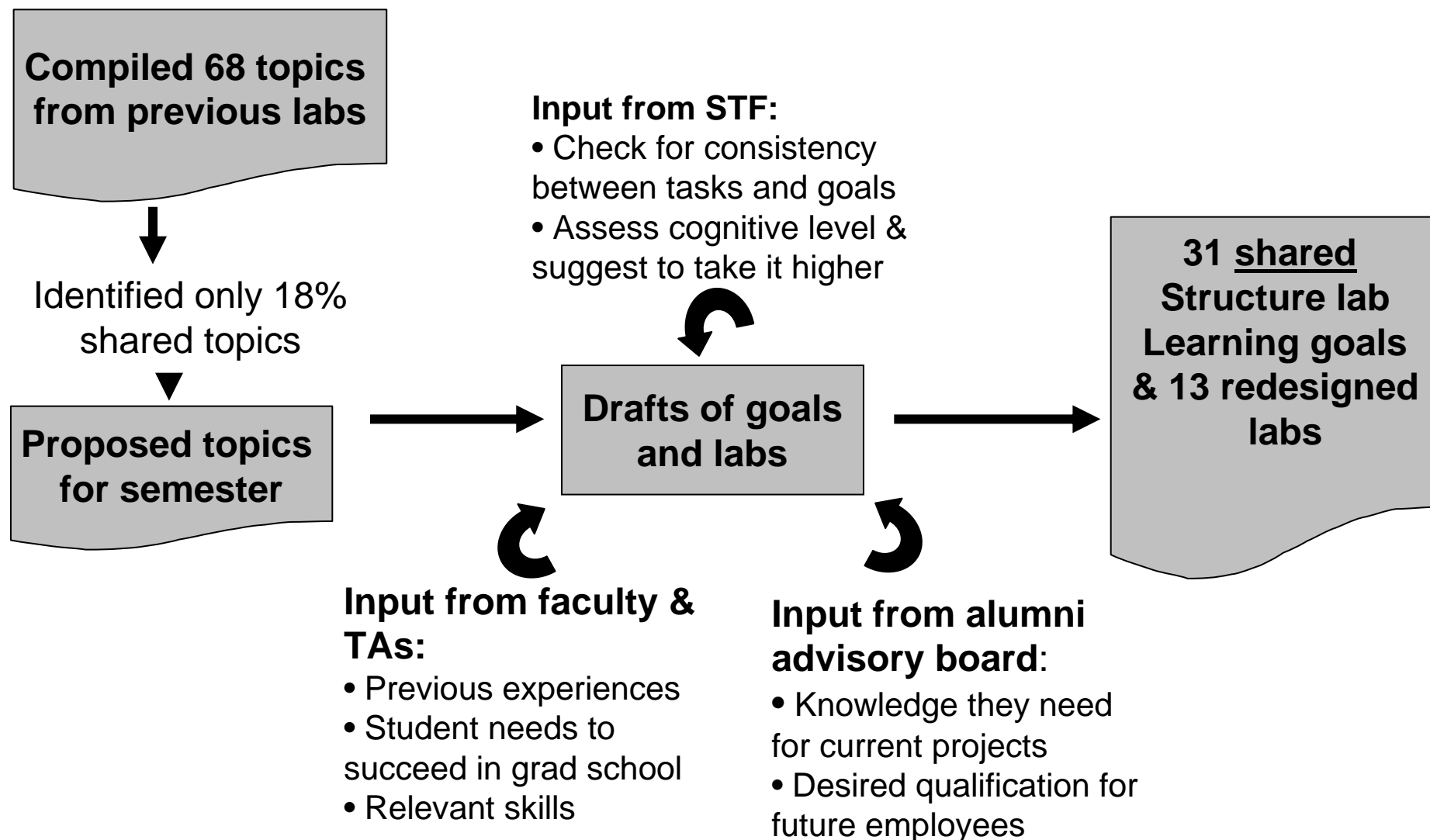
Suggest pedagogical approaches and design



Past structure labs had characteristics similar to upper-division labs that needed to be addressed before designing:

- Previous labs were designed by TAs but not necessarily shared year to year.**
- No agreed upon learning goals**
- Input from faculty on past labs were minimum**
- Labs were presented in “cookbook” style directions.**
- Labs consisted of a lot of repetitive calculation, caused a grading overload for TAs**

Previous labs and input from many experts were used to develop shared goals



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The Structural Geology Working Group

Faculty: Karl Mueller and Kevin Mahan

Graduate Students: Tarka Wilcox and Katy Barnhart

Science Teaching Fellow: Jennifer Stempien



Clear communication of goals and tasks were essential in new lab format

Name: _____

Structural Geology

GEOL 3120

Lab 9

Where should we drill for oil in offshore south Texas?

1. Concrete question/goal for students to work towards

2. Clearly identify what are the big ideas/learning goals that are specific to that lab, and if there are any that will overlap with other labs.

These include:

- Recognizing how growth faults accommodate extensional strain through time
- Using stratigraphic growth architecture to define the timing of slip on faults

- **3. Sentence that describes why it is important to know the information presented in lab, an answer to the questions “What is the purpose of this?”**

The exercise will be completed during _____ of lab using six seismic profiles and closely spaced well logs. The overall goal of this lab is to identify oil traps by creating structural contour maps of three stratigraphic horizons of interest and determine potential areas of four way closures that can trap oil. In general, we will assume that the faults in this region act as seals to the movement of oil and gas.

“Cookbook” format was replaced by questions on why certain approaches/methods would work better than others.

Previous “cookbook” format

Step by Step directions

1. Correlate the orange horizon first, then the blue horizon across all the seismic profiles. Finally, after you are confident of the upper horizons, correlate the green horizon across all the profiles as well. Use colored pencils (orange, blue and green) to correlate the three horizons across the grid of seismic profiles. Hint: start with the upper two first, and then do the green one, it is much harder to correlate because the lateral reflector character degrades with increasing depth.
2. Check to see that the orange, blue and green horizons and the fault traces all “tie” at places where seismic lines intersect (denoted by the downward pointing triangle on the tops of the seismic profiles). The logic behind this is apparent - if a given horizon is crossed by two seismic profiles intersect, the horizon should be at the same level at that point of intersection.

Methodological questions.

Below are a series of questions that will assist you in thinking about the best approach to creating those maps.

- 1) Why is it suggested to work with the upper horizons first before attempting to work with the deeper “green” horizon?
- 2) Places where seismic lines intersect one another is denoted by a downward pointed triangle at the top of the seismic line. If a horizon is crossed by two seismic profiles that intersect, how well should the levels match up on each of those lines?

- **Allowed instructors to easily identify conceptual or visualization problems**
- **Students had to think about the approach that they were using.**