NRE 531 Student Interviews

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1 Introduction and methods

Student volunteers from the NRE 531 "Principles of GIS" class were interviewed about their experiences in the course. The goal was to learn what worked and didn't work for their learning processes, what strategies they used to complete the labs and study for the tests, and what recommendations they had for improving the learning experience.

Students

I asked for volunteers during my lab sections, and also approached some students whom I knew from office-hour conversations were interested in the pedagogical process. Consequently I got a mix of students from my own and the other GSI's sections, and a mix of volunteers and willing recruits.

Interviews

Interviews occurred during the last 2 weeks of the term. Interviews ranged from 10 to 50 minutes. A loosely standard set of questions was asked of each student (see below), but the intent of the interview was to find out what issues or ideas were most interesting to each individual.

Students were interviewed in a public location of their choosing, including the ESA lab, the MLA break room, the Dana Commons and a cafe. Interview times were chosen to be convenient to the interviewee and interviewer, and were commonly in the late morning or early afternoon. Responses to questions and ideas were recorded by hand in summarized/paraphrased form. No verbatim transcription was made.

Common questions

The following questions were typically asked of each student, although in some cases some were forgotten or abandoned.

- To the extent that you believe in the "learner type" categories (i.e. visual/verbal/tactile), what kind of learner do you think you are?
- Have you taken other technical/skills courses (e.g. software/statistics/visual arts) before?
- What questions should I ask people to understand their experiences in the course?

- Did you change your learning strategies over the course of the course? For the lecture? For the lab?
- (and related to that) If you were a GSI and you were asked by a student for study tips for the course, what would you tell them?
- Any ideas or comments you would particularly want to make their way up the chain of command?

In addition to those common questions I tried to follow up on any topics of interest to each student.

A note on names

It didn't occur to me until after most of the interviews were complete that I should have asked each student if I could use their names in the report. I suspect the interviewees generally would be okay with it if I had asked, but in the absence of such permission I decided it was best not to do so. Consequently the students are referred to by their major.

2 Interviews

For each interview I have tried to summarize each of the main answers given and points made. Note that these are not transcriptions, but per-point paraphrases.

2.1 Landscape architect

Learning profile

Learns through "drawing/doing it". This facilitates understanding rather than just memorization and regurgitation. Increases "depth of understanding". Wants to know concretely "what is the computer doing for me", in the same sense as understanding what a bicycle does. Suspects this might be a generational thing. On the older side of a technological generation gap, the other side of which accepts the behavior of computers implicitly.

[Me: Perhaps that generation requires fewer analogies to be drawn between computer functions and other experiences, but is comfortable with computer functions as a primary paradigm?]

Art classes are closest to previous technical course experience, otherwise nothing since typing. Also currently taking some CAD and photoshop short courses. Thinks these courses

must be difficult to teach, as many of the concepts are intuitive to the instructor ("just click on the eraser tool") but that intuitiveness will be unevenly shared among students. A feedback loop for calibrating those assumptions is needed, but is not naturally available in the "stand in front of the class and lecture" approach.

Finds that running through demonstrations simultaneous with an instructor isn't workable. It's hard to memorize commands at the same time as executing them. Prefers to watch it being done while taking notes. Finds it difficult to focus on the display, the speaker and the software.

Comments & recommendations

"Teach the course backwards." Once some realistic analyses were completed, it made sense why you would have to worry in detail about some of the file/projection bread and butter issues. Felt that it would be easier to absorb those details when they had a meaningful context, instead of being floating knowledge.

Thinks that having students select a set of layers and work on them throughout the course would be a good approach. Suggests that questions could be simplified to reduce marking load. "In your layers, which is vector?".

Mentioned in previous conversations that a strong appreciated for the level of "click by click" detail in the instructions, which gave confidence to take on tasks that otherwise would have been daunting. Once guided through a first time, could do it confidently solo after.

Also mentioned in previous conversation that software demos in lectures were very helpful for making ideas concrete.

Notes that the MLA students commonly worked through the labs jointly, and suggested that it would have been much more difficult without that working community.

Work strategies

Ran through the labs once in class, typically completing 3/4s or so of the lab. Then later in the week, rather than picking up at that point (which was difficult) would start from the beginning. This also aided "understanding rather than obedience to instructions".

Study suggestions

Key word review. Daily. That way you know what to study instead of everything. Also helps tie to labs.

Text book is hit and miss.

Talk out loud: "language is referenced to itself", if you're explaining it to someone (even a imaginary someone?) it's hard to b.s. someone else.

2.2 Urban planner

Learning profile

Not a lot of experience with technical/skills classes. Not especially comfortable with tech. Prefers to learn by trial and error, "step by step". Hands-on rather than reading ahead. Left-handed/right-brained, creative and visual.

Comments & recommendations

Didn't find the theoretical component very useful. Cares about: how to use it? and: what can it be used for? I.e. the discussion of binary numbers wasn't of much value. Raster and vector likewise weren't fruitful theoretical discussions. Presumably a working understanding would have emerged through use?

Would have preferred 1 lecture and 2 lab sessions per week, instead of the reverse.

Liked the trial-by-error process of learning map layout.

Doesn't think reversing order of the course would be a good idea: operating details should come ahead of applications, as they currently do. Likes proceeding incrementally towards "composite" work. Now considers projection before every applied task.

An experience in another class drove home the implications of projection mismatches. Suggests having a real-world example of that kind of problem at the start of class.

Visually explicit topics easy. E.g. TINs: "if every class could be so easy". "You just look at it". "Got" raster and "got" vector without difficulty.

Liked the course. Knows how powerful GIS is now. Could hire a consultant and they couldn't say "I can't do that". Can open a map and play around.

Work strategies

Learns by "writing it down". Rewrote all lab instructions!

Previous to spring break, did every lab twice! - first time would just "march forward" following instructions verbatim. - second time provided enforcement of technical details as well as the "why".

"Keep up." Understand what you did before the next one. "You can't cut corners".

Study suggestions

Powerpoints are a blessing and a crutch. "The keywords are all there, so I'll just go blank". But for times when you don't get it, it's there.

Know the terms.

Readings haven't been much help. A lot of it is what's in the powerpoints.

2.3 Public health student

Learning profile

Masters of Public Health. Previously BSc. in Zoology, i.e. an analytical, "hard" background. Current classes and skill set "very touchy-feely", wanted to pick up some hard skills for the resume. Now feels could use GIS (but painfully). Going on the resume? Yup, already there.

Comments & recommendations

Found the hands-on portion most helpful. Seems like a course on how to use a program and what to use it on. Students "need help playing". Lecture and theory is thus not helpful, and there is nowhere to take it. Might be more helpful if more of the labs were like the final, i.e. unguided problem solving.

Early lectures more relevant. "More technical". E.g. cartography/projection. Doesn't know what we've been doing in lecture lately. Not taking anything away.

Comments & recommendations

Maybe more collaborative environment? That way could/would encourage more student-directed learning, labs could be less guided.

Fix the software for in-lecture demonstrations. Would be more interested in the software demos if students were going to be required to "make their own stuff" instead of being click-by-click guided. "I'd check out because I knew I'm going to spend 2 hours doing the same thing in lab". Flowchart question was the first "do I understand anything" moment in the lab.

Suggests that labs be reconfigured to add or replace with an ongoing project (somewhat like Jason's idea). Students start by identifying data (as they did, although she notes that it was a difficult task at the time because they didn't know what GIS data *was*) and then apply new skills each week. Suggests that the project could be graded only at the end of the term, to increase marking feasibility.

1.5 hours of lecture is too long. Perhaps shorter lectures and longer lab times, especially if there was a side project.

Good lecture style for the most part.

Even more "dialogue" sections would benefit retention at all times by keeping students ready for exchange.

Really liked class quizzes. Compared to exams, the quizzes seemed more mathematical, and the exams more "what does this mean?".

Work Strategies

Worked straight through the lab. At the end of the course is spending less time on labs, has more confidence with them.

Study suggestions

"Good luck." Test wasn't as expected. Questions were either too easy or difficult to interpret. No happy medium.

2.4 Urban planner II

Learning profile

Very visual-spatial. Fair number of studio/technical/skills classes (often attached to a theory and/or field component).

Wanted to know where to get data using the program.

Reports that planning students claim that this is the more advanced GIS class.

In the course more for the labs than the lectures ("I'm not going to do GPS"). "On the whole, planners just have to add the layers", theory isn't going to have a big impact.

Comments & recommendations

Felt there was a disconnect between the labs and the lectures.

Noted distracting/confusing grammar errors on the quizzes and midterms.

Liked the powerpoints. Had clearer notes because slides could be annotated.

Found the material lecture material dry, across the board. "Most of what you want to learn is going to happen in the lab". Lectures were "another 4 hours out of lab time".

Liked whiteboard clarifications at the beginning of labs.

Liked the "progressive" step-by-step lab instructions.

Suggests two notes to start all labs: remember to turn on your extensions and remember to turn on relative filenames.

Work strategies

Spent more time on layout towards the end. Bullet pointed on the labs to reinforce understanding. Made more involved notes towards the end of the semester. Started working ahead of time so weighty questions would be ready during lab hours.

2.5 Public policy student

Learning profile

Visual learner. Has avoided maths but has taken seminars in econ and statistics.

Comments & recommendations

Likes the theory component and questions which elicit consideration of theory. Helps with doing the work "correctly". Unless you *understand* what's happening, you are just "put in a room with a bunch of data".

Sees a lack of links between the theory and the process. Most link are made through lab questions. The data processing chart was a good one.

One thing that students *haven't* learned enough about is misrepresentation of data. How to critique products of GIS, (and by extension how to defend your products against critique).

Thought that the realer-world the applications the better. Even small applications, like the Stinchfield woods scenario, better. Case-based work would link the theory together and expose problems with processes. Might learn less about the steps but would benefit in the balance. Fun to work with real data sets generally.

Examples of lecture material we *don't* need: lambda (I forget what that was a reference to), binary value calculations, how DEMs are calculated.

Don't give step by step instructions. Rather knowledge and solutions can be generated by interaction among students. Force people to think about the steps, instead of giving them away.

Felt that the labs were cumulative, as they were intended to be, and that was an effective approach. Suggests that can be exploited further. Each lab could be the free implementation of ideas that were concretely introduced in the last lab.

Would like to see more forthright discussion of the limitations of the hard science aspects of the discipline. Data analysis is often conducted wth the context of non-trivial socioeconomic situations.

Work strategies The labs had a fast learning curve (in a good way). Experimentation, use of the help menu, and google, were all effective teachers.

Study suggestions

Read the powerpoints, meet the requirements.

"Visualize" ideas. (This relates to teaching the material as well as learning it.) Draw it out. Make it concrete, something you can see.

2.6 Environmental justice student

Learning profile

Learns knowledge by writing it down. Learns skills by doing them.

For technical/skills classes, has taken some art classes but not since college. Has had absolutely no computer courses.

Comments & recommendations

Likes the step-by-step nature of the lab instructions. "can't figure out excel", *needed* click-by-click guidelines.

Add 1 question per lab that *wasn't* explained click-by-click for bonus marks.

Stayed engaged because of the necessity of getting the details.

In lectures, give *simple* definitions. 1 slide and then stop. Additional supporting material for newly introduced concepts made it hard to sort out what were the key ideas (which in GIS often aren't that complicated once you boil them down) from what was support and example. This is more generally true when teaching new concepts: emphasize differences between skeleton and supporting material.

Found the lack of powerpoint files (as opposed to .pdf exports) "absolutely infuriating". In other classes takes notes directly into the powerpoint files. Keeps notes connected to images.

Expectations for labs weren't initially clear, lost some marks due to ambiguity about what was required. Suggests writing out expectations beyond any possibility of uncertainty, recognizing that the kinds of knowledge we're looking for is a bit of a leap for some people.

More preparation necessary for software demos in lectures. Not a good use of students' time otherwise. Particularly since the skills were repeated in lab anyway. "I learned what I learned in lab".

Ignored the theory until memorizing the terms for the tests.

Felt that 1 day on participatory GIS was an under-representation of it's importance. Would have liked a more substantial discussion.

Also would have liked more discussion of problems/critiques of GIS.

Student wasn't sure what they initially expected or wanted from the lectures, but wasn't comfortable with the mixing of lecture and lab. Suggests either making the lectures specifically about labs or specifically about theory. "Hard to tune in and out" when there was material which would be repeated more effectively in lab mixed with other material. Wasn't comfortable learning technical skills from a lecture.

3 Analysis

Learning styles

Practically all students reported themselves as visual learners. This could be self-selective (visual learners might be more likely to be positive and engaged in this very visual course, and thus more likely to volunteer or be recruited for interviews), but it still seems like a lot.

Opposed learning desires

Several of the specific recommendations made by a student were countered by the opposite recommendation made by another. Two students were abidingly grateful for the granular specificity of the lab instructions. Another was adamant that learning would be better if goals were set and students were required to experiment towards solutions. Some clearly felt that applications should come first in the course to motivate and contextualize understanding of operational details, or because those details would be more easily learned through doing. Others were satisfied with the current process of building the basics first and then applying them, and felt it would be confusing otherwise. One student "tuned out" every time software demos were run in lecture (even when they worked), another found them particularly useful.

I have no idea how to reconcile these sorts of differences. In the absence of more data about the relative proportions of students who would prefer one method or another, one "solution" is to pick one path arbitrarily and stick with it. Another would be to try both experimentally - it seems that at least some students wouldn't mind no matter what happens. Given logistical limitations, perhaps we should just stay the course.

Expectations and marking

Many students did exceptional work on their lab reports, characterized as above and beyond what we asked for, often in a very thoughtful way. As many as half each week turn in such unnecessarily exceptional work. Although we explicitly tried to make space for that kind of work (initially setting 75% as the mark for "answering the minimum interpretation of the question") the demands of a transparent and consistent marking scheme ultimately made it impractical. In the end, we had to give full marks for doing exactly what we asked, which meant that students that did something great in addition to the requirements would get the same marks as those that "just" met the requirements, and students that did something great but different from what we asked would actually get lower marks. Nonetheless, some students consistently kept doing both. This seems to me like evidence that those students (perhaps half or a third of the the class each week, but almost all of them at one time or another) put real value in their work beyond just getting the mark and the certification

it represented. Perhaps this isn't surprising–these are graduate students after all–but it suggests that there is a strong base if someone wanted to try and build a more sophisticated set of tasks. (And had time to do so.)

Powerpoint and diagrams

Powerpoint is a great lecturing tool, and works well for graphic explanations, which are an essential part of a GIS class. Almost all of the students I talked to from my sections mentioned that they appreciated the white-board diagrams which were used to illustrate concepts at the beginning of labs. They drew a distinction (or perhaps I encouraged them to draw a distinction) between hand-drawn diagrams and powerpoint. The advantage of hand-drawing diagrams may be that the process leads you to explain each diagram component as you draw it. Because the time spent drawing can leave a vacuum of silence, the drawer is unlikely to leave out explaining any component of the diagram, even if it seems intuitively clear to them. Each axis or shape gets a moment for a separate mention. Instead of expecting students to digest the diagram as a sudden cohesive whole, it's told like a story. I suspect that improves uptake.

Context

This falls in the "obviously" category, but it's worth emphasizing. Students do better learning and retaining material when they have clear reasons to do so. Every theoretical meme needs clear real-world contextualization. In cases where students didn't see obvious reasons why some idea might be useful, they were quick to discard it as fluff. If we think there is a reason why students might need to know something at some point in their GIS careers, we should be clear about those reasons if we expect them to absorb that thing now. Considerable bafflement about binary numbers, for instance.

Lecture v. lab

All but one of the students felt that the lectures weren't as valuable as the labs. It seems likely that the value of the lecture material will become greater if they later find themselves doing GIS under less controlled conditions, or planning or supervising it's use. If they reach that stage they may find they haven't retained the higher-level material as well as if they had valued it when learning it. This relates to the topic of contextualization.

In any case, the tone of the interviews seemed to indicate that student's interest was generally weighted towards hard skills and away from the theories those skills are grounded in.

Simplifying simple concepts

This is one of my own reflections on teaching GIS, but is related to a couple of student comments. It seems to me that few of the concepts we teach are especially "deep" or subtle. Once you understand them, they are mostly straightforward, to the degree that a summary of them is almost a complete explanation. For example, vector data is a series of points with x/y locations and attributes assigned to each point. There may be many more implications and extensions of that fact, but often it isn't those implications or extensions which students struggle with, but rather the core concept. Making these shallow concepts appear shallow to students is challenging because they exist outside of any pre-existing paradigm which could otherwise be used for analogy. They form context for each other, and are internally coherent, but are not contextualized by non-GIS concepts. Students can't make ready connections between the ideas and anything they've studied before. Often our efforts to illustrate the concepts rely on expanding and providing details of the concepts' implications, but this can have the contrary effect of making the core ideas appear more complicated than they really are.

In a situation like this, our familiarity with the concepts we are teaching is a liability as well as an asset. I haven't developed many strategies to work with this problem. The only obvious one is that many of the concepts, being explicitly spatial, are thus inherently visual in explanation. Consequently careful use of spartan diagram can help. For example, the urban planning student suggested that TIN, raster and vector were all easily acquired because they could just be looked at. Many of the concepts in a GIS class should be equally explainable through visual observation. The lecture material is already largely visually focused, but perhaps an even greater focus would help further.

4 A suggestion for reworking the labs

What follows are some experimental ideas for reworking the labs. The goal is to address some of the student's concerns. I haven't considered the logistic feasibility of preparing or implementing them. The overall idea is a welding of several students' suggestions.

Motivations for these changes

Asking students to identify their own data layers and refer back to them throughout the course was generally well received, even though it added a parallel workload to the assigned tasks of the labs. The initial identification of layers was a bit tricky and some students weren't sure what we were asking for. The final task of writing out a processing flowchart was an especially big demand (and took a lot of marking) but was widely approved of (both by interviewed students and during in-lab informal voting). We have discussed developing this into a broader focus on student-identified research questions and data. This would

have some advantages, but also some disadvantages. If each student identified their own question to pursue and data to pursue it with, it would make it difficult to ensure that every student was learning each of the skills we feel are important. It might also conflict with the learning of bread-and-butter skills, as we couldn't simply add another layer of tasks to the already substantial work load of the course. This would necessitate cutting out some of the existing tasks.

As mentioned above, there was a division between those students who appreciated the very specific instructions and those who thought they hindered learning. Trying to accommodate both types of learners seems to require two different sets of labs.

Also mentioned above, students tended to devalue lecture-based theory as irrelevant if it didn't directly apply to the labs, and in some cases ignore if it did apply to the labs on the grounds that they would be directly reviewing it in shortly.

A hybrid approach

To finesse these paradoxes, a hybrid approach might work. Each lab could be broken into a first, "skills" section and a second "project" section. In the skills section, students would be given a click-by-click tutorial to follow using a sample data set. The existing labs could be shortened and utilized for these portions. These sections would not be marked or even required, but would allow those students who needed specific instructions to have them, and would retain the value of the labs as a cumulative skills reference.

In the project section, students would be asked to apply their new skills to the question and data they would be developing. "Think of an application for least cost path to some aspect of your project question... execute a least cost path analysis such that your end product is a line vector linking some important places in your data... produce a high quality map displaying the results of your analysis".

- The option would always be available for students to change their data or even their question mid-course to better fit a lab (this would actually represent *more* work for the student, but would be a safety valve so that they weren't straining to find relevance of some techniques). We made that option available for the hypothetical data flow question and several students made use of it and registered their approval of it.
- Students who wanted to learn through trial-and-error could skip the skills sections entirely, thus we could cater to their learning styles as well.
- Marking would have to be less specific, as it wouldn't be possible to carefully assess each operation conducted by each student. As an option, individual labs could be given lower mark weights (and receive more cursory marking), balanced by a more substantial report-so-far submitted twice or more during the term.
- By forcing the students to guide their own analysis, it might also make a wider range of the lecture material seem more relevant.

- The tendency would still be to end up with a greater work load. Although we made progress on winnowing out "show me you followed the steps" questions this term, we would have to be comfortable in eliminating all of those questions. The result still might be a greater work load for many of the students, given both a tutorial to complete and a project question to implement.