

Morgan's Initial Thoughts on ISAT 190

Context of the Class

The Class

ISAT 190 is the introduction to the ISAT major. It is a replacement for the 1-credit ISAT 101 which currently exists but is not required for ISAT majors. It is being developed as part of a curriculum renewal process prompted by self-studies conducted during the upper-level ISAT curriculum review and the ABET re-accreditation process. These studies led to the development of what has come to be known as the ISAT Problem-Centric Habits of Mind (PCHOM). PCHOM describes characteristics an ideal ISAT graduate would exhibit several years **after** graduation, but which, importantly, may not be evident prior to graduation. Some of ISAT 190's chief aims, therefore, would be:

- to introduce students to the concept of PCHOM
- to persuade students that PCHOM is worth acquiring
- to illustrate to students the many and varying paths through the ISAT curriculum that would allow them to acquire PCHOM
- to prepare students to create wise, intentional plans for their time in ISAT

The Students

ISAT 190 will be taken primarily by first and second year students who either have decided to become or are exploring becoming an ISAT major. Students' conceptions of science and technology will be based largely on their experiences in science and technology courses taken in high school. Most of them will likely be at what Baxter Magolda (1992) describes as the "absolute" stage of knowing in which students believe:

- Knowledge is certain and there are always answers
- Uncertainty exists only when the learners don't know the answers
- The teacher is an expert
- The focus of learning is on absorbing knowledge
- Assessment is simply a matter of checking what the learner has "acquired"

The students will have a number of preconceptions and/or goals which will have led them to take ISAT 190 which we know about from interviews with past ISAT students, including:

- ISAT is a good major to take if you want to get a good job upon graduating
- "I am good at science" or "I am good at math"--alignment with a perceived personal strength
- My parents wanted me to do it
- My friend/sibling/teacher/acquaintance knew about it and said it was a good idea
- I couldn't get into the engineering program; engineering wasn't what I expected

- I am passionate about [the environment/alternative energy/etc.] and this seemed like the best major to do stuff like that
- Well, I had to declare a major, and from the info session I went to when I visited, this one seemed pretty cool

The students are not likely to know many or any of the other students in the course and are likely to have undeveloped social/academic/support networks among people in the ISAT community, including members of their cohort, older cohorts, faculty, and staff members. Students almost assuredly will never have heard the term “PCHOM” nor have any sense of what that means. If asked, their goals for the course will likely be generic and unspecific:

- I want to get a good grade
- I want to learn about the major

Students are likely to enter ISAT 190 with a great deal of enthusiasm, and as such, another goal of the course should be at least to preserve if not build upon that enthusiasm.

Program and Course Assessment

The ISAT Program is incredibly broad, diverse, and allows for a great deal of personalization. As a result, assessment of the program goals and objectives has always been challenging and a significant focus of faculty members’ time, energy, resources. The idea for ISAT 190 grew out of a perception of deficiencies uncovered in the assessment process. As we work to develop 190, assessability will be a major driver and shaper of the course content. As such, it is expected that each element of the course will be tied to program-level goals and objectives, and designed in such a way that evidence for the effectiveness of the course (or its lack thereof!) will be a natural product of students’ activity in the course.

Definition of “Learning”

The dominant definition of learning in our society is based on *psychometrics*, or the measurement of psychological properties. Because the amount someone has learned can’t be directly observed, we *infer* learning using tests or other student-generated artifacts. Although we can never know exactly what a person knows or can do, we believe we can make a pretty good guess by giving them tests and scoring the results. In abstract terms, learning equals the difference in performance of a person over time, or:

$$t_1 - t_0 = \text{learning}$$

More concretely, if you give someone a test at the beginning of the course and they get a 62%, then give them a test at the end of the course and they get 92%, then we define learning as:

$$92 - 62 = 30$$

Unfortunately, there are no standardized units of learning, as we have with say money, or weight, or temperature. Therefore we really have no way to interpret such scores in a reliably meaningful way. Fortunately, though, there are other ways to define learning that don't have the same kinds of problems.

A better definition of learning, more "ISAT-ty" in the sense that it takes into account the contextualized and systemic aspects of learning, comes from Moss (2003) who said:

From a sociocultural perspective, learning is perceived through changing relationships among the learner, the other human participants, and the tools (material and symbolic) available in a given context. Thus learning involves not only acquiring new knowledge and skill, but taking on a new identity and social position within a particular discourse or community of practice. As Wenger puts it, learning "changes who we are by changing our ability to participate, to belong, and to experience our life and the world as meaningful." (p14)

Learning is, at its core, an artifact of relationship. It's fundamentally a social process because we *need the mirror* provided by others to help us recognize and apply our gifts and talents. In more concrete terms, as a result of learning, I go from being "that guy who works down the hall" to being "that guy who works down the hall and is a great web developer." As a result of learning, people come to see us differently, and they begin to approach us and rely on us to contribute our gifts and talents back to them. This definition of learning conforms much better to our notion of the PCHOM practitioner who is member of a team or network of people working to solve problems.

Some Thoughts About Educational Objectives

Before articulating any objectives, I want to explain some of the nuances of my beliefs about them. I'll start with a quote from Dwight Eisenhower: "In preparing for battle I have always found that plans are useless, but planning is indispensable." Likewise, I believe that developing course objectives and a syllabus is a critical activity for an instructor, but that one needs to be capable of and willing to ditch the initial plans when they turn out not to be a good fit for the specific students who show up in the classroom. Second, as a result of our experience and training, I think it is reasonable that we should be the ones to develop the objectives. Third, there is such a thing as too much freedom--students can become overwhelmed by the perceived scope of a course if some boundaries are not drawn.

However, we need to not fall into the trap of believing that since we have done the thinking already on what is right/appropriate/effective for students to study, that students should just blindly follow our guidelines. We **want** them to question and challenge us. We want them to ask us "Why is this important? (Is this on the test?)" If we are unable to provide them with a satisfactory answer, then it means one of two things:

1. We, as instructors, need to spend some more time thinking about it and coming up with an effective way to clearly articulate the importance of some piece of content, in a way that will persuade the students to believe as we do, and in the process, also come to having a nuanced understanding of how a particular piece of content fits into the web of content that they are **currently** engaged in building.
2. Maybe they're right. It's entirely possible that some of the objectives on our syllabi are not important or relevant for students to be spending time on right now.

These things being said, let me take a first stab at some objectives for the course.

A First Stab at Educational Objectives for ISAT 190

Each of the following suggestions will articulate:

1. The objective
2. **Relevance:** Why this objective is important to include in *this* class and how it relates to the rest of the ISAT curriculum
3. **Value:** Why we think students would want to accomplish it and a rough plan of attack for getting students on board with it and/or potential reasons why students may not want to spend time on this objective
4. **Assessment:** A means for assessing whether or not the objective has been accomplished

Objective #1: Students will develop a professional identity via self-reflection and assessment of their strengths.

- **Relevance:** Since learning is demonstrated through the evolution of one's skills and identity within a community of practice, it is necessary to form a baseline, a sense of what one's strengths and weakness are, a sense of who they want to be in this community.
- **Value:** Currently, we wait until ISAT 491 to guide students in developing their professional persona via creating a resume and getting skill in interviewing. Students will be able to understand the value of developing these skills earlier.
- **Assessment:** Elevator-speeches could be coached and evaluated. Resumes, websites, LinkedIn pages could serve as artifacts articulating professional identity within ISAT. Also students can begin to develop a portfolio of exemplary work around which they develop an evolving narrative of who they were, what they experienced, and how this has given them added ability to participate in a scientific/technological community.

Objectives 2, 3, and 4 form a set:

Objective #2: Students will get to know all of the other people in their cohort.

Objective #3: Students will get to know most/all of the faculty in ISAT.

Objective #4: Students will get to know a large number of ISAT students from other cohorts

- **Relevance:** By definition, learning doesn't take place unless a person's role in a community of practice evolves. As such, forming a community of practice is a necessary first step. PCHOM habits related to knowing where to seek outside expertise, and engaging diverse perspectives are relevant. Since teamwork is core to many/most ISAT courses, and since it is such a highly valued professional skill, it makes sense to give them explicit "for credit" opportunities to develop their skill at community-building.
- **Value:** The value of being a member of the ISAT community can be demonstrated to students via testimonials from peers, and making them aware of the many team projects across the curriculum, as well as between faculty members, their larger academic and professional communities.
- **Assessment:** The professional identities developed in Objective #1 can form the source of the content for these objectives. ISAT community trivia contests or scavenger hunts could be used to find out how well they know each other. Taking attendance using a buddy system. By "get to know" we mean that for any given community member the students:
 - a. Can recognize them by name and face
 - b. Can advise someone on what this person's key strengths are and for what kinds of reasons someone might seek out their expertise
 - c. Can generally describe their personality
 - d. Can tell a story about an interaction with this person (that would be appropriate to share in a professional setting)

Objective #5: Understand the concept of a "problem-centric" approach and be able to distinguish it with examples from non-problem-centric approaches, e.g. discipline-specific, as well as be able to describe why it is superior to other approaches.

- **Relevance:** Graduates are frequently at a loss to articulate to non-ISAT people what makes ISAT unique and different, primarily because this is all they know and they don't have enough world experience to realize that not everyone thinks like they do. PCHOM doesn't make sense if students don't first get an understanding of what "problem-centric" means.
- **Value:** Not being able to explain ISAT to non-ISAT people is one of the biggest worries that our juniors and seniors have when going out to pursue jobs and internships. If students understand how critical this will be to developing their future careers, they will be motivated to learn it.
- **Assessment:** At the early stages, given multiple descriptions of various approaches to a problem, students should be able to distinguish between problem-centric and non-problem centric. At later stages, students should write proposals that describe problem-centric approaches. Peer evaluation can be used to determine if, and how well, this has been done. Alternatively, students can be asked to explain why the ISAT curriculum is constructed in the way that it is. Why a foundation? Why sectors? Why *these* sectors? What's missing?

Objective #6: Have a fundamental appreciation for scope/scale, and develop skill in proposing solutions to problems with reasonable and clearly defined scopes.

- **Relevance:** Being able to identify the scope of a proposed solution is one of the problems our students have the most trouble with. Somewhere between “end world hunger” and “I’d like a snack” there is at least one clearly defined level at which it is appropriate to tackle a problem in any given context. Choosing an appropriate scope usually means that one has to understand the amount of time, effort, and money necessary to carry out all of the sub-tasks related to solving the problem at that scope. Our students are frequently weak at figuring out what all of those tasks are and budgeting their time and energy accordingly. This is a skill they will use frequently in the many semester projects they will encounter while in ISAT.
- **Value:** Students are impressed when they see grant proposals that have been written by faculty. These are excellent examples of the level of detail that is necessary when proposing a particular solution to a problem. The dollar values attached to the winning proposals make the case of their value. Unsuccessful proposals can also be analyzed to identify potential problems, including inappropriate scope.
- **Assessment:** Have the students read 491 proposals and evaluate their quality based on the scope of the solution proposed. Given a general problem area and a set of constraints (time, personnel, expertise, money, etc.) have them propose and defend tackling some solution within this domain at a specific scale.

References

- Magolda, M. B. B. (1992). Students' Epistemologies and Academic Experiences: Implications for Pedagogy. *Review of Higher Education*, 15(3), 265-87.
- Moss, P. A. (2003). Reconceptualizing validity for classroom assessment. *Educational Measurement: Issues and Practice*, 22(4), 13-25.