Focus Group Questions and Activities

Goal: The focus of this session is to determine key responses to students' learning experiences in the major program. The interview concludes with a problem-solving opportunity to ensure constructive and applicable feedback.

Topics of Interest: Program Learning Outcomes, support services, instructional methods, workload, extracurricular activities, research opportunities (further suggestions?)

Two Options for the Category of Brainstorming (15 minutes)

Open-ended questions:

(1) Take about 2-3 minutes to list or write a brief paragraph about your primary experiences as a Physics student. What are the immediate images, concepts, or phrases that come to mind?
(2) Exchange your writing with a partner, take about 5 minutes to read and discuss responses. It is not necessary to agree on a unified perspective, though to identify what appear to be a few positive and a few negative responses worth sharing with the group
(3) Pairs report to the group about main ideas; Anne will list on board

* If any of the above topics of interest were not mentioned in responses, weave into conversation and ask follow-up questions.

Close-ended questions:

(4) A brief survey and then discussion. Survey would include questions that ask the student to rate understanding of Program Learning Outcomes on a scale of 1 to 10 with 1 being not at all and 10 being exceptionally well.

Elaboration (15 minutes)

(5) At what point (or which project) did you really feel as though you were fully engaged with and learning Physics?
(6) Have there been teaching practices that have been particularly effective at supporting your learning? How so?
(7) How influential have Physics-related "culture" activities been towards your learning? These activities might include extracurricular clubs, presentations at science fairs, etc.

Parting Wisdom (15 minutes)

Imagine that you have opportunity to share impart your wisdom to incoming students…

(8) What do you think would be most important for them to know about the Physics major?
(9) What will a student need to do to succeed?
(10) How can this message about best be delivered?
(11) What will the faculty need to do to encourage student success (within the major and professionally)
(12) How can this be best implemented?

Physics Major
Focus Group, Summary Report
June 2009

Goal: The focus of this interview session is to determine key responses to students' learning experiences in the Physics major program, concluding with a problem-solving opportunity to ensure constructive and applicable feedback.

Brainstorming

(1) Take about 2-3 minutes to list or write a brief paragraph about your primary experiences as a Physics student. What are the immediate images, concepts, or phrases that come to mind?

Curriculum

Laboratory reports: Frustration about assignment design, students need clear instructions and a rubric since report writing process can be subject-specific.

Homework: Most assignments are homework; exams are rare and high-stakes. "A good homework assignment is one that fits with previous work but includes a bit of a challenge. A bad homework problem is one where it is really easy or so hard the teacher can't answer." Another rare situation is too many exams and very few homework problems to prepare for exams.

Rubrics: They are rarely shared with assignments. "Rubrics are useful because not only can you see the expectations, you can also go back and figure out how to improve." "It would be nice to know what was expected."

MIT courseware: Not appropriate level of difficulty nor aligned with instructional focus. Not mathematically rigorous enough.

Sequencing of courses (coherency): Current catalog provides better links between courses than previous years. In some courses, material is very easy and quickly becomes too difficult. Lower-division courses were often taught by post-docs, so temporary contact with some faculty (and turn-over with course assignments).

Student experience

Lord of the flies: Tight-knit group of students

Teaching Assistants: Quality varies considerably. Some are disengaged or not prepared to teach. Successful TAs work closely with faculty mentors.

Fun and new professors, though some faculty do not seem prepared for class (lecture) or focused on teaching. "Nevertheless, I think the Physics program is still interesting."

<u>Program Learning Outcomes</u>. Upon graduation, how well prepared do you feel with respect to the following learning outcomes?

[Scale of 1-5. Well-prepared = 5; Average = 3; Under-prepared = 1]

Physical Principles. Students will be able to apply basic physical principles – including classical mechanics, electricity and magnetism, quantum mechanics, and statistical mechanics – to explain, analyze, and predict a variety of natural phenomenon.

[4] Very well prepared in all areas, perhaps a little less so with quantum mechanics. Statistical mechanics seems less integrated with the other areas of Physics.

Mathematical Expertise. Students will be able to apply advanced mathematical techniques (e.g. calculus, linear algebra, probability, and statistics) in their explanations, analyses, and predictions of physical phenomena.

[3] Math and Physics classes seem isolated from one another. For example, linear algebra is not aligned with quantum mechanics (in the Math department), so difficult to connect skills.

Experimental Techniques. Students will be able to take physical measurements in an experimental laboratory setting and analyze these results to draw conclusions about the physical system under investigation, including whether data supports or refutes a given physical model.

[4] Lab research experiences beyond the classroom have been immensely helpful learning experiences (learning to write effective notes, for example).

Communication and Teamwork Skills. Students will be able to clearly explain their mathematical and physical reasoning, both orally and in writing, and will be able to communicate and work effectively in groups on a common project.

[2.5] Group work opportunities, thus far, have been rare (exception is WRI 116). Students would like more instruction and opportunities to practice skill. Referenced Physics 160 as the only instance where this is cultivated – would like more opportunities to present research findings (orally and in writing). Best teamwork experiences have been outside the classroom in laboratory work and presenting at undergraduate conferences. "Amount of presented works in our classes is lacking in terms of preparing us for careers [or graduate school]."

Research Proficiency. Students will be able to formulate personal research questions that expand their knowledge of physics. Students will be able to apply sound scientific research methods to address these questions, either by researching the current literature or developing independent results.

[2] Respondents grappled with the idea of formulating personal research questions, debating whether this is feasible for undergraduates. Curriculum does not build to the outcome, but research opportunities do. All concluded that intensive mentoring will be necessary.

Elaboration

Engagement. At what point (or which project) did you really feel as though you were fully engaged with and learning Physics?

> Not yet, all admitted that synthesis is something that occurs at another stage. One respondent mentioned being part of a meeting with a graduate student preparing for a qualifying exam, and having the epiphany that he was able to answer some of the same questions.

Teaching Practices. Have there been teaching practices that have been particularly effective at supporting your learning? How so?

> **Math:** Teaching math in a rigorous, sequential way – not skipping any steps to show the Math behind the Physics. Students would benefit from a full, complete and thorough description of the basic mathematics and how it fits with the Physics. Rigorous proof to demonstrate mathematics, in classes without it "my understanding has been deficient, I know that for a fact."
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> **Finding connections:** In lecture, referring back to previous points helps students "mind-map" the concept.
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> **Knowing students' current knowledge:** Ask or test for knowledge (or be familiar with the standards of pre-requisites) to situate teaching.

Extracurricular Activities. How influential have Physics-related "culture" activities been towards your learning? These activities might include extracurricular clubs, presentations at science fairs, etc.

> **Research Day:** Presentation for general audiences at Research Day has not tested knowledge or benefited project development. Format was useful in terms of connecting with a general audience.
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> **Seminars and Conferences:** Seminars have been very helpful towards learning more about the field. Students mentioned conference participation as beneficial towards their learning and professional advancement, "building professional connections, seeing hiring opportunities." A respondent added the caveat that conferences are not for every Physics student. "It takes a mentality to be a Physics student. You have to be interested in things that you can't see. That takes a lot of dedication."
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> **Professional memberships:** Receiving the field publications has been useful particularly "seeing articles and how the writing works."

Parting Wisdom: Imagine that you have opportunity to share impart your wisdom to incoming students. What will a student need to do to succeed in the Physics program?

Study / Time Management: Identify early on what your challenges will be, mathematics for example.

Student mentors: Challenge with connecting with incoming Physics majors is that many of them are undeclared or minors.

Faculty mentors: Find faculty who you feel comfortable asking questions and fit with your strengths. Don't be afraid to ask questions and push yourself to learn.

Advisors: Advising is "very below average" (according to one student). Students are often advised against taking challenging courses or do not seem to fully understand the Physics curriculum (e.g. that ICP would be relevant). One student joked that advising is usually like this, so it is important to read the catalog to be knowledgeable about what is needed. Be assertive about your goals.

Conclusion: Summary of general student consensus. What are the key points that the faculty should know?

Teaching Assistants: The benefits of faculty mentoring are evident, as the quality of teaching varies accordingly. Some TA's do not respond to student work or show up to discussion sections. Some TA's have not been knowledgeable within the field. Others, with faculty guidance and clear expectations, have been incredible.

Textbooks: Use of textbooks vary, often not integrated into lectures (ideally would serve as a reference guide). Lectures often differ so much from the content of the textbook that the purpose of the textbook has been confusing.

Awareness of the sequencing of courses: Instructors knowing how courses fit together will help pace the material and establish connections among courses.

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