Input by Faculty Stakeholders in Other Departments at Tennessee State University

It is important for students who take many courses in areas outside of their discipline to be meaningful and relevant in some way to their program of study. As a part of the academic audit report, the committee believed it was very important to survey faculty who are stakeholders. Faculty members from the following areas were surveyed: biology (Professor), chemistry (Professor), computer science (Associate Professor), electrical and computer engineering (department chairperson and professor), and physics (Associate Professor). The following questions were selected to find out more information from our stakeholders about what we are doing well and what can be improved to increase student success in our courses and in their academic and career paths. Below is a list of the questions that were posed and the responses from the stakeholders.

1) What type of collaboration, if any, do you think could improve how the mathematics department supports your degree program?

   Biology: A periodic review of the course content of the mathematics courses that our majors are required to take. This will allow both parties to make sure that students receive the math content that they will need in their future careers. In the past, I have discussed the needs of our majors with a mathematics professor who served as one of the coordinator for mathematics courses.

   Chemistry: The tutorial center is one important way that math supports chemistry. The development of some diagnostic tests to help identify math weaknesses in Chemistry students might be useful in targeting the type of tutoring that would most benefit an individual student.

   Computer Science: It may be helpful to know what students are actually double majors or major-minors in Math/CS. Maybe host a gathering or meeting. Maybe a faculty member from each department makes a presentation about major/minor options to the early classes/major in the other department.

   Another thought. We could consider a way for there to be a presence of professors from one department in certain courses of the other department. In other words, maybe a guest lecturer in Discrete Math or Abstract Algebra from a professor that presents a lecture topic and also how it relates to the other discipline.

   Lastly, collaborating on advising research or joint projects are another option. Just thought of this – for students doing both a mathematics and CS senior project, is there a way for the advisors to communicate to define the project(s) so that they have synergy instead of competing? This may not affect a lot of students, but is a thought.

   Electrical and Computer Engineering: Provide ECE department timely update and more details about the course contents (for example, provide ECE department detailed course

syllabi for MATH 1910, 1920, 2110, and 3120); Get inputs from ECE department about prerequisites for new students and when to offer the classes. ECE and Mathematics departments should have more collaborations and communications on course contents, class offering time and prerequisites.

Physics: Since Mathematics and Physics are in the same department, in some ways we work closely together. However, in other ways we do not communicate well. Mathematics could be more consistent about doing examples and problems that are more similar to physics problems, especially in the Calculus sequence. This would get students in the Calculus-based physics sequence a jump start on problem solving. I feel that students would also appreciate the power of Calculus more if they saw more applications.

2) Do you believe the information contained in the syllabi or material that is covered in the mathematics courses connects your discipline and math in an optimal way? In your opinion, do students majoring in your discipline see the usefulness of the subject matter taught in the mathematics course once they take their major courses?

Biology: Yes, I believe that the two are connected. In my courses, the importance of math is emphasized. Also, math is used in many of the laboratory classes.

Chemistry: I am not sure.

Computer Science: I am not sure that the material connects in an optimal way. A meeting between the curriculum committees may be helpful to assess this and potentially develop a strategy. Also, where appropriate, I try to make the connections in lecture, but I don't know how widespread that practice is or if it is always clear (to me or other faculty) where connections exist.

Another issue is that students who have difficulty proceeding from College Algebra to the Calculus II segment of their mathematics path may frequently be out of sync by the time they get to their upper-level CS courses.

The students do not frequently express that they see the usefulness of the Mathematics courses for the CS courses. Some have, however. For some students, this might be influenced by the out-of-sync issue mentioned above.

Electrical and Computer Engineering: We do not have the syllabi yet. We will give better answer to the first part of this question after we receive the detailed syllabi. As to the second part of this question, the answer is YES. Mathematics is the foundation of ECE upper level courses.

Physics: My answer to #1 touches on this – I think that somewhat more emphasis on applications in the Calculus sequence would be valuable to students taking Calculus-based physics. In Algebra-

based physics one key math concept students struggle with are vectors. In physics, a skill they struggle with in particular is going from a magnitude-angle representation to a components representation. Since we do not currently have the physics major, this is not a relevant question. However, when we did have the physics major I got a lot of feedback that students felt a much better understanding of why the math skills they learned in their math courses was valuable as they learned specific physics applications for the ideas.

3) Do you have any specific suggestions about how the mathematics courses that majors in your area must take can be improved to benefit the student knowledge, skills, and ability to apply the mathematics to various problems in your discipline?

Biology: When possible, problem solving involving/emphasizing biological concepts.

Chemistry: If the students could be given some chemistry-related example problems in their math courses that may be useful.

Computer Science: One approach may be to discuss types of examples and applications that relate to the discipline. Another, depending on the level of the course, may be to talk about how a mathematical problem could be solved with computational thinking.

Electrical and Computer Engineering: The students should see real ECE applications when they learn the mathematical theories in classroom. ECE faculty can help identify these applications. Moreover, ECE students need very basic linear algebra knowledge. If basic linear algebra could be covered in Applied Math (MATH 3120), that will be beneficial to ECE students.

Physics: As mentioned before, more application examples / problems would be helpful. One thing that I've found is that in problems where the differential element needed in a problem is not defined, students struggle in setting up even very simple integrals. More practice is choosing the right differential element for different geometries / situations would be valuable.

4) Based on your experience and expertise, what type of instruction and assessment do you believe works best for students majoring in your discipline?

Biology: Interactive instructions in which students are actively involved; Use a variety of approaches to assessment.

Chemistry: Working example problems in class has been, in my experience, the most useful way to approach most concepts in general chemistry. For upper level chemistry, the approach depends on the particular course.

Computer Science: Although there are a variety of ways, so I'm not sure what is best. It seems that students having a lot of examples for reference, but being called to work on the technique with the instructor as a guide is useful. In class working problems is helpful. (That

might be what is already being done.) I'm not sure what they class sizes are, but they could benefit if they are a size where the instructor is able to know how the less confident students are proceeding.

Electrical and Computer Engineering: Let the students see and understand how to apply mathematics formula in real ECE problem when they learn will benefit the students. This also applies to assessment, students should be assessed by solving real ECE problems with the mathematics knowledge they learn in classroom.

Physics: A good introduction to theory as shown by deriving important formulas /ideas from first principles, and then conceptual work and applications to understand how to use those ideas.

Many faculty members in the department of mathematical sciences have expressed an interest in meeting with faculty in other stakeholder departments to determine how our courses would best suit the needs of the students majoring in those areas. This seems to be an idea that would prove valuable for all stakeholders based on the comments received from the different academic units. Depending on our forthcoming new leadership, this is an effort that may be pursued in the future in a more structured way in order to improve our course offerings to better fit the needs of our student population. Depending on student demand for a particular course, there is a possibility of considering offering certain sections of particular courses just for students in a specific major, which would allow the course examples and focus on topics to be tailored toward that particular field of study. Furthermore, some faculty already includes assignments and projects in their mathematics courses to enhance student learning and participation. Some of these course projects were developed as a part of grant projects and they were created to get students thinking about how research and education intersect. In addition, these course modules give students training in knowledge/skills that can be applied to specific fields of study. This allows students to engage in applied problems related to the course material they are studying and realize the true importance of using mathematics to solve real-world problems. These types of assignments also help students further develop their critical thinking abilities, problem solving skills, and creativity.

In addition, there is an effort by the director of the STEM Tutorial Center to improve the services offered to students through that Center. Therefore, there is a desire to try to secure more funding to support additional tutors who could be hired on a full-time basis and to determine how to optimize the schedule of services offered. Further, there was an idea shared about putting some notes and tutorial hints online and students and instructors would have access to these materials, like in the Blackboard system. These types of initiatives should assist in increasing the tutorial support all of the STEM areas receive here at Tennessee State University.