

Biology Program Review

**College of Arts and Sciences
Dakota State University
April 24, 2009**

**Review conducted by
Dr. Robert K. Noyd
Professor of Biology
United States Air Force Academy**

Part 1. Executive Summary of Findings

Dakota State University has a sharply focused mission that is based on the application of cutting edge computer technology to traditional disciplines such as the humanities, social sciences, and natural sciences. If its practices were perfectly aligned with its mission, then I would expect to find a number of campus characteristics. First, the campus would be expected to be a rich technological environment for learning. Second, faculty would be expected to be the most highly trained in the application of educational technology to their disciplines and employ the latest technological advances in their classroom teaching. Third, students would be expected to interact with their computers and faculty in new and innovative ways. Lastly, DSU graduates would be expected to have skills that make them highly marketable and valuable to schools and businesses.

Aligned with its mission, DSU has made a considerable investment in the infrastructure of computer hardware and software. The campus has an impressive technological network.

Students are required to lease a tablet PC computer and then integrate it into their studies. The upcoming renovation of the Science Building will incorporate the latest technology and create office, classroom, and laboratory learning spaces. Biology students and faculty are fortunate to be part of a university that values and invests in its facilities. I might add that it is easy to be enamored with the latest technology and the new facilities that will be constructed, but remember the true heart and soul of any institution is how talented faculty use the technology to improve student learning.

My campus visit found that the Biology Program delivers personal and meaningful instruction to its students. I found that faculty-student interactions were warm and caring in a positive and supportive learning environment. The Biology faculty are DSU's most valuable resource and I found that the university is misaligned with respect to investing in the human capital of technology. There appears to be an underinvestment on the part of the university to fund the professional growth and development of faculty to become state and national leaders in the area of use of computer technology to promote student learning. Funding for faculty to attend conferences, short courses, or workshops is so low that it does not encourage or motivate faculty to bring the latest advances in educational technology back to DSU. Financial and promotional incentives are placed squarely on discipline-based research, whereas the emphasis, I believe, should be placed on productivity and publications in the scholarship of teaching and learning (SoTL) that emphasize the positive impact of computer technology on student learning.

The result of this underinvestment in faculty development, I believe, is manifested in the underutilization of the tablet PCs in the classroom environment. I found that the integration of the tablet PCs into the classroom environment was mainly as tools to gather information rather than use them to engage students and assess learning in class. The technological capabilities of the Desire2Learn course management system can also be better tapped for learning. Instead of asking faculty to do more, I am suggesting that you create the space for them to stay current and better integrate technology into the classroom.

I found that institutional and program goals and assessments to be in place and suggest ways to better align and integrate them. The Biology Program goals are a good start and need to be further clarified for more targeted assessments and learning experiences in courses. The culture of assessment and the collection of data is impressive, however, I did not see the results of assessment on any level making it way back to the classroom with the expressed intent of improving learning.

Retention and recruitment of students seems to be an ongoing challenge. There needs to be more data gathered on the percent of students who start and complete the Biology Program and how long it takes them. If the current estimate of 25% is accurate, then this needs to be explored further.

At the curriculum level, I discussed several opportunities for curriculum integration in the College of Arts and Sciences between the Biology Program, the Scientific Forensic Technology Program, and the

Institutional Mission Statement

Dakota State University is an institution specializing in programs in computer management, computer information systems, and other related undergraduate and graduate programs as outlined in SDCL 13-59-2.2. A special emphasis is the preparation of elementary and secondary teachers with expertise in the use of computer technology and information processing in the teaching and learning process. A secondary purpose is to offer two-year and one-year programs and short courses for application and operator training in areas authorized.

Digital Arts for Design Programs. The single most important finding in this area was that students studying forensic technology were not required to take any biology courses.

Each of the sections of this review is followed by my suggestions for improvement. I am grateful for the opportunity to review of your program at DSU as it has led me to gain insights into my own program at Air Force. Thank you.

Part 2: Schedule of On-Site Visit

Schedule for On-Site Visit

Friday, April 24, 2009

08:00 – 08:30 AM	Cecelia Wittmayer, Academic Vice President, Heston Hall 314
08:30 – 09:30 AM	Assessment – Carrie Ahern, Heston Hall 310
09:30- 10:00 AM	Meet with Directors/Faculty of Programs (Bruce Feistner, Dorine Bennett, Gale Wiedow)
10:00 -10:30AM	Kari Forbes-Boyte, Dean of College of Arts and Sciences, Beadle Hall 114
10:30 – 11:00 AM	Risë Smith, Karl Mundt Library
11:00 – 11:30 AM	Donna Hazelwood, Biology Faculty – SC 129
11:30 – 12:00 PM	Kristel Bakker, Biology Faculty – SC 130
12:00 – 1:00 PM	Lunch – Biology Faculty
1:00 – 1:30 PM	Meet with Biology Students --SC 109
1:30 – 2:00PM	Dale Droge, Biology Faculty – SC 122
2:00 – 3:00 PM	Preparation time/ Tour/other interviews, if desired
3:00– 4:00 PM	Exit Interview with Dr. Wittmayer, VPAA and Kari Forbes-Boyte, Dean College of Arts and Sciences

Part 3: Program Evaluation (organized by focus areas)

A. Program Goals and Strategic Planning

- Appropriateness of goals and whether / not goals are being met
- Program goals relative to institutional mission
- Program goals relative to current national trends and forecasts for the discipline

Commentary on Regent’s Goal #6 and Biology 101:

I see strong alignment between the Biology Program goals and the Regental General Education Goal #6. They both emphasize knowledge and skills aspects of learning. Both sets of goals overlap in the areas of

Regental General Education Goal (#6)

Students will understand the fundamental principles of natural sciences and apply scientific methods of inquiry to investigate the natural world.

Student Learning Outcome 1: Demonstrate the scientific method in a laboratory experience.

Student Learning Outcome 2: Gather and critically evaluate data using the scientific method.

Student Learning Outcome 3: Identify and explain the basic concepts, terminology, and theories of biology.

Student Learning Outcome 4: Apply selected concepts and theories of biology to contemporary issues.

1) knowledge of biology, 2) thinking and problem-solving skills, and 3) applying knowledge to contemporary issues. I think that Regental Outcomes 1 and 2 could easily be combined and the wording regarding the scientific method may portray this as a linear step-wise approach to understanding the natural world. A more current term is scientific thinking that involves a number of skills such as observation, data collection, analysis, synthesis, and evaluation. An even broader term called scientific *literacy* is probably more appropriate for nonmajors.

The four outcomes comprising the Regental goal are rather specific, measurable, and challenging, which makes them relatively easy to map to courses and assess their success. In the Biology Program these outcomes map directly to learning experiences in Biology 101. Looking at the Bio 101 syllabus, it is easy to see Goals 1, 2 and 3, or the scientific method and principles of biology. In a general education program, it’s important to remember that the emphasis on the scientific method is not to make students into scientists, but rather have them understand how science works so that they value evidence and trust science in an ever-increasingly complex world. However, the application of biological concepts to contemporary issues, Goal 4, is not apparent in the Bio 101 syllabus. My opinion is that this is at the heart of general education in biology – producing students who value and can make data-driven decisions regarding contemporary issues.

Biology 101 also serves as a natural point of assessment of the four outcomes. I did not find that these outcomes were directly assessed as part of a systematic program of improvement. Like most programs, it is assumed that if students participate in learning experiences and receive a passing grade that they have met the learning outcome. Assessment professionals universally regard course grades as poor indicators of learning because of the number of non-learning factors that influence them. Lastly, simply exposing students to contemporary issues or scientific methodology does not ensure that they actually learned what you want them to learn.

Suggestions for Improvement

The following suggestions arise from current trends in higher education. The American Association of Colleges and Universities (AAC&U) produces a number of publications regarding general education.

- 1) Redesign Biology 101 with a contemporary issues theme that directly addresses Regental Outcome #4. If it already does revolve around this, then make it more apparent. Make contemporary issues more visible to students from Day 1. Be sure students see how 101 helps them understand issues such as stem cells, obesity, global climate change, public health issues, deforestation, and genetic testing.
- 2) Eliminate Regental Learning Outcome #2; if the student successfully performs #1, then he or she has also demonstrated #2 (If you disagree then combine them into a single outcome).
- 3) Determine what are the basic concepts, terms, and theories of biology for nonmajors. I suggest a “backwards design” model, where you work from the contemporary issues in Outcome #4 backwards to the concepts, theories and terms needed to frame and understand them. For example, to understand stem cells, students will have to understand cells, mitosis, differentiation, embryos, bone marrow, etc.
- 4) To more strongly align Regental Goal #6 with assessment, embed specific assessments in Biology 101 to determine student progress, develop rubrics, and give feedback to students for improvement. Have this information be communicated upwards from course to college to university levels.

Commentary on Biology Program Goals:

The Biology Program Goals are good ones – they involve knowledge of biological concepts, the application of knowledge, tools to expand knowledge, and the communication of knowledge. There are many programs in the country that lack goals altogether and when framed are vague and difficult to measure. In general, these four goals are stated in terms of student actions; they are appropriate and challenging. Clearly Goal #3 is aligned with the institutional mission in terms of proficiency with computer technology.

Suggestions for Improvement

- 1) Map these goals to specific courses in the curriculum.
- 2) Design specific instruments to assess competencies of your students and then map them to specific courses.
- 3) **Goal #1 Knowledge.** This goal is a good start, but more clarification is needed. First, describe what a student does to demonstrate that they understand a principle of biology. Second enter into faculty discussions to further clarify what you mean by “basic knowledge and principles of biology.” List the essential biological concepts that must be included in the program. Then map this conceptual content to specific courses in a table like shown below.

	Botany	Zoology	Micro	Cell	Genetics	A & P
Concept 1	X	X			X	
Concept 2	X		X	X		
Concept 3			X		X	X

Be careful not to get too specific. For example, rather than say, “photosynthesis drives all life” as a concept, be more general and say, “living systems transform energy.” This way you can more easily assess this through the MFAT, or design your own assessment tool to evaluate their conceptual knowledge of biology. This type of table will go a long way toward integrating the courses in the curriculum by displaying overlaps, reinforcements, prerequisite information, and possible gaps in the content knowledge of the program.

4) **Goal #2 Problem-solving.** As before, the trend is to not state the scientific methods as a stepwise approach to thinking scientifically. The California Science Center has an excellent website that shows this process as dynamic and real. You will need to develop rubrics to clarify what you mean by “understand” and “think logically.”

5) **Goal #3 Computer Technology.** Like my comments above, to make put these goals into action, you’ll need to articulate what it means to be “proficient” in the use of computer technology. Do students arrive already proficient? Is there something you do in the Biology Program that makes them more proficient? What learning experiences in which courses speak to this goal? How much value is added by these biology courses? The employer survey asked for feedback on computers in only 2/12 questions; plus, I don’t think they ask the right questions – one question asks if the alumni of your program are “adapting to changes in computing” and the other asks if they were “using computers effectively.” These questions are vague and don’t really support the assessment of this goal.

Goals and Objectives of the Biology Program

Goal 1. Graduates will have a basic knowledge of the principles of biology.

a. Graduates will understand the important concepts and methods of the major disciplines within biology.

b. Graduates will have a basic knowledge of the history and philosophy of science and will understand the ethical and humanistic implications of the practice of science including issues in biology that are controversial in nature.

Goal 2. Students will be able to use their knowledge of concepts in biology to solve new problems.

a. Students will understand the process of science including the basic steps of the scientific method and use this ability to conduct research in biology.

b. Graduates will think logically and be experienced problem solvers.

Goal 3. Have a high degree of proficiency in the use of computer technology.

a. Students will be proficient users of computer technology to find information, acquire and analyze data, and communicate results and conclusions.

b. Graduates will be able to successfully use technology in their post-graduate career:

Goal 4. Students will be able to communicate their knowledge and results effectively for a wide range of purposes and intended audiences.

a. Graduates can effectively communicate information in writing.

b. Graduates are effective speakers communicating information to a variety of audiences.

c. Graduates have solid social skills.

Goals specific to the degree in Biology for Information Systems:

- Graduates of the BIS program will be able to gain employment in business and industry where an understanding of the world of business, information systems, biology, and related math and science areas is required or desirable.

Goals specific to the degree in Biology for Education:

- Graduates will be effective teachers of the biological sciences at the secondary level.

- Graduates will be prepared to integrate the use of computers into teaching processes within the biological sciences.

6) **Goal #4 Communication.** Faculty need to develop a rubric that clarifies the meaning of “effective communication” in writing and speaking. This rubric should be developmental in nature and should ideally, be able detect improvements in students’ communication skills as they progress through the Biology Program. Look at the rubric developed by AAC&U to assess oral communication. They are currently developing one for written communication. As we discussed in my outbrief referring to the subgoal “develop solid social skills,” I understand its origin in the Employer Surveys, but unless you have an intentional means to develop these skills in your students and assess your program’s impact on them, I suggest you delete it.

B. Program Resources

- Effective use of resources to meet program goals
- Faculty staffing levels and credentials
- Classroom facilities
- Laboratory facilities and equipment
- Financial support

Faculty as a Resource in Meeting Goals. The fact that the Biology program accomplishes so much with so little is impressive. DSU is very fortunate to have three fulltime faculty members who do it all – they teach a diverse array of general education, service, majors, and special topics courses; they involve undergraduates in their research projects; they write grants for extramural funding; they serve on a number of university committees; they advise, mentor and support student activities; they serve the community and the outreach component of the department, and also must stay abreast of the rapidly changing educational technology practices. In the past review, the external reviewer expressed concern that faculty are teaching outside of their specialization. For example, Dr. Donna Hazelwood, who is trained in plant-microbes relationships is teaching the human anatomy and physiology course, which serves majors, Respiratory care, and Exercise science majors. I think that her ability to bring knowledge from one area of biology to another is actually a strength of the program. Her perspectives on plant pathology serve her well in teaching microbiology and cell and molecular biology. Too often specialists have narrow perspectives and fail to bring in cross-disciplinary connections like Dr Hazelwood.

It was also noted in the previous review (see box at right) that faculty prep their own labs and that parts of this time intensive activity could be accomplished by a student worker. This is especially true in the hours it takes to make growth media for microbiology labs. I personally performed this role as an undergraduate and learned a lot of microbiology in the process. I suggest that it would be a better use of resources to hire a student worker to prep the microbiology lab. Given the scope of the biology program in serving a number of other majors on campus, as well as the upcoming new facilities, I suggest the hiring of a lab manager (even part time) to alleviate some of the more tedious, time consuming tasks currently handled by faculty. This finding by the reviewer in 2004 has not been resolved. I suggest exploring the barriers preventing this solution. Is it the fact that faculty do not want to give up this task? Is it the money is not available? Are reliable student workers not available? Is setting up the lab too challenging for an undergraduate? Is training a student too time consuming, so it is easier to be done by the faculty member? If the reason(s) is (are) known, then it should be addressed. I elaborate further on this in my suggestions section.

From the Self-Study, page 8...

“An even greater concern was the lack of staff support for the Biology program. While office administrative support was adequate, no laboratory technical support existed. Therefore, faculty must do all the ordering of supplies and equipment for the labs, must set up and take down their laboratories, as well as be present as instructors during lab exercises. They also must perform all recordkeeping entailed in the use of chemicals, preserved specimens, or live animals in teaching exercises, and they must insure compliance with OSHA, EPA, and USDA regulations. ***This is not an efficient or well thought out use of the time of highly trained Ph.D. teachers/scholars.*** If the Biology faculty did not have to spend time carrying out what are usually the functions of a technical support staff, they would have more time to spend on student recruitment, research, and grant seeking.”

Laboratory Facilities & Equipment

Given the planned renovation for the Science Center, I will assume that upgrades to the outdated facilities will be very positive for supporting the learning goals of the program. It is exciting to see the plans and the involvement of faculty in the prospect of a renovated facility. Again, I will caution that it's easy to highlight the shiny new facilities and technology to students, parents, and external stakeholders, but the essence of the university resides in faculty-student interactions – a strength of DSU. Optimal learning occurs when students are appropriately supported and challenged within rich learning environments. Technology contributes to one aspect of this equation – a rich learning environment.

The integration of scientific probes linked to data collection software will place DSU out front in incorporating hands-on activities in the classroom. This will also be true of digital imaging equipment. Again, the effectiveness will depend on how it is used and put into play by faculty. Learning depends, not on being *physically* active; rather it depends on the *cognitive* tasks that the equipment affords. Measurements made from digital images can be used to gain insight into biological structures, as well as acquiring research data. This equipment will be essential when biology courses become integrated into the Scientific Forensic Technology Program in the future.

Library Support

In my visit with Risë Smith at the Karl Mundt Library, I was impressed with her commitment and involvement in the information literacy of students. She teaches 4 lessons of the course SCTC 303 Computer Applications in the Natural Sciences. I was unable to recall if the online journal resources were universally available through databases such as Science Direct, PubMed, Academic Premier, Web of Science, EbscoHost, Agricola, or Biosis. This level of access to full text papers is expensive, yet it is essential for faculty and students to meet published learning goals. Risë mentioned that Interlibrary loan was often used as another avenue of rapid access to scientific papers, and more cost-effective.

Financial Support for Faculty Development

Given that faculty are asked to teach outside of their areas of specialty, I would expect a fairly large commitment to their professional development. It is my opinion that the real mark of excellence is in the faculty-student interactions. Flashy computer technology can be deceptive and appear to enhance learning when it depends entirely on how the faculty put it into use. I was surprised to see that there are so little monies invested in the pedagogical uses of technology. The Self-Study states that “Faculty apply for support and up to \$1000 per year is available for each faculty member.” One faculty member told me that they personally funded an entire professional development conference out of pocket. When you add up the investment in technology infrastructure each year, as well as the new facilities, the relative investment in the human capital to make effective use of this technology is low. The costs of attending a national conference today require more money. I think a target goal of \$2000 per faculty member would make a statement about the importance of keeping current in the rapidly changing field of educational computer technology at DSU. In the Technology Integration section I suggest that you consider a Center for Technology in Teaching, that facilitates innovative uses of computer technology by faculty.

Suggestions for Improvement

- 1) Hire a work-study student (there may be Federal work-study funds available to pay for this) or a part time lab manager to prep some of the labs and/or file Hazmat and other chemical paperwork. Hiring and mentoring work-study students may also help in student retention and may provide an opportunity for students to apply their knowledge to solve problems (Program Goal #2). The faculty member doesn't necessarily have to cede control over the lab set up, he or she can work with the student, mentoring them in how to construct and implement a lab program – what a win-win situation for a biology education major and the faculty!
- 2) Provide ways to get your faculty to use the latest in computer technology in the classroom. If it is not feasible to reallocate technology money toward professional development, perhaps an internal grant funding process can be initiated. A specific pool of monies can be awarded to those faculty members who apply for it and will use it to a) innovate and experiment with technology applications in the classroom and b) train other faculty members.

C. Program Curriculum

The coursework demanded of the majors seems an appropriate mix and balance for the Biology for Information Systems degree. The BIS student I met with was enthusiastic about his preparation for a job

Strategic Goals - Academic Programs

- The biology faculty will carefully revise the current curriculum to achieve the flexibility needed to accommodate the diverse career goals of our students. With an increasing number of students interested in health professions, wildlife and resource management, and research lab technology as well as education, additional options are needed.
- Other changes in the curriculum are necessary to allow an increase in the number and frequency of upper level biology offerings. Currently, students are generally pressed to take enough elective biology credits to meet the requirements, and a greater diversity of special topics offering would be desirable.
- The biology program and exercise science program need more interaction to improve the scheduling of courses. Majors take courses in both programs and conflicts are too frequent. Faculty should work together to provide course offerings that would be beneficial to students in both programs. A positive step in this direction was the addition of an upper level course in physiology.

in industry and is absolutely convinced that his business coursework serves him well. Given the low enrollment of biology for information systems (17) and biology education (4) majors, I see that the Biology Department serves many other majors as shown by the large enrollment in Bio 101 (~200 per year) and Bio 103 (~120 per year). The Anatomy and Physiology course serves five different majors (HIM, exercise science, respiratory health, biology majors, and secondary education). No classes have 100% biology majors, and thus must serve the interests of a diverse clientele.

Dr. Droge and I discussed opportunities in the bioinformatics field. Most professionals in this field have extensive graduate work in cell and molecular biology and biochemistry, and thus not making it a feasible major or program at DSU. I suggested partnering with SDSU or USD to provide the information systems or the graphic modeling portion of a graduate program.

Increasing the number of upper level courses may be achieved by offering special topics courses. However, there is a faculty "cost" to this decision. There is only so much you can ask of your three faculty members. Additional offerings would

come out of the prep time of your faculty. One possible solution entails hiring an adjunct professor to teach within his or her area of specialization. Enrollments in the health professions such as Respiratory Care tend to be cyclical with the economy and may be wise to remain flexible in terms of course offerings.

There is a great opportunity for the department to grow along with the Scientific Forensic Technology Program. I was surprised to find that there currently is no link between programs. Dr. Forbes-Boyte indicated that this natural connection would be made soon. This seems like a perfect match – applied biological technology. How will the Biology Program absorb and service the additional students in courses such as general biology, cell and molecular biology, and anatomy and physiology? How will DSU support faculty to become highly skilled in this specialty area of biology? Will special equipment for the amplification of DNA, detection of short tandem repeats (STRs), and databases be purchased, used, and maintained? Forging this link will be expensive and require investments in faculty training or hire.

Another opportunity for integration within the College of Arts and Sciences exists between the Digital Arts and Design (DAD) Program and the Biology Program. The DAD Program involves audio and animation production, as well as computer graphics, modeling and simulations. All of these capabilities can be applied to authentic and useful biology projects. This will merge cutting edge technology and cutting edge pedagogy! The Dean mentioned a Tech Fellows Program that has contributed to specific projects and that the current DAD program focuses more on artistic expression rather than scientific ventures. I can't think of a more mission-appropriate program for DSU than the creation of real world modeling or animations of biological systems.

Suggestions for Improvement

- 1) Require biology courses in general biology, cell and molecular biology in the Scientific Forensic Technology Program.
- 2) Explore ways that the DAD program can support the animations and simulations that would enhance biology courses and student learning. Cross-disciplinary ties are critical at DSU and should be built into the department's strategic goals.

D. Technology Integration

As you would expect, DSU has made a considerable investment in the range of \$300-500K in infrastructure of computer hardware and software throughout the campus. The Madison campus has an impressive wireless network that supports every student's tablet PC. Tablets are used in all biology courses and students bring them to each class to create a paperless environment (except for in-class quizzes). Students I talked with said that the tablet is a substitute for the traditional notebook as a means of taking notes. PowerPoint presentations are downloaded before class and students then take notes on their tablets with their stylus pen. Both faculty and students mentioned the downside to this technology – it is common to see first and second year students, especially, surfing the net, social networking, or checking their email during class. Policy statements regarding this negative side are also included in the syllabi I reviewed.

I was surprised that this powerful tablet platform was not better utilized to engage students and assess learning in class. Simply using tablets as devices for information transfer fails to take full advantage of DSU's large investment in the wireless campus. For example, tablets are capable of acting like "clickers" or polling devices used in large classrooms throughout the country. All it would take is a modest investment in software and an USB antenna to connect the instructor's PC to all students in the class. Another advantage to tablet PCs is their ability to engage students in class by way of classroom management software (i.e. SynchronEyes®). This system allows the instructor to view and control what students see on their tablet. I have seen this used effectively when an instructor poses a graph and asks students to complete the graph with their stylus pens. The instructor can then tile and present a number of student graphs on the screen. By viewing their work, the instructor can give feedback and guidance, as well as encouragement. This has the added benefit of keeping students on task and away from distractions during class. There may be some pushback from students on this system, especially those that see this as an invasion of their privacy, or their "right" to disengage themselves from the class.

The Desire2Learn course management system is used primarily as a communication tool that facilitates information sharing between faculty and students. I was also surprised that none of the biology courses employed online quizzing assignments that can be built using the quiz tool in the Desire2Learn system. It can be used to prepare students for lecture or lab experiences and the score can be dropped directly into the instructor's gradebook. I personally use this technology in my course – before each lesson, students read a section of the text and take an online quiz. My students universally tell me that they like this system because it gets them to read the text and prepares the class to go further than simply transferring information through a lecture. I even have a student who takes my online quizzes on her iPhone. This is just another example of technology that biology courses can tap into. A discussion with people highly trained in the educational technology arena would provide a wealth of ideas for you.

This underutilization of powerful technology may be due, in part, to the underinvestment on the part of the university to fund the technological abilities and development of faculty. I would expect that your faculty would lead the state in the use of computer technology to promote student learning. I would highly encourage a shift in priorities to "grow your faculty" to attend conferences, short courses, or workshops to bring the latest advances in educational technology back to DSU. A more cost-effective way may be to invite guest speakers or software sales reps to campus. Currently, financial and promotional incentives are placed squarely on discipline-based research, where the emphasis, I believe, should be placed on productivity and publications in the scholarship of teaching and learning (SoTL), which emphasizes the positive impact of computer technology on student learning. The Strategic Goal Technology #3 can also be interpreted to use technology to collect educational and learning data as well as scientific data. This type of incentive would bring the mission of the university squarely in line with faculty rewards.

Strategic Goals - Technology

1. Wireless mobile technology (PC tablets) will be integrated into general education courses and along with other computer technology will be used in all biology courses as soon as possible.
2. The use of digital images will be increased in all courses with students developing their own study guides and lab manuals in many courses.
3. More equipment will be obtained that can be connected to the new technology and allow the collection of extensive and long term data.

Strategic Goal #2 for technology addresses digital imaging, which will be a great addition to the biology laboratory and classroom. The January 2009 issue of *The American Biology Teacher* has a “how to” article on making digital images accessible for study and testing. These images can be uploaded to a website and can then be used in class or as an assignment. Here lies another opportunity for integration with the students in the DAD Program. A web design student could be commissioned to design and build a biology course website that includes digital images for students to access and study – an authentic win-win project.

Suggestions for Improvement

- 1) Invest in faculty to go out and bring back the latest innovations in educational technology pedagogy to DSU and the state. This can be decentralized by seeding faculty or more centralized approach through a Teaching with Technology Center. This type of technology center runs workshops and finds ways to get faculty to try out new hardware and software. The University of Denver has such a program, where the center works with faculty to try different technologies. The director told me that most vendors provide a free trial period. She told me that it’s a “bottom-up” type of program where faculty come to her rather than having the center push particular types of technologies to the faculty. Is DSU part of teaching with technology consortium? Colorado has a group that can be explored at <http://telecoop.org>
- 2) Explore new software programs to better utilize tablet PCs to prepare, engage and assess student learning.
- 3) Explore the quiz tool to expand use of the Desire2Learn course management system.
- 4) Align your mission with faculty promotion by rewarding faculty to investigate how specific educational technologies impact learning. Include this as part of the “Institutional priorities” portion of their annual review. If you award more monies for faculty development, then incorporate this in the annual review to make the most of these dollars.

E. Program Assessment

- Appropriateness of assessment measures/activities for the discipline
- Major field assessment activities, relative to program goals

There is terrific institutional support for assessment and there is even a day set aside as “Assessment Day.” This culture of assessment is enviable and praiseworthy. It is relatively easy to set aside time to collect assessment data, however, remember that the purpose of assessment is *to improve student learning*. Step back and ask yourself, “How do I use the NSSE results to improve learning?”

The Biology Program Goals are assessed a number of ways as detailed on the Self-Study. Assessment measures include course grades, national exams, graduate surveys, employer surveys and exit interviews. This aspect of the review speaks to the HLC’s second and third fundamental questions on gathering evidence and feeding it back into a system of continuous improvement.

Course grades. As previously reported, assessment professionals universally regard course grades as poor indicators of learning because of the number of non-learning factors that influence them. A student’s grade reflects behaviors not directly linked to accomplishment of learning goals. For example, if there is an attendance requirement in a course, or policies that deduct points for late work, grades encompass more than mastery. Grades are crude measures because they lack the specificity to be useful to improve.

Major Field Tests (MFAT). This standardized exam is used throughout the country and has the advantage of providing comparative data to other colleges. The disadvantages are 1) getting students to take them seriously, 2) targeting questions to the DSU curriculum. The MFAT in biology tests a broad range of content and has been criticized for testing lower-level factual recall. Results and trends were not revealed in the Self-study and it is unclear from my discussions with faculty how MFAT results have influenced curriculum decisions and have fed back into the system. It may have played a role in introducing a course on cell and molecular biology.

Surveys. Employer and exit interviews are indirect measures of learning and attainment of goals. The Employer Surveys indicated a positive impression that DSU’s graduates have made on their employer. Exit interviews are based on perceptions and level of satisfaction of graduates exiting a program. The real In terms of NSSE, I did not know if the results were broken out to show the engagement of biology majors. I suspect the sample size would be too low to make any meaningful comparisons.

Classroom Assessment Techniques. On a course level, two faculty members in the department regularly used in-class assessment techniques called “writing to learn” and “muddiest point.” This 3-minute activity is a simple way to get students to reveal their thinking to the instructor and thus allows the instructor to assess whether students are progressing in their understanding of the material. This technique is consistent with best practices about learning. With this technique the instructor can address misconceptions and guide deeper thinking. Students told me that they receive feedback on their answers at the beginning of the next class and find it useful.

Classroom Observations. Is there a classroom observation program? Are faculty members using each other to improve their teaching? Do biology faculty observe biology education students in their student teaching?

The Higher Learning Commission’s Five Fundamental Questions

1. How are your stated student learning outcomes appropriate to your mission and program?

2. What evidence do you have that students achieve your stated learning outcomes?

At what points in the program are the outcomes assessed?

3. In what ways so you analyze and use evidence of student learning?

What is your evidence telling you about student learning?

4. How do you ensure shared responsibility for assessment of student learning?

Is it cross-functional, and communicated to all stakeholders?

5. How do you evaluate and improve effectiveness of your efforts to assess and improve student learning?

What is the quality of the information you have collected – What is it telling us?

Suggestions for Improvement

- 1) Include specific decisions you have made to the program based on assessment data. The Self-Study states "The faculty meet annually to review assessment data and make recommendations for improvement, if necessary."
- 2) Consider designing your own exit exam to assess accomplishment of Goal 1 on concepts and principles. It is time-intensive but forces the faculty to decide what is really important for students to retain.
- 3) Target courses for embedded assessments for Goal 2 on communication and Goal 3 on proficiency with computer technology. Look for specific writing and speaking assignments or computer projects that indicate the progress along the path of accomplishments of learning goals. Then develop rubrics and collect the data. At this point, these goals seem to have placement and employer surveys as the only assessment instruments.
- 4) The Assessment Office gathers lots of data that do not filter downward to making informed decisions about how to adjust teaching, course design, or assessment on the program and course levels. I suggest that the Assessment Office present the results from the NSSE to the faculty in a series of campus workshops. The results are often surprising to faculty, especially in areas of how much time students put into their classes. These discussions would connect the high level assessments to faculty and students.

F. Student Support/Enrollments

- Student recruitment efforts
- Student enrollment numbers
- Student graduation rates and placement
- Student support services
- Academic advising

Observations and Suggestions for Improvement

Student Enrollment & Recruitment Efforts

Biology Education. The low enrollment in the biology education program is a cause of concern. Teacher shortages in the sciences mean that a job awaits those that complete their degree and certification requirements, even though the pay is low. So I was not sure why the biology education student I talked with said that DSU was having difficulty placing her into a student teaching assignment. I would imagine that any of the region's high schools would welcome a student teacher.

There are many challenges to recruiting students into biology education. I heard that many students are reluctant to relocate farther than Sioux Falls due to family, friends, or familiarity. It was also frequently mentioned that South Dakota ranks 50th out of the 50 states in several categories supporting public education, namely teacher salaries. I was quoted a starting salary of \$24-28K for a biology teacher in the secondary schools. Low pay along with the myriad of social challenges facing secondary biology teachers, it is easy to understand why teaching is not the top choice of students today. I did not speak with anyone from the Education Department, so I am unclear as to their relationship with Biology or other departments in terms of working relationships, the extent of collaboration, or the cross-fertilization of ideas.

Biology for Information Systems. The two areas of specialization, namely Business and Health and Technology strike me as areas that are experiencing job growth and opportunity for your graduates.

Graduation Rates & Placement

Dr. Droge estimated that about 25% of students who started the Biology Program actually completed it. This is a very low retention rate and should at least trigger questions as to why students do not complete the program. When asked, Dr. Droge cited mostly personal issues of the students who left. In all of his years he could only remember a few who changed majors because of difficulties with the program. Across the country retention rates in the science and engineering majors is about 50%. This low retention rate has been attributed to poor teaching, traditional pedagogy, lack of personal involvement, and a "weed out" mentality among faculty members.

Although I would characterize the pedagogy as traditional lecture and lab, punctuated with discussion, there was no evidence of poor quality instruction, lack of caring or involvement or a “weed out” mentality commonly found at larger state universities. Both students I interviewed expressed admiration for the education they received in the department.

Student Support Services & Advising

Positive and frequent student-faculty interactions allow excellent mentoring and advising to occur. This personal attention is a great strength of the department and the university. I suggest that you capitalize on this strength for recruitment and retention purposes.

Suggestions for Improvement

- 1) Link DSU’s computer technology focus to the future of K-12 education.
- 2) Make students aware of scholarship opportunities such as the Robert Noyce Scholarship Program for Math and Science Teachers. This national program encourages talented Science, Technology, Engineering, and Mathematics (STEM) majors to consider the teaching profession. Its website states that each Noyce Scholar receives a maximum of two years of scholarship support of up to \$10,000 per year.
- 3) I suggest that the department continue to portray what a person with a BIS degree can do with it and get alumni to recruit at “Majors Night” type events where students are making career decisions. Tout the fact that placements are high and there are good jobs available in the local area.

G. Program Strengths and Areas for Improvement

Strengths

- 1) The highly dedicated and involved faculty who do it all and do it well – teaching, service, research, advising, and lab prep.
- 2) The positive and personal atmosphere of the university that permits students to intellectually develop and faculty to innovate. This personal attention is a great strength of the department and the university. I suggest that you capitalize on this strength for recruitment and retention purposes.
- 3) The sense of teamwork from central administration to the library to the faculty.
- 4) The wireless network across campus creates a wide variety of learning opportunities for students and faculty.
- 5) The renovation of the Science Center will provide state-of-the-art facilities for a rich learning environment.
- 6) The Biology Program has a set of program goals and assessment measures in place.

Areas for Improvement

- 1) Gather information and catalog reasons why students who start the program do not complete it.
- 2) Better utilize the learning potential of the tablet PCs in classroom teaching – expand the powerful tool you have by training and rewarding faculty to experiment and innovate. – I see DSU as an educational technology laboratory.
- 3) Better clarify program goals and then map each goal to learning experiences in specific courses in the curriculum.
- 4) Embed assessment measurements in specific courses and use those measures to truly evaluate the students’ accomplishment of your program goals and ultimately to improve student learning
- 5) Begin to integrate the Biology Program with two other programs in the College of Arts and Sciences – Digital Arts and Design and Scientific Forensic Technology – opportunities abound for collaboration
- 6) Commit to align faculty rewards with the institutional mission to be the leader and innovator of educational technology in the state and region.
 - A. Allocate more technology dollars towards faculty training and development – \$2K per faculty member is a minimum to attend a conference.

- B. Reward faculty that serve the institutional mission by innovating and training others in the use of educational technology
- C. Release faculty from the burden of lab prep by hiring a lab manager for the new upgraded facility.

H. Specific Issues

I conducted a general review and was not asked to look at specific issues other than those addressed in this report.