Board 105: Work-in-Process:Cultivating Meta-cognitive Skills and Emotional Intelligence in First-Year Curricula

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Dr. Josh Mattes grew up in Indiana. He received his PhD in Physics from Purdue in 2013. His research interests are foundations of quantum mechanics, finite temperature quantum field theory, and STEM education.

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Dr. Robert Pieri is Professor of Mechanical Engineering at North Dakota State University (NDSU) in Fargo, ND. He has many conference publications on engineering education and design. His primary interest areas include: Engineering Education, CADD, Design, Fracture Mechanics, Materials Science and Alternative Energy Options. Prior to joining NDSU, he worked for Allied-Signal Corporation and in the aircraft supply industry. Prior to his industrial experience he taught for 10 years at the US Air Force Academy. Prior to his time at USAFA, Bob was a Research & Development Engineer with the US Air Force, studying problems of pollution in the earth's atmosphere. One of his dissertations involves the environment and policy decisions that could affect it. Dr. Pieri has degrees from the University of Massachusetts at Amherst, Thayer School at Dartmouth College and Carnegie – Mellon University in Pittsburg, Pennsylvania. For the academic year 2003- 2004, Bob was on the faculty at Turtle Mountain Community College in Belcourt,N.D. where he taught Math and Engineering classes. This is the basis for his current interest in Native Americans into Engineering. Bob, originally from the northeast area of the USA, has been a resident of Fargo, ND since 1996.

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Austin Allard is a Pre-Engineering Instructor at Turtle Mountain Community College. He earned a doctorate degree in Civil Engineering from Texas A&M University. His work deals with using manufactured drones to map ecological areas. He is dedicated to using engineering solutions to investigate environmental issues close to home.

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Mike Parker received a BS in Mechanical Engineering from North Dakota State University. He served in the US Army as a reliability engineer and vehicle test officer. He has been an agricultural producer in his home state of ND as well as being involved in local manufacturing and oil well hydraulic fracturing. He is currently an instructor at Cankdeska Cikana Community College in the Pre-engineering program.

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Lori Nelson began her professional experience as an Industrial Engineer working the capacity of business process manager for a major U.S. aerospace manufacturing firm. This role provided functional consulting for supply chain with key ownership responsibility ensuring appropriate data design of master data, IT architecture and solution design for all ERP solutions across the organization.

She holds a Masters of Arts in Teaching Mathematics from Minot State University, a Bachelor of Science degree in Industrial Engineering and Management from North Dakota State University, and post-masters certificate in Experiential Education through Equine Assisted Learning from Prescott College.

Currently she serves as the Land Grant Director and also as PI of the Pre-Engineering Education Collaboration (PEEC) Grant at Nueta Hidatsa Sahnish College in New Town, ND. In addition, she teaches Mathematics and Equine Studies courses.

Her and her husband, Chris, live and raise Angus beef cattle, near Towner, ND. In her spare time, she enjoys riding horses and providing community outreach through relational horsemanship through the Nueta Hidatsa Sahnish College Horse Nation program. Currently she serves on the board of directors for an engineering firm that specializes in transportation engineering and materials testing.

Mr. Karl Haefner, Cankdeska Cikana Community College

Cankdeska Cikana Community College Karl Haefner, PEEC Collaborative Team Member. University of Phoenix, M.A.e.d., Secondary Education, 2008 Grand Valley State University, B.S. Geology, 2004 Saginaw Valley State University, B.S. Mechanical Engineering, 1988 Mr. Haefner is an engineering instructor at Cankdeska Cikana Community College, where he is actively working to build the Pre-Engineering Department. He assisted with writing the AMI accreditation report to the HLC, wrote several successful grants, and managed CCCC's Advanced Manufacturing Curriculum and Pre-Engineering Educational Consortium. In addition the Advanced Manufacturing initiative at CCCC has hired two undergraduates to run the 3-D/Scanner Laboratory. The aforementioned gives the students hands on training in a STEM related field. Mr. Haefner has 13 years' experience teaching college STEM courses. He has taught construction management at Westwood College in Chicago; mathematics at Mid-Michigan Community College and Cornerstone University in Grand Rapids, MI. Mr. Haefner has taught algebra, engineering statics, several HVAC courses, several CMT classes, as well as AutoCAD and Advanced Manufacturing using SolidWorks. Mr. Haefner also has over 15 years; experience in the fields of civil, geo-technical and environmental engineering at companies including: Testing Service Corporation in Carol Stream, IL; Singh & Associates in Chicago, IL, Weaver, Boos and Gordon in Chicago, IL; STS Ltd. In Grand Rapids, MI.

Cultivating Meta-cognitive Skills and Emotional Intelligence in First-Year Curricula

MOTIVATION

Colleges and universities have traditionally devoted considerable resources to restructuring and refining learning environments in order to address deficits in "hard skills" such as reading, writing, mathematics, and critical thinking. Comparatively fewer resources have been devoted to improving the cultivation of “emotional intelligence” and "soft skills/attributes" such as interpersonal communication skills, metacognitive analysis of study methods [1], resiliency [2], [3] motivation, and problem solving around non-academic issues. However, research and experience have shown that while hard skills are necessary, they are often not sufficient for academic success, because developing proficiency in soft skills is a often a prerequisite for obtaining necessary proficiency in the hard skills (see [4], [5] for illustrations).

The engineering instructors in the NSF-funded Pre-Engineering Educational Collaborative (PEEC), which partners tribal colleges with mainstream engineering schools, have seen the degree to which such difficulties are amplified in settings where traditionally under-represented and often under-prepared students engage with the rigors of a STEM degree program such as engineering [6], [7]. Many willing-and-eager students enter such programs with deficits in hard skills that are difficult to correct in the absence of sufficiently developed soft-skills, resulting in an extremely challenging situation for both students and instructors. In response to this, Sitting Bull College (SBC) has embarked on a program, hereafter called IFYEP (Integrated First Year Experience Project), to incorporate a focus on soft-skills development into a cohort-focused first year experience. The IFYEP model can serve to enhance the cultivation of soft-skills without the need for significant curricular change. Furthermore, this program model is capable of fostering a culturally appropriate learning community that helps bridge the gap between mainstream academic settings and the students’ collective culture of origin (see [8], [9] for background). The purpose of this paper is to briefly present the salient features of the IFYEP model as manifested in a pilot program at SBC.

IMPLEMENTATION OF IFYEP

For purposes of comparison, we briefly indicate the structure of the first semester at SBC before the implementation of the IFYEP. Students typically had a fixed schedule of classes their first semester, with some divergence (depending upon degree plan) taking place in the second semester. For example, first semester students take courses in student success (PSYC 100), computer skills (CSCI 101), composition (ENGL 110), and math (MATH 099 thru 103) in alignment with their placement test. The classes and the instructors more or less operated independently, with few students ending up in multiple classes together.

The development of the IFYEP model was informed by five primary goals:

1. In order to easily facilitate the transfer of students within the North Dakota State University system, there should be no changes to course numbers, course descriptions, and degree plans.
2. Informed by the belief that the students' best resource is a healthy learning community where students learn from *each other* as much as they do their teachers and books, the IFYEP should involve a cohort of students consistently working together in meaningful ways.
3. Some portion of the activities in each class should be coordinated amongst the other classes, creating an element of project-based learning and subject integration
4. In addition to the hard/study skills that are developed in typical first year experiences, there is to be an emphasis on the development of soft skills and emotional intelligence
5. The cooperation, mutual support, and development encouraged amongst the students should be paralleled by the instructors, in the form of weekly meetings and trainings.

We now provide a brief sketch of the implementation details of the IFYEP pilot, focusing on those aspects that help achieve the five goals listed above. In the interest of space, we will not document the process of developing the original proposal and cultivating instructor buy-in.

In Fall 2017 and 2018, a special section of each of four first-semester courses was set aside, and around 15 to 20 students were simultaneously registered into all four of these courses, thus establishing a cohort. This cohort was comprised of random students, without regard to their degree plan, placement tests, etc. All other first semester students were enrolled in the traditional non-cohort curriculum. About a month prior to the start of the semester, each of the instructors (MATH, PSYC, CSCI, and ENGL), and the IFYEP project coordinator (Dr. Mattes) attended several meetings (roughly 6 hours total) to establish a sequence of weekly topics that would easily allow for subject integration across the courses. An example of a weekly theme threading through the four core courses is illustrated in Fig. 1, along with an indication of how additional major-specific first-semester courses could be integrated:

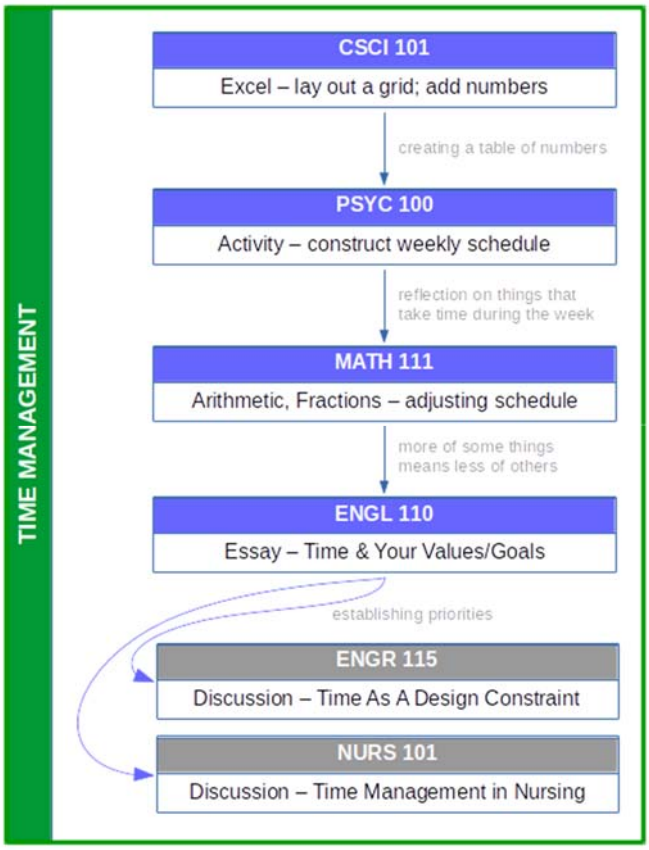

Figure 1 - Example Implementation of Integrated Weekly Theme

In designing this sequence, the instructors collaborated not only in deciding on the overall topic, but also on the specific sequencing, so that in each course there was some new skill, activity, or awareness/knowledge that was directly utilized in the following course. Thus, In CSCI 101, students would learn how to use spreadsheets to organize information in a grid and automatically add numbers. In PSYC 100, students would use this spreadsheet knowledge to lay out a weekly personal schedule, which could form the basis for a discussion of time-management skills. This discussion would involve some reflection on the various things that take time during the week, such as family time, hygiene, work, study, relaxation, exercise, making meals, travel, etc. Carrying this awareness of time-sinks into MATH, students would apply the concepts of arithmetic, fractions, and solving for unknowns to answer questions like “If I spend 20 hrs a week working, 10 on personal care, 30 on family, 4 on travel, and I want to sleep 8 hours a night, how much time is left for studying per day?” This type of mathematical exploration would emphasize the fact that spending more time on some things means less time for others, and that choices need to be made. The way in which these choices are made could then be the prompt for an essay in ENGL 110 in which they discuss the relationship between values, goals, and the way time is spent. The students have thus spent four classes discussing time management and establishing priorities in a personal setting. This segues nicely into major-specific intro classes (such as NURS 101 or ENGR 115) in which students could then have more specialized conversations of time-management as they relate to these specific professions. In both engineering and nursing, for example, time is a resource that requires establishing priorities in complex and interesting ways.

Another important feature is that the topic of time was revisited repeatedly throughout the course. For example, when assigning a big essay in ENGL 110 later in the semester, the instructor would ask the students to get out their planner and weekly schedule, and make a time-budget of the various tasks that will go into writing the paper. Because the instructors were meeting regularly, they were able to remind each other of doing such things. In this way, developing study skills isn't confined to a single class like PSYC 100, but is reinforced consistently across all courses, making it more likely for the student to develop better skills and habits.

While much of the semester was planned out during the summer, the 1-hour weekly instructor meetings allowed for modifying the schedule as needed. These meetings also provided an opportunity to discuss any issues related to particular students. For example, if a student is having some difficulties with particular tasks because they are very shy, all the instructors can brainstorm ways to help make the social setting more comfortable for the student as they work to enhance their confidence and interpersonal skills. In addition to planning specific classroom tasks and interventions, the meetings are also useful just as a way of building instructor community and solidarity: teaching is often a tough job, and being able to encourage and support each other can be profoundly valuable.

This structure and coordination by the team is essential in the development of a program in which soft skills are cultivated without sacrificing the necessary attention to required hard-skills. While some of the soft-skills are naturally developed in a cohort/group-work oriented context, other skills require more deliberate cultivation. Instructors work together in planning lessons that incorporate skill-development in various forms of problem solving and decision making. Students are taught easy-to-use tools, such as decisional balances [10], to help them make informed choices around their schooling. Using SMART goals [11], and creating safe environments in which students can be vulnerable and take risks, help students develop a stronger sense of self-efficacy. A large focus of the program is helping students move from negative and external motivators (e.g. avoiding poverty, not failing a class) to positive and intrinsic motivators [12] (e.g. feeling good when they overcome a challenge) that are more likely to carry them through the entirety of their program. In order to facilitate this, instructors have been taught motivational interviewing techniques to meet students where they are at and help them move through the stages of change [13], [14]. Through intentionality in instructor-student interactions these skills are integrated into classroom activities and office hours without losing focus on subject matter or leading to a watered down curriculum.

PRELIMINARY PROGRAM ASSESSMENT RESULTS

Three sources of data inform the ongoing assessment of the efficacy of the IFY EP model. One is qualitative data and "anecdata" from the instructors and students. For example, the instructors have all noticed more cooperation and voluntary interactions amongst the students. Such information is valid though difficult to quantify. A second source of data is retention data and pass rates for the classes involved, e.g. the data in Table 1.

	PSYC 100	ENGL 110	CSCI 101	MATH
cohort	67	67	73	76
non-cohort	57	43	55	81

Table 1: Percentage of students passing first-semester classes in Fall 2017

The sample sizes involved are sufficiently small that, in conjunction with other variates (such as differences in instructors, etc.), this isn't very strong evidence yet, though it is encouraging that the cohort students passed at higher rates in all classes but math (where it was comparable). In future semesters longer-term retention data (comparing students who were in the cohort their first semester) will become available.

A final source of data relates to student motivation and confidence. Motivation generally requires that somebody not only finds something important, but also that they feel competent enough to sand that they feel like it is possible for them to succeed [13], [14]. Thus, starting in Fall 2018, SBC is tracking student confidence/motivation and self-efficacy data via an anonymous pre/post 20-question student survey. Examples of the questions, all with responses on a 0-10 scale, are "Do you feel you have the skills necessary to succeed in college?", "How confident are you in your ability to be sure that you have reached the right answer or conclusion when you don't have the input of your instructor", "How valuable do you find group activities and assignments?", and "When you get stuck trying to learn or understand something in a class, how likely are you to experiment with different ways of studying to tree and see which way is best for you?". The questions were developed under the guidelines outlined in [15]. While differential data between cohort and non-cohort hasn't been collected, there are significant pre/post gains for most questions within the cohort, which again is promising.

CONCLUSION

The preliminary testing stages of the IFYEP model shows promising indications of fostering a culturally competent learning environment that can cultivate soft-skills and student motivation without sacrificing requisite hard-skills. The parallel cooperation and development of the instructors also has had positive benefit. The fact that such a model can be incorporated with minimal to no curricular change suggests potential benefit at other institutions as well.

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