Western Technical College and University of Wisconsin - La Crosse 2+2 Computer Engineering Technology-Computer Science Program

Jeff Fancher
Electronic & Computer Eng. Tech.
Western Technical College
La Crosse, WI 54601
FancherJ@westerntc.edu

Thomas Gendreau
Computer Science Department
University of Wisconsin – La Crosse
La Crosse, WI 54601
gendreau@cs.uwlax.edu

Abstract

Satisfying the needs of the 21st century workforce requires increasing the number of people holding baccalaureate degrees. This is especially true for careers in technical fields. Providing multiple pathways to complete a baccalaureate degree can lead to an increase in the number of degree holders. To address this issue the Electronic and Computer Engineering Technology Program (ECET) at Western Technical College (Western) and the Computer Science Department at the University of Wisconsin - La Crosse (UWL) created a 2+2 transfer agreement that allows students who complete the Computer Engineering Technology concentration (CET) of the ECET program at Western to transfer to UWL to complete a bachelors of science degree in Computer Science (CS). Students can complete the program in four years but students can also attend part time. The programs complement each other nicely because the CET concentration focuses on hardware and the hardware/software interface in systems and the CS program focuses on software engineering and advanced topics in computer science such as computer networks, parallel computing and security.

1. Introduction

Satisfying the needs of the 21st century workforce requires increasing the number of people holding baccalaureate degrees. This is especially true for careers in technical fields. Providing multiple pathways to complete such a degree is one way to increase the number of degree holders. To address this issue the Electronic and Computer Engineering Technology Program (ECET) at Western Technical College (Western) and the Computer Science Department at the University of Wisconsin - La Crosse (UWL) created a 2+2 transfer agreement that allows students who complete the Computer Engineering Technology concentration (CET) of the ECET program at Western to transfer to UWL to complete a bachelor of science degree in Computer Science (CS). Students can complete the program in four years but students can also attend part time. This is attractive because students with CET degrees can find good local employment and continue pursing the CS degree part time.

In the following sections we discuss the program and our experience with students in the program. Section 2 presents a brief history of the 2+2 program. In Section 3 we describe the curriculum of the 2+2 program. Section 4 discusses a National Science Foundation S-STEM grant that supports students in the 2+2 program. Section 5 discusses our informal judgment of the success of the program. In Section 6 we discuss ideas for additional collaboration between the UWL Computer Science Department and the Electronic and Computer Engineering Technology program at Western.

2. Brief History

In 2004 Jeff Fancher contacted the UWL Computer Science department about the possibility of creating a transfer path to UWL for students in the CET concentration of the ECET program (known at the time as Electronic Engineering Technology). At the time the ECET program was having trouble recruiting and retaining students and Jeff thought a transfer path for CET students to UWL's CS program would be a good recruiting tool. UWL CS was open to the creation of the transfer agreement in part because like many CS programs the UWL program had seen a drop in enrollment with the collapse of the Dot-com boom and was also interested in ways to increase enrollment.

A transfer agreement also made sense because the two institutions are located within one mile of each other and the CET concentration and CS program complement each other. The CET concentration focuses on hardware and the hardware/software interface in systems. The ECET faculty and their advisory committee could see the growing importance of students learning more about programming so they could work with the growing number of devices controlled by microprocessors. UWL CS can provide the CET students with additional software skills because the program focuses on software engineering. The CS program also offers a number of electives, such as robotics, computer networks and security that the ECET faculty thought would match the

interests of students and employers. In general the growth of embedded systems increases the need for people with skills in software engineering and an understanding of the hardware/software interface and developing the 2+2 program seemed a good fit for this trend.

The initial 2+2 program development and approvals by UWL, Western and their respective state systems was completed in 2005. The first student transferred from Western to UWL in 2007 and the first two graduates of the program graduated in 2011 (both students attended UWL part time). There are currently twenty-five students in the pipeline. Ten students have completed the CET degree at Western and are now enrolled in UWL and another fifteen students are enrolled at Western and are planning on transferring to UWL when they complete the CET degree.

3. Curriculum

The program is designed to have students complete the CET concentration at Western in two years after which they will transfer to UWL and can complete the CS major in an additional two years. Transfer is guaranteed as long as the students complete the requirements for the CET degree and maintain a 3.0 GPA at Western. In the initial program design the CET concentration required sixty-three credits, fifty-nine of which transferred to UWL. Some of the courses could transfer to UWL as part of previous agreements between Western and UWL but other course were only transferable by students in the 2+2 program. In general the transfer agreement broke new ground in the transferability between the two institutions.

A challenge in the design of the program was to make sure students were prepared to transfer from Western to UWL and to give enough credit for work completed at Western so students could graduate in a total of four years. For example the UWL computer science department agreed to award credit for CS 120 and CS 220 (the first two software engineering course taken by UWL CS students) based on students having learned similar material at Western. There are not individual courses at Western that transfer as CS 120 or CS 220 but the UWL computer science department agreed to award credit for these two courses based on a collection of material and courses students completed as part of the CET concentration. Thus when students transfer they could start in the third software engineering course (CS 340). As another example of accommodations made to this program, UWL CS requires students to complete two semesters of calculus but at the time of the initial agreement the Western calculus courses did not transfer to UWL. The computer science department agreed to count these courses as satisfying the calculus requirement and students were able to transfer the Western calculus courses for general education mathematics credit.

After transferring to UWL students needed to complete an additional sixty-six credits including twenty-four CS credits, twenty-five general education credits (the

total number of credits in the UWL general education program is forty eight credits) and a course in mathematical logic. The requirements of the 2+2 program match the requirements of the standard UWL CS degree except the number of required CS credits is three less CS credits and the students are not required to complete a minor. These changes were primarily motivated by the desire to have a degree that students could complete in 4 years but we felt justified in these reductions because the CET concentration was sufficiently different than the CS program and thus could take the place of the minor and the CET concentration requires a final project for which no credit was transferred.

Since the initial design of the program a few changes have been made. The most significant change is the starting point for transfer students in the UWL CS software engineering sequence. In the original design students started in the third course but after a couple of years of experience this seemed too big a jump for most students. So we changed the program so that based on courses the students take at Western they now get credit for CS 120 but not CS 220. Therefore transfer students now start in the second (CS 220) software engineering course. Two groups of students have followed this path and it does seem to work much better. Another change from the original design is that Western changed their calculus courses so they now transfer to UWL. For most students this is a minor change but for a few students who wanted to take additional mathematics courses this change makes it much easier to do so.

As the program now stands students complete sixty-seven credits at Western. Sixty of the credits transfer to UWL. Based in the Western course work students are given ten computer science credits and twenty-five general education credits. At UWL students complete an additional twenty-eight credits of computer science, twenty-three general education credits, a course in mathematical logic and enough electives to have a total of at least one hundred and twenty credits.

While the 2+2 program is designed so it is possible to complete in four years, it is flexible enough to accommodate students who attend part time or for other reasons need more time to complete the degrees. For example if a student has not yet completed the degree requirements of the CET concentration but have completed enough course work that they are prepared to take CS 220 at UWL, they can register at UWL as a special student and take CS 220. When they have completed the CET concentration they can officially transfer as a 2+2 student.

Complete details of the Western ECET program and the UWL CS program can be found at [1] and [2].

4. S-STEM Grant

A big boost to the 2+2 program was being awarded a National Science Foundation S-STEM (S-STEM) grant. The goal of S-STEM grants is to increase the number of

students pursing degrees related to science, technology, engineering and mathematics. The grants provide need based financial support for students pursing degrees in STEM fields. The 2+2 program was awarded an S-STEM grant for almost $600,000 in 2008 and we made our first awards in 2009.

The grant was structured so it could fund students at both Western and UWL. In the first two years the grant funded new UWL CS freshmen, new Western CET freshmen, students who completed the CET concentration at Western and were transferring to UWL and second year Western CET students. Our goal in funding students in all these groups was to create cohorts with students from both institutions with the hope that Western students would be more comfortable when they transferred to UWL if they already knew some UWL students and faculty. The majority of Western students are the first in their family to attend post secondary education and many of them had not considered attending a four-year college. Our hope in creating the cohorts was that the Western students would see they have the same skills and potential as the UWL CS students and that would encourage them to the complete the four-year degree. In the third year new awards were only given to new Western freshmen. All students receiving awards can continue to do so until the grant expires in 2013 (as long as they are making good progress toward the completion of the degree).

In addition to financial support for the students the grant also funded a monthly cohort meeting. There are a variety of activities that have been done at the cohort meetings. Usually students are provided food and we have a speaker either from a local business or from the faculty at Western or UWL. Other meeting events include general advising, field trips to local businesses and student presentations. In general the cohort meetings have been a good time for students from both institutions to mingle and learn about each other and the programs at each school.

The grant also funded a small number of tutor hours. The tutor holds office hours at both Western and UWL. The primary work the tutor does is help with programming problems. The existence of the tutor seems to have been especially helpful for Western students taking their first software engineering course at UWL. The students already had the experience of working with the tutor before they came to UWL and the tutor learned some of the more frequent challenges the Western students had with programming problems.

There is little doubt that the S-STEM grant helped in recruitment to the program but it also seems that the 2+2 program helped retain students receiving the grants. Western had previously (before the 2+2 program existed) been awarded an NSF CSEMS grant. They had trouble recruiting and retaining qualified students for the ECET program even with the grant funding. We had no trouble recruiting qualified students for the S-STEM awards and have been very successful in retention. Of the twenty-five students who have received awards only four have dropped out of the program.

The grant expires in 2013 and it will be interesting to see how much this will influence the recruitment and retention of students in the program. We hope the grant has helped the program create a track record of success for the students in the program and that we can use that record of success to help with recruitment and retention.

5. How Is It Working

One of the motivations for creating the program was to increase the recruitment and retention of students in the ECET program. This goal has been achieved. The number of students in the ECET program is limited by laboratory space to twenty students per year. In 2007 the program had very few active students and graduated only one student. In 2011 there were many more applicants than there were slots available and 14 students graduated. These numbers are influenced not only by the 2+2 program but also by changes in the economy and the S-STEM funding. Surveys of students receiving funding from the S-STEM grant indicate that both the 2+2 program and the S-STEM funding motivated them to enter and stay in the program. Whatever combination of factors influenced the students the ECET program has greatly improved its recruitment and retention.

Another motivation is to increase the number of students pursing a bachelor's degree. Two students have graduated from the 2+2 program and two more students will graduate in Spring 2012. Eight more transfer students are completing their junior year at UWL. These numbers are small but most of the students would not have moved from Western to a bachelor's program without the 2+2 program. If we could reach a steady state of six to eight transfer students graduating from the 2+2 program per year we would judge it a great success. The biggest unanswered question is will we be able to maintain these numbers when the S-STEM grant expires.

6. Opportunities for Additional Collaboration

We think there are many other areas of potential collaboration between the UWL CS program and Western ECET program. Two potential areas of collaboration are embedded system curriculum and student recruitment.

The most natural curricular opportunity for interaction is in embedded systems. This is a large area of growth, as many devices will contain embedded microprocessors. These microprocessors must be programmed to implement the functions of the device in which they are embedded. This requires an understanding of the hardware, the hardware/software interface and software engineering techniques. The 2+2 students are ideal candidates for positions that require these skills. A possible addition to the 2+2 program is to develop a project based course

that includes teams of UWL CS and Western CET students working on embedded systems. This would be a great experience for both groups.

While both the UWL CS program and the Western ECET program have seen enrollment growth in the last couple of years, recruitment of new students continues to be important. Both programs need students who acquire good mathematics and science skills in high school. Both programs need to explain to potential students the opportunities and types of work that graduates of the two programs do. Successful outreach to high schools would increase the number and quality of applicants to the program and help contribute to the national cause of getting more people into STEM fields.

7. Conclusion

The 2+2 program has five years of experience with students. Initial participation was small but has increased in the last three years. Only one transfer student has left the program after transferring to UWL and the Western students are successfully completing classes at UWL. Many of them attend part time so we have had only a few graduates but we expect that number to increase in the next couple of years as we have more students in the pipeline. The fact that the two institutions are so geographically close to each other make us natural partners but we think this program is a model that other technical colleges and four-year institutions could successfully adapt to provide another path to a baccalaureate degree.

8. References

1. http://www.westerntc.edu/programs/program.aspx?PROGRAM_NBR=106632

2. http://www.uwlax.edu/records/UGCat/Courses/CS.htm

Acknowledgments