

BSSE at MSU:
The First Accredited Software Engineering Bachelor's Degree in a Public University

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Abstract

Mississippi State University (MSU) has learned that the Accreditation Board for Engineering & Technology (ABET) has accredited its Bachelor of Science in Software Engineering (BSSE) degree program, effective Fall 2000. MSU's BSSE program was one of four software engineering programs accredited in the U.S. in the first year of eligibility. It is the only one of the four in a public university, and the only one in the southeastern region of the U.S. The other three accredited programs are at Rochester Institute of Technology, Milwaukee School of Engineering, and Clarkson University. The BSSE program relies heavily on the use of experiential learning provided through real-world projects provided by customers across the university and surrounding community. These projects provide services for the customer and essential experience to the software engineering student. The benefits to the student include the challenge of producing under realistic pressure for a real customer, producing to a fixed deadline, responding to an RFP, and feeling satisfaction at having produced something useful. Additionally, it gives them "real-world" work experience to put on their resume and show potential employers. This paper discusses the BSSE program, accreditation experiences for other programs seeking accreditation, and lessons learned that will be used to improve the program in the future.

Introduction

Software engineering is one of the fastest growing fields in the world. As a result, software engineering education programs have been growing at a phenomenal pace. Up until recently, such programs have been developed at the graduate level to accommodate professional software developers who wanted to expand their knowledge and improve their employment opportunities. Recently, the need was determined to train software engineers at the undergraduate level to introduce more practical application of software development. It was hoped that this introduction would better prepare graduates to contribute more quickly to the ever-growing software development problem in the industry. Mississippi State University (MSU) introduced its Bachelor of Science in Software Engineering (BSSE) program in the Fall of 2000, and at the time, it was one of only seven such programs in the U.S.. Since that time, many more of these programs have started in this country, and the major is growing rapidly as a popular field for entering college freshmen.

In May 2002, the first two students graduated from the BSSE program at MSU. This made MSU eligible to apply for accreditation. An application was submitted and in the fall semester of 2002, an accreditation team from Accreditation Board for Engineering and Technology (ABET) visited MSU and reviewed the program. The result of that accreditation visit was a recommendation for accreditation and in July 2003, MSU became one of the first four schools in the country to have a BSSE program accredited and the first public university to have the honor. This paper will describe the BSSE program at MSU and the efforts required to gain accreditation.

MSU's BSSE Program

Turning software engineering students into professional software engineers is our primary goal. The software engineering program in the Computer Science and Engineering Department at Mississippi State University (MSU) relies heavily on practical application projects to teach students the reality of producing real products for real customers. [1,2] The professors teaching the Software Engineering classes and the Software Engineering Senior Design class are always on the lookout for projects that will provide realistic expectations to the software engineering students, but will not be so large that they are doomed to fail.

The first two years of the BSSE program are very similar to a typical computer science curriculum, requiring the student to learn how to program and learn basic computer science subjects like data structures, logic and discrete mathematics. One basic difference during the preparatory first years of the program is an increased amount of mathematics requirements. Software engineering students are required to take the full Calculus sequence, as well as Linear Algebra and Differential Equations. Also during the final two years of the Bachelor of Science in Software Engineering (BSSE) program at MSU, a sequence of increasingly more focused and practical software engineering courses are offered to provide students with sufficient preparation to enter the software industrial community. [4] The first two courses in this sequence are Software Engineering I and Software Engineering II. The last two courses are two halves of a year long experience spread over two semesters – the software engineering Senior Design I & II series. The next couple of sections describe these experience-based courses in greater detail.

Software Engineering I

SE I is the gateway course to all other software engineering courses at MSU. Its purpose is to teach traditional software development processes and methodologies to software engineering students, as well as to introduce them to activities associated with a typical development effort. It is a lab-based course with 2 hours of lecture and two hours of laboratory each week. The lectures provide the theoretical basis of software engineering, and the laboratories provide opportunities for the students to read and critique documentation from industrial projects, and to develop documentation for a small laboratory project.

Software Engineering II

SE II is an advanced software engineering course for undergraduates. This course continues the software engineering fundamentals by addressing more advanced topics. Alternative design paradigms are explored, as well as the use of commercial CASE tools for activities like project management, cost estimation, configuration management, and software evolution. Additionally, web engineering and reengineering are explored, as well as new and controversial techniques such as Extreme Programming. The laboratory experience associated with SE II introduces an industrial experience for the first time to the software engineering curriculum. Industrial partners, local businesses, and other university agencies are approached to provide real software system needs that can be accomplished by a small team in a single semester. Students are formed into teams to address these development needs.

This participation involves all of the activities that would be required in an industrial team, from forming a team with diverse skill sets and providing a management structure to delivering the final product. Activities the team will be required to perform include: requirements engineering, design, development, delivery and maintenance. Laboratory periods in SE II provide an opportunity for the students to work in their teams under the guidance of a laboratory instructor that is familiar with the processes they are using.

Software Engineering Senior Design

The capstone course is the culminating senior experience for BSSE students. It is a two-semester practicum where the students are formed into project teams and expected to exercise the entire lifecycle approach to software engineering. This begins with a Request for Proposals (RFP) that they respond to in a formal manner. Students must decide on a management structure, respond to the RFP with an appropriate proposal (to include cost, management and technical offerings). They must devise a process, develop the product within that process, and deliver the product to the customer within the schedule and budget constraints proposed by the team. They finish their year's experience by entering a maintenance phase for the delivered product, as well as a period of training for the customers.

Additionally, they are required to provide all of the same monthly status reports and a final report that software contractors typically provide. This kind of preparation and experience is essential to a well-rounded software engineering graduate, as these kinds of skills are always required in industry. The first offering of this senior project was in the 2001-2002 academic year. The project involved work for a Department of Defense organization and the construction of a web-enabled interface for multiple databases. The project was not a complete success, as it did not provide a complete solution, but that was due as much to the customer not knowing exactly what they wanted as it was to the students not completing the work. Everyone knows what a problem "requirements creep" can be. It was valuable to the customer though, as it allowed them an opportunity to refine their requirements, and it gave them a prototype they could show to a contractor for building the integrated database. The second offering in the 2002-2003 academic year was more successful. The customer in this offering was the K-12 Outreach Coordinator for the College of Engineering, and a working version of the application was provided to

the customer at the end of the year. The lesson learned here was that it was very important for the team to be able to visit with the customer on a regular basis. The team was able to visit with the customer with as little as 24 hours notice, and could stay in regular contact by e-mail. The current year project is a development for a local church that will provide an automated calendar application for the staff as well as an information kiosk to provide information to visitors about ongoing events and locations of those events in the church.

Another valuable lesson that can be learned from this year-long experience is the opportunity to experience some of the real problems associated with working with teams over a long period of time. Since this course is two semesters long, it is possible for the team to change composition in the middle of the project. As a matter of fact, the program was designed to allow the students to sign up for these two semester courses in any order they chose. This was first experienced last year when a software engineering student signed up for the spring semester course and worked on the science fair project at the end of the project, and then worked on the current year project during the beginning of the project. In industry, teams change on a regular basis. This aspect of the program was designed in from the beginning to allow students to gain this valuable experience.

Other Courses in the BSSE Program

In addition to these courses, there are several other courses that are required in the BSSE curriculum. *Information and Computer Security* is one such course, and it is required for all BSSE students, as security is an essential characteristic of good software. *Software Testing and Quality Assurance* is another required course for all BSSE students, and the reason for this requirement is obvious. *Software Architecture and Design Paradigms* is the last of the required courses peculiar to the BSSE curriculum, and it is required to give the student exposure to the current trends in architecture driven software development and the use of templates in design.

Accreditation Process

When it was determined that the BSSE program would have its first graduates in Spring or Summer of 2002, and would be able to apply for accreditation, the faculty teaching the software engineering courses began to collect data to demonstrate the effectiveness of the curriculum to the accreditation board. Data was collected for all courses in the curriculum taught by either the Computer Science and Engineering Department or the Industrial Engineering Department. That data included copies of all assignments given, as well as copies of randomly selected submissions by students. These were stored in a binder for each course, along with a copy of the textbook used to teach the course. These records were then made available to the reviewers on their visit to MSU.

Another very valuable activity that was done was to have a mock review in advance of the accreditation visit. Members of the faculty at MSU, as well as members of other institutions were invited to do a mock review of the accreditation materials approximately two months prior to the scheduled visit. This mock review turned out to be very

beneficial in our preparation for the real visit. The reviewers comments during the mock review were used to clarify information provided to the ABET team during the real visit.

Conclusion

As the software engineering education program at Mississippi State University grows, we continue to gain valuable knowledge in how to better prepare our software engineering students to enter a highly demanding software development industry. The announced accreditation of MSU's BSSE program as one of the first four such programs in the country speaks highly of the success of the program in the short time since its inception, but it takes a lot of work and determination to get there.

References

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