Introduction

Construction management and civil engineering education is rapidly changing due to the new and extremely useful technology that is Building Information Modeling (BIM). This proposal will present evidence as to why BIM should be implemented into Lafayette’s engineering curriculum and the best methods of implementing the software. It will briefly give an overview of BIM and some of its features and also demonstrate how BIM is hastily changing the construction industry. This proposal will then give evidence of other college and universities that have begun to integrate BIM into their curriculums and answer the question of how Lafayette can successfully integrate BIM into its own curriculum.

Background

In order to convince Lafayette to integrate BIM into its current engineering curriculum it is imperative to give them evidence that BIM has been successful within the construction industry and will continue to be a factor for years to come. “In 2004, the National Institute of Standards and Technology (NIST) published a report stating that poor interoperability and data management costs the construction industry, approximately $15.8 billion a year, or approximately 3-4% of the total industry.” (Suermann 1). Since the report in 2007, BIM has seemed to become the solution to this problem within the construction industry. According to a survey conducted by Patrick Suermann and Raja Issa, 90% of respondents agreed that BIM has improved quality control and the on-time completion and 84% said it improved the overall cost of projects (Suermann 5).

Not only has BIM greatly impacted the construction industry, but other schools have recognized BIM’s importance and have begun to implement it into their own curriculums. “Today, schools as PennState, Georgia Tech, University of Southern California, Montana State University, and University of Wyoming are identified as leaders in BIM education,” (Barison 3). Other schools that have introduced BIM include: New Jersey Institute of Technology, Brigham Young University, Auburn University, Texas Tech University, Carnegie Mellon University, University of Illinois, Stanford University, among others (Barison 2-3).

BIM has been introduced in two different ways. It has been offered as a stand-alone course, which includes a course solely devoted to learning BIM, and as an interdisciplinary portion of another preexisting course. Clevenger, Ozbek, Glick, and Porter, all from Colorado State University have suggested to begin with the interdisciplinary portion of another course and eventually work it into its own stand along course once faculty and students become more familiar with the software.
Research

The research involved two steps: finding out the best way to introduce new technologies (in particular, BIM) into engineering curriculums and researching BIM, its effect on the construction industry, and locating an expert who would be able to give a demonstration of BIM at Lafayette College. Through Lafayette’s resources and Google Scholar, I was fortunate to locate several articles on methods of integrating new technologies into existing engineering curriculums. I was also able to locate a few articles involving the integration of BIM itself. I was also able to find articles of BIM’s impact on the construction industry and why BIM is important to the industry. Unfortunately locating these articles was the easy part.

I also worked with Professor Veshosky, the teacher of both the Project Management and Construction Management courses, to come into contact with a BIM professional to give a demonstration of BIM at Lafayette. He was the right choice for this task due to his connections of individuals within the construction industry and his shared passion for implementing BIM. Unfortunately we were unable to find an individual available to give the demonstration we both wanted.

Pilot Integration of BIM

After the research and struggles with locating a BIM professional I have put together a proposal to integrate BIM into Lafayette’s engineering curriculum. Using my research mentioned above, I first briefly introduced the abstract of my proposal. I also introduced BIM as a whole. I mentioned the impact it has had on the construction industry and some of BIM’s features.

After BIM’s introduction, I mentioned some of the other schools that use BIM and how they use it in their classrooms (whether they offer it as a stand-alone class or as an integrated part of a previously existing class). This is important because it shows how other schools are adapting to the new software and how other schools find it important to integrate the software. This would then serve as a transition to the next portion of the proposal which is why Lafayette should integrate BIM into its curriculum. Here I briefly referred back to BIM’s benefits, the other schools that have already integrated the software, while also mentioning how important it is to keep up with new technologies.

Finally, I introduced my own recommendation, based on my research, of the best way Lafayette can integrate the new software. I believe that BIM should be slowly introduced. It should first be offered as a part of another class, for instance beginner’s level within Project and Construction Management courses and then, eventually, as the faculty involved becomes more familiar and comfortable with the software, introduce BIM as its own stand-alone course, similar to AutoCAD in Civil Engineering Computing courses.
**Struggles**

While in constant contact with Professor Veshosky, I attempted to locate and come in contact with a BIM professional who would be willing to give a demonstration of BIM at Lafayette. With the advice of Professor Veshosky, my community contact, I first reached out to the head of the Human Resources department at Clark Construction. This seemed a good first choice since I will be starting my career there in a few short months. After a few emails back and forth, I was invited to attend a 4-hour "Intro to BIM" class on Friday, 3/16 in the Bethesda office. Regrettably, I was unable to attend due to the fact that that date was during spring break and I was with the baseball team playing the University of South Florida in Tampa, FL.

I was eventually given contact information of Clark’s two BIM professionals: Steve Stankiewicz and Kasey Kinney. After a carefully thought out email, I was unable to get a response from either expert. Professor Veshosky then contacted an employee from Turner Construction and Quandel Construction; however neither was available to give a demonstration within the next few months. Within the past week arrived at one more option: an employee from Whiting-Turner Construction. This employee was our last chance to get a real life demonstration of BIM on campus. Professor Veshosky contacted him soon after and unfortunately, like the rest of our contacts, he was unable to give a demonstration due to scheduling conflicts.

Locating a professional to give a demonstration of BIM at Lafayette College has turned out to be a much more difficult task than I had previously imagined. I would encourage the person who continues this proposal to continue the pursuit of the demonstration, however they should not be disheartened if they cannot find a professional who will be willing to present right away. They should also consider other professionals other than ones within construction companies. These options could include, but are not limited to, alumni within the construction company (contact me in a year or so) or contact AutoDesk (the company who produces BIM) for a demonstration.

**The Next Step**

Using my current proposal the next step needs to be catching the attention of the engineering department. Integrating BIM into the curriculum will be an impossible task if the engineering board is not on board with the idea and does not feel it as an important part of our engineering education. The best way to do this is to continue to pursue someone who can give an informative demonstration of BIM, possibly as a brown bag, or even as an afternoon event. It should be open to the student body as well as all engineering faculty. Although it is important for the faculty to attend, sparking the interest of the student body could be just as useful.

After the interest of the engineering department has been successfully captured, the next step would be to hand them a revised version of my proposal. The proposal already gives the school why it’s important to integrate BIM and even a way to do it. Once the proposal has been given to the engineering board all there is left to do is wait and hope I did a decent job of research and reasoning.
Integrating BIM into the Engineering Studies curriculum is going to be a task that requires a lot of time and cooperation. It will not be able to be instantly added to classes and worked into engineering students' lives. Integrating BIM will be a gradual process.

The engineering staff, who would be involved with BIM in their classes, will first need to be trained to use the technology. Since BIM is a technology that cannot be learned too quickly, it should be taught at a very basic level to begin. Using BIM in both the Project and Construction Management courses would be an easy initial place to briefly implement BIM. As everyone become more familiar with BIM, then eventually it could become its own course, such as the ones offered in Penn State, Carnegie Mellon, and Stanford.
Appendix A: Annotated Bibliography


After convincing the faculty that BIM should be introduced into the engineering curriculum the next challenge that the school will come across is teaching the software. In this article Barison and Santos first talk about how they believe that BIM will change the civil engineering, construction management, and architectural sectors, and if it changes the sector, it will naturally change the way the sectors are taught in universities and colleges alike. The authors give the readers different methods of teaching the software such as a single course or interdisciplinary methods. Lafayette will have to choose a single method to teach BIM and this article can give a few examples.


Clevenger, Ozbek, Glick, and Porter, all from Colorado State University, have found a way to integrate BIM into the Construction Management curriculum. Fortunately, they have shared their plans in integrating BIM into the Construction Management curriculum. They speak of the importance of the integration in architecture, design, and engineering departments. They also speak not only of the challenges one would face in integrating the software, such as developing an expert within the faculty, but also of the benefits, which seem to greatly out-weigh the challenges. This article is the most important article within the research because it gives the reader an idea of what a proposal to introduce BIM into the engineering curriculum.


Unfortunately, BIM is not very well known throughout our engineering division and even across the country. DeLacey’s article from Engineering News Record examines why BIM is not only important to know BIM, but why BIM is going to have such a great impact on the construction and design industries in the year 2012. DeLacey goes into detail of three main areas in which engineering and construction need vast improvements (reviewing project technologies, considering the concept of the “Master Builder”, and doing a better job of collaboration, especially in sharing BIM models) and how BIM will help improve them. This article provides a decent background of why BIM is important and what it can be used to help with.
In order to implement BIM entirely, students will need to have hands on experience with the software. They will need to be in the lab working with the professor and BIM. In the paper, “The Role of the Laboratory in Undergraduate Engineering Education”, Lyle Feisel tells the reader that in order for an engineer to become successful outside the classroom, they must go beyond the theory of engineering, and the laboratory is where they can gain this knowledge. This paper also goes through the history of how laboratories have been used in education along with a list of fundamental objectives that labs should adhere to.


Although sparking the interest of the engineering department and demonstrating why BIM is important enough to consider being introduced to the curriculum is important, it’s only half the battle. The other half of the battle is coming up with a plan to implement the software into the curriculum. Heywood, a Professorial Fellow Emeritus of Trinity College Dublin, uses chapter seven of his book, Engineering education: Research and development in curriculum and instruction, to talk about changing the curriculum of engineering and some of the traditional approaches. He also goes into detail showing how newer technologies can present the need to alter the curriculum due to the evolving world around the new technology. This information will help guide the implementation of BIM at Lafayette.


Many engineering curricula have continued to focus most, if not all, of their energy on theories rather than some of the technology and process that become extremely important in the life of a professional engineer. “Curriculum for an Engineering Renaissance” gives the readers a sense of what needs to be done in order to change this problem. BIM would be one of those solutions. By introducing technologies such as BIM into the curriculum, it would enhance the engineering curriculum and better prepare students for their professional careers. This paper also goes into detail of why introducing newer technology and processes is so vital to the engineering curriculum.

As important as the engineering curriculum is, the professors and their methods that teach it are equally, if not more, important. However, with new technologies comes a need for not only the knowledge of the technology, but also different methods of teaching to incorporate the said technologies. In this paper the authors go into detail to introduce different methods to improve their methods of teaching the engineering education. This paper presents certain problems faculty face with engineering education and suggests methods to improve their teaching skills. Integrating BIM into the curriculum could present certain problems with teaching it and this paper could have some solutions to the problems.


In order to successfully implement BIM into the engineering curriculum at Lafayette, it is important to look at other attempts to do the same. Farid Sabongi does exactly that. In his paper he surveyed members of the Associated Schools of Construction which offer four-year undergraduate programs and asked them about AutoCAD and BIM and whether they are offered as stand alone courses or as part of other courses. It also asked them if they thought BIM should be taught at the undergraduate level and if they believed BIM’s use in the industry would increase. Although 67% thought it isn’t necessary to teach, 75% thought its use would increase.


Shaw and the School of Computer Science from Carnegie Mellon University discuss here the need to reform computer science curricula for the reason that technology has changed drastically over the years. Here they discuss the method used at Carnegie Mellon to alter the software engineering curriculum. Although this paper focuses mainly on software engineering, it can also apply to all forms of engineering. Technology has not only changed in software engineering, but civil engineering as well, in particular, BIM. The civil engineering department is encountering a movement from AutoCAD, which Lafayette currently uses, to BIM, which the college needs to begin to implement.


In order to convince the faculty and staff of Lafayette to implement BIM into the curriculum, they need to know why BIM is such an important part of the construction management and civil engineering industries. Suermann’s article demonstrates the impact BIM has had on the construction industry. The author reveals the positive impacts BIM has had on factors of the
construction process such as quality control, on-time completion, cost, and safety. These examples of how BIM has changed and enhanced the construction industry could severely help persuade the college and faculty to begin to implement BIM within the engineering curriculum.


Although the article goes into particulars for construction management education in Hong Kong, the methods and reasoning can directly apply to universities and colleges within the United States. This article first goes into an overview of BIM and its impact on architecture, engineering, and construction. It also talks about BIM and how it’s taught. It gives the reader examples of classes that have implemented BIM and schools that have introduced BIM in the curriculum. The article also speaks of methods to implement BIM in classes and curricula alike. This could be used as an example of how Lafayette could implement BIM into its classes and curriculum.


Technology is one of the most important aspects of engineering today. It allows the engineer to accomplish some things we could only dream of decades ago. Like Heywood, Yilmazel-Sahin and Oxford demonstrate the importance of altering the curriculum, especially the engineering curriculum. They go into detail to show the importance of effectively integrating new technologies into the curriculum, in fear that failure to do so will lead to a lack in understanding of the technologies after school, as well as the lack of use of said technologies by the university. This article demonstrates the importance of the integration of BIM as a new technology.