

Increasing the Accessibility of BIM Training within the AEC Industry

Xavier Caldera

California Polytechnic University
San Luis Obispo, California

At the turn of the 21st century, the rise of new technology has helped modernize the AEC industry. Architects, engineers, general contractors, and foremen can build, collaborate, and communicate more efficiently using BIM to help facilitate the building process. The benefits of BIM have been proven through increased coordination, risk mitigation, and cost optimization. However, with the increasing use of BIM, there is a growing education gap between construction workers and BIM technology. Currently, there are three main avenues to learn BIM: in-house company training, attending college, or paying to learn independently online. The foundation for a BIM learning module can be created to help bridge the BIM education gap by analyzing current training programs available and then using the perspectives of a senior BIM engineer, an assistant project manager, and a general foreman. The two groups of people determined to benefit the most from a BIM learning module would be high school students and unemployed construction workers. This type of learning module would be most effective and easiest to implement into pre-existing learning systems such as in high schools, non-profit job training programs, or pre-apprentice programs.

Key Words: BIM, pre-apprentice programs, job training, AEC industry

Introduction

At the turn of the 21st century, the rise of new technology has helped modernize the AEC industry. With new Building Information Modeling (BIM) technology available, architects, engineers, general contractors, and foremen can build, collaborate, and communicate more efficiently. BIM technology is the overarching term for 3-D model-based software that can be used at all stages of the building process. There is software designed to help model, collaborate, and build on site. These all require a specific level of training and education to be used effectively in their respective stages of the building process. In order to effectively be trained and to learn about BIM technology, currently, people must either already be within the professional AEC industry, pay to learn online independently, or attend college. High school students and unemployed people who are interested in pursuing construction are the two groups who would benefit the most from a comprehensive BIM technology learning module. This type of learning module would be most effective and easiest to implement in pre-existing learning systems such as in high schools, non-profit job training programs, or pre-apprentice programs.

Rise of BIM

Construction has technologically transformed in the recent decades with stronger usage of technology to help facilitate the building process. The benefits of BIM have been widely accepted throughout the industry. For example, Alex Ivanikiw, Senior Vice President at Barton Malow states, “the real benefit is how the use of BIM enable collaboration, which in turns builds a real sense of trust and teamwork” (Cassidy, 2012). According to Jose Sanchez, assistant project manager at Bernards, the construction industry has started to maximize its use of BIM technology within the last five years. In a study done by Adnan Ali Enshassi, “the benefits of BIM include, life cycle cost control, effective construction process, design and quality improvement, and decision making support” (Enshassi 2018). With the benefits clear, its usage is on the rise and companies are using it on the job sites more. With the rise of BIM people in the construction industry need to have a basic understanding of what BIM is. Many people who are not able to learn about BIM are often at a disadvantage to their peers as technology advancements move forward, leaving some workers behind, unemployed.

Unemployment within Construction Industry

The Bureau of Labor Statistics predicts a continued expansion of employment in the construction industry, with more than 7.5 million jobs projected by 2026 as population growth spurs demand for new buildings and infrastructure (Bureau of Labor Statistics 2018). However, as of October 2019, the construction sector still has a 4% unemployment rate, which is second only to the leisure and hospitality industry (Bureau of Labor Statistics 2019). This shows how currently, a large portion of unemployed construction workers are being left behind as this industry continues to grow. In order to bridge the gap between the jobs available and the unemployment rates, there needs to be more comprehensive training available to people. This includes adapting workers to the new and modern construction practices that are on the job site. Exposing workers to new technology and helping them reach basic levels of certifications will make them more marketable and useful on the job. This will decrease the need for on-the-job training as they will be already familiar with newer technology being used. This would not only benefit the worker but also help the jobsite run much more efficiently which will then benefit the subcontractor, general contractor, and owner.

Current Construction Training Programs

There are many different types of construction training programs already in place that are designed to help people gain a basic understanding of construction. These types of programs are often associated with non-profit job training programs or pre-apprentice programs which are the foundation to a career in construction. For example, in the San Luis Obispo County, SLO Partners has a program called ‘Ticket into Trades’ that offers a Building Trades Apprenticeship Readiness Program which was recognized by the US Department of Labor and given the Registered Apprenticeship Innovator and Trailblazer award (SLO Partners 2019). This program is a standardized, comprehensive, 120-hour curriculum designed to help young people and transitioning adults choose and succeed in an apprenticeship program that is appropriate for them.

Within this course, there are nine chapters covered: construction industry orientation, tools and materials, construction health and safety, blueprint reading, basic math for construction, heritage of the American worker, diversity in the construction industry, green construction, and financial literacy. While the topics covered are important and useful for those taking the course, a program, even one that’s highly recognized, fails to address and teach about construction technology. With the growing rates of usage of technology within the construction industry, people should be exposed to this technology as early as possible. As stated by SLO Partners on their website, “one of the goals of this program is to increase the retention rate among apprentices by providing them with a deeper understanding of both the industry and the role of craft unions in construction.” Implementing a BIM technology chapter into this pre-existing course would be very beneficial to workers entering an apprenticeship as they can work towards certification which bolsters their skillset even before they begin. Workers will be able to contribute more with a stronger foundation in all aspects of construction, including BIM technology.

The Los Angeles Unified School District also had a comprehensive Pre-Apprenticeship Construction Program, ‘We Build Program’, which caters exclusively to people living within the LAUSD service area. This helps ‘We Build Program’ partner with local unions and serve as a feeder program to available local apprenticeships and thus strengthen the local workforce in the Los Angeles County. The components of this program includes: fundamentals of construction, specialty trades, safety procedures, soft skills training, career counseling, job placement assistance, and union trade center tours. According to Mr. Sanchez, Assistant Project Manager at Bernards, most general contractors within the LA area are now implementing BIM into the contract. The “We Build” program does not include any topics related to BIM technology which could be extremely beneficial to workers who begin their careers in Los Angeles specifically. With a growing usage of technology, there is a clear need for improved basic construction training.

BIM within high schools

Currently, there are limited options for young people interested in pursuing a career in construction to learn about BIM technology, especially high school students who don’t end up attending college. The construction industry is partly fueled by high school students who opt-into apprenticeship programs and vocational trade schools over college. “Today in America, fewer than 5 percent of young people train as apprentices, the overwhelming majority in the construction trades” (Jacoby 2014). If we expose students in high school to the new and exciting BIM

technology within the AEC industry, we can inspire students to pursue construction and expand the industry workforce. Autodesk's TinkerBox app is one way high schools can include BIM technology in their school curriculum. For example, "CAD [Computer Aided Drafting] is helping to shore up the country's supply of engineers by instilling a passion for technology use at a young age" (Livingston 2012). However, CAD is just the tip of the iceberg with the many BIM programs available. In order to truly expose high school students to BIM technology and increase enthusiasm, there needs to be a more comprehensive learning module that can be implemented more efficiently into high school classrooms.

Methodology

In order to gain a better understanding of the construction industry's expectations for workers coming into the workforce, it's important to hear directly from those currently in the industry. For this reason, three interviews with three different perspectives will help formulate what a BIM learning module should look like to meet the industry's needs. The point of view of a senior BIM engineer, an assistant project manager, and general foreman were all used in creating the foundation for the learning module.

Interview with Rommel Palis, Senior BIM Engineer, Bernards

Mr. Palis has a background education in electrical engineering and worked as a design engineer before his time with Bernards. Now he has taken a role as Senior BIM Engineer to bridge the gap between design document and construction. Mr. Palis recently attended Autodesk University, which showcases the latest construction technology. With his comprehensive background in BIM, Mr. Palis was able to give valuable insight as to what a BIM learning module can look like.

For this interview, Mr. Palis was asked the following questions:

1. How have you used BIM technology within your career?
2. What are some of the most used BIM programs used in your experience?
3. Can you speak on your recent attendance to Autodesk University which showcases the latest construction technology?
4. In your perspective, does the construction industry fully maximize BIM technology?
5. In your perspective, do you think there is lack of knowledge with regards to BIM technology and construction workers?
6. Does your company, Bernards, offer training to its employees with regards to BIM technology?
7. In your perspective, what are some of the most important topics that should be covered when learning about BIM technology?

Interview with Jose Sanchez, Assistant Project Manager, Bernards

Mr. Sanchez started his career as a BIM engineer followed by project engineer then made his way to the position he is at now as assistant project manager for Bernards, a mid-level general contractor based out of Los Angeles, California. With a strong background in BIM technology, Mr. Sanchez is always looking to implement BIM technology into the projects he works on. Mr. Sanchez was able to speak on the expectations a general contractor may have for subcontractors on the jobsite with regards to BIM technology.

For this interview, Mr. Sanchez was asked the following questions:

1. How have you used BIM technology within your career?
2. What are some of the most used BIM programs used in your experience?
3. In your perspective, does the construction industry fully maximize BIM technology?
4. As an assistant project manager, what are some of the expectations you have for workers (subcontractors) and their knowledge about BIM technology?
5. As an assistant project manager within Los Angeles county, do you see a rise of BIM being implemented into contracts?
6. In your perspective, do you think there is lack of knowledge with regards to BIM technology and workers?

7. In your perspective, what are some of the most important topics that should be covered when learning about BIM technology?

Interview with Gasper Gonzalez, General Foreman, Sharpe Interior Systems

Mr. Gonzalez is the General Foreman for Sharpe Interior Systems which is a premiere Union labor firm that specializes in drywall and metal stud framing. As a general foreman, Mr. Gonzalez brings the perspective of workers out in the field who begin as apprentices to foremen. Currently, Mr. Gonzalez is actively learning more about BIM and how to effectively use it on the jobsite.

For this interview, Mr. Gonzalez was asked the following questions:

1. How have you used BIM technology within your career ?
2. In your perspective, does the construction industry fully maximize BIM technology ?
3. As a construction foreman, what are some of the expectations you have for workers and their knowledge about BIM technology?
4. As a construction foreman, do you see an advantage if an apprentice came in with a basic understanding of BIM?
5. In your perspective, do you think there is lack of knowledge with regards to BIM technology and workers?
6. Does your company offer training to its workers with regards to BIM technology ?
7. In your perspective, what are some of the most important topics that should be covered when learning about BIM technology?

Results

Interview with Rommel Palis, Senior BIM Engineer, Bernards

Mr. Palis provided a unique perspective as someone who has worked as a designer and on the general contractor side, both times using BIM heavily to coordinate and more specifically see if the models he worked on were constructible. Recently, he was able to attend the AutoDesk University Conference which showcases the latest construction technology as well as teaches industry professionals about that new technology. He shared how there is so much information being put into models that could be used to quantify, track, and ultimately build more efficiently if the people in the industry know how to use the technology. He believes there is a big gap between BIM technology and construction workers. “The struggle is how do you mobilize the technology from the model at the office to the field workers and foremen,” Mr. Palis asked. He was more adamant about being able to put helpful technology into the hands of the people who are installing. For this reason, he went on to say, “There is a great advantage to expose workers to BIM technology, the earlier the better”.

As the Senior BIM Engineer within the BIM department at Bernards, Mr. Palis offers training to the employees with regards to BIM technology. He typically targets project engineers, field engineers, and superintendents who are typically more involved with the model and coordination meetings. He added how when working with different subcontractors, he’s been approached by an electrical foreman for help using BIM 360 which allows them to fly the 3-D model. When asked which topics are most important to be included in a learning module, Mr. Palis stated, “it’s important for people to understand what BIM technology is, the difference between programs, and how they are being used within our industry.” Mr. Palis ended the interview by sharing how there needs to be cultural shift within the construction industry if BIM technology is going to continue to grow. He hopes one day that this technology is easily acceptable, reliable, and more reputable, because currently inspectors and authorities only approve paper plans.

Interview with Jose Sanchez, Assistant Project Manager, Bernards

Mr. Sanchez shared how throughout his career he has been able to use BIM to coordinate different overhead systems, MEP, structural, and even owner equipment. Over the past five years, he has seen the construction industry start to fully maximize BIM technology. He mentioned how within the Los Angeles county, he has seen a rise in BIM being implemented into contracts. It’s interesting to note that when asked if there was a lack of knowledge with regards to BIM technology and workers, Mr. Sanchez – in contrast to what Mr. Palis believes – said, “There’s no

real lack of knowledge but people are shy to use it because it seems so complicated.” With regards to expectations he has for subcontractors and BIM technology, he expects them to know how to utilize the virtual model as a tool during building, double check that they are installing per plans, and confirm spatial coordination. For this reason, when asked about important topics to include in a BIM learning module, Mr. Sanchez said, “ Coordination, access zones, equipment clearance, and building codes should be a part of the module.” He emphasized including topics that will be directly relevant to workers earlier in their careers.

Interview with Gasper Gonzalez, General Foreman, Sharpe Interiors

As General Foreman for a drywall and metal stud framing subcontracting company, Mr. Gonzalez has to deal with a heavy amount of coordination with other trades. He has used BIM to help foresee potential problems and get a head start on modeling to prevent future problems. As a foreman, he uses it in the field as reference to check existing conditions and necessary dimensions for installation. Mr. Gonzalez said that ten years ago, BIM would be very rare but now a days its being used a lot more especially by the bigger companies. As general foreman, he is currently being trained by his company to take on a bigger role with BIM for future projects. He is currently learning Navisworks and he learned AutoCAD earlier. Mr. Gonzalez said, “they cover topics such as understanding what BIM is, what it takes to model, what to do, and what to look out for”. As a general foreman, he sees the benefits of understanding BIM and works towards learning more. Not only that but, when asked if an apprentice with basic knowledge of BIM came onto the job site would have an advantage, he said, “Yes, definitely. There’s a better opportunity to learn because they are already familiar with BIM.” He also mentioned how he expects his lead workers to know the basics including how to navigate the model and get from one point to another. Mr. Gonzalez gives valuable insight to certain topics that should be included in a BIM learning module as its something they will eventually have to work with when they are on the jobsite.

BIM Learning Module Outline

Through analyzing the current state of training programs available within the AEC industry and using the perspectives of different people in the industry, the foundation for a BIM learning module can be created. From the interview process, one of the topics that was stressed the most was to ensure people had a basic understanding of what BIM is and how its used within our industry. There are many BIM programs out in the market but in order to optimize the class, three programs were chosen specifically: AutoCAD, Navisworks, and BIM 360. These programs are all made by Autodesk which would make learning them easier, cheaper to acquire, and most commonly used within the industry. AutoCAD will show those who take the class how a designer contributes to the construction process, Navisworks can show the general contractor’s role in running coordination meetings and running clash detection, and BIM 360 can be used to show how BIM is used in the field. These three programs can give those who are exposed to the BIM learning module a basic understanding of how BIM is used throughout the building process.

Here is a basic outline of a BIM Learning Module:

- 1) What is BIM?
 - a. General Overview
 - b. Benefits of BIM
- 2) BIM Programs
 - a. Introduce a variety of BIM programs
 - b. Explain the difference between BIM programs
 - c. Why/When are programs and by who
- 3) AutoCAD
 - a. Basics of software
 - b. Designer’s role in the building process
- 4) Navisworks
 - a. Basic coordination, clash detection, spatial coordination
 - b. Learning to fly the 3-D model
- 5) BIM 360
 - a. BIM 360 application in the field
 - b. Learning to fly the 3-D model

Conclusion

BIM technology has already proven itself to be beneficial to the construction process which is why more and more contracts are requiring BIM. However, it's important to bridge the education gap especially to those people who generally don't have access to learn BIM. Currently, the three main avenues to learn about BIM are through in-house company training, paying privately online, or attending college. The target audience for this BIM learning module would be high school students who want to pursue an apprentice and unemployed people actively trying to start a career in construction. Through a comprehensive literary review and with three different perspectives within the AEC industry, the basic structure for a learning module is created. This module would be most effective by implementing itself into pre-existing learning systems such the SLO Partners "Ticket to Trades" program or the LAUSD "We Build" program. Here, people will be exposed to BIM early in their careers and make them more valuable on their jobsite. As the construction industry continues to move toward technological innovation, it's important that everyone has a chance to learn and be a part of the future of construction.

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