Interview of Mr. Robert Adams, P.E.

The "E" in STEM: Meaningful Content for Engineering

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NASA Endeavor Science Teaching Certificate Project

June, 2015

Abstract

This paper documents my interview of Robert Adams, Project Director for the New York State Department of Transportation's Kosciuszko Bridge Project. I contacted the Public Relations Liaison for the Kosciuszko Bridge Project, Christine Holowacz, in hopes that I would be able to talk to one of the engineers on the current replacement of this bridge. I covered the Kosciuszko Bridge during my Computer Applications class this past semester at Immaculate Heart Academy as an example of a "truss" bridge. I wanted to maintain continuity in my own studies of engineering design and wanted to ask more in depth questions about this bridge. I was very pleased to have my email forwarded by Ms. Holowacz to Mr. Adams, who is the Project Director of the current replacement of the Kosciuszko Bridge. The interview took place on Thursday, June 18th via a phone conversation.

Interview Context

Mr. Robert Adams, P.E. is Project Director of the current replacement of the Kosciuszko Bridge which connects the New York boroughs of Brooklyn and Queens on the "BQE", the Brooklyn-Queens Expressway. He directs this project for the New York State Department of Transportation, Region 11 and his office is in Maspeth, N.Y. I contacted Mr. Adams through the Public Relations Liaison, Christine Holowacz and was fortunate to have Ms. Holowacz forward my email to Mr. Adams. When he replied to my request for an interview, we agreed that a phone interview would be best on Thursday, June 18, 2015.

Mr. Adams is a Civil Engineer, having completed his studies at Penn State University. His expertise is in Transportation, Trucking and Railroad. He has been employed by the New York State Division of Transportation for the past twenty-eight years.

Having participated in and provided the leadership for numerous engineering projects for the State of New York, Mr. Adams was able to share a "front-line" perspective of the engineering design process to demonstrate that he is an "expert problem solver".

The Interview

The interview took place on Thursday, June 18, 2015 via phone conversation. I initiated the call to Mr. Adams at his offices in Maspeth, N.Y. At the time, I was located in Rome, Italy. The N.Y. time was 2:00pm while in Rome, it was 8:00pm. The interview lasted approximately forty-five minutes. I began the interview by explaining to Mr. Adams that I was particularly interested in discussing two topics. The first was "problem-solving" strategies that I could share with my students. The second was any insights that he might have in encouraging young women to choose the field of engineering as a career.

The Problem Solving Process

I asked Mr. Adams to describe the steps that he took with his team to design the replacement of the Kosciuszko Bridge. Mr. Adams indicated that the project began in 2001 and he started by listing the “problems” to be solved as per the Engineering Design Process. The Federal Government considers the Kosciuszko Bridge a “critical bridge” over Newtown Creek. This is the only crossing of this navigable waterway at a point that is strategic to connecting the Brooklyn-Queens Expressway (BQE) and the Long Island Expressway (LIE). The current bridge is too small to accommodate the volumes of traffic requiring the transition between these two main roadways. The current slope of the approach to the bridge does not allow trucks to maintain a constant speed or allow for enough visibility of traffic ahead of approaching vehicles. The Newtown Creek is utilized by ships that must have clearance beneath the bridge structure. One of the greatest factors in replacing the bridge was that the accident rate on or approaching the Kosciuszko Bridge was six times the statewide average.

The first broad step of the team was to devise an “Environmental Impact Statement” to take into consideration all possible “environments” that needed to be addressed. These environments include, the Newtown Creek itself, air quality to the surrounding community, noise pollution and hazardous materials such as former lead paint used on the existing structure. In a city proud of its skyline, visual impacts of an aesthetically pleasing bridge design had to be taken seriously. Mr. Adams was very clear that the surrounding community was included in this environment study through town meetings to give the community the opportunity to express their concerns and to hear about team findings. Historic impacts had to also be considered since the Kosciuszko Bridge was eligible for enrollment into the National Register of Historic Places. An added concern was the impact on the local Calvary Cemetery, a local park and playground and relocation of homes and businesses.

Taking all of the Environmental Impacts into consideration, the team was now ready to do what Mr. Adams called "scoping". He described this as a very collaborative process that included the community. The team created a "long list" of possible solutions. They applied basic engineering concepts against goals and objectives. Scoping is also known as the "alternatives analysis process". The scoping process considered any solution that met 75% of the criteria. The solutions had to include a "no-build" option as per the State of New York. Mr. Adams indicated that one of the solutions was even to "fill in" the Newtown Creek, or to build a tunnel instead of a bridge. Also, two bridges were considered as well as a "double decker" bridge. The options were narrowed down from twenty-five to nine and then to four viable and feasible options.

The next phase of his design project took the four viable and feasible options and applied more engineering rules to the possible solutions to arrive at the best option. Once the detailed engineering was applied to the four options, then one bridge stood out as the winner, the cable-stayed bridge design. The cable-stayed bridge moved on to the full engineering design stage of the project with detailed drawings, full cost analysis and filing of plans.

Learning this Process

I asked Mr. Adams if he learned the problem solving process at Penn State or if this was learned "on-the-job" once he arrived in the field. He indicated that the process that he uses was learned during his coursework at Penn State and the he felt very prepared for Civil Engineering in the field. He interjected, however, that he was told by his professors that he would not need to know how to write. Mr. Adams indicated that this was not true and it is his ability to write that is a crucial skill in the engineering process to adequately communicate the problems and possible solutions throughout the design process.

I reiterated that, at IHA, we are trying to encourage our female students to consider careers in engineering. I asked him for a percentage of female engineers on his team. I was pleasantly surprised to hear that his team of engineer designers and construction engineers is fifty percent female! They are both behind the desk and behind the blueprints in the field with construction boots on.

I also asked him how he handles the training of his new engineers that come on board with his team. He indicated that he places them for a period of time with each of the main categories of the engineering process, design, construction, planning and maintenance. Then he places them within the expertise that he believes that their talents will excel.

Problems Encountered

I asked Mr. Adams to describe a problem that he encountered after the bridge had been designed and approved. He indicated that they do their best to take core samples of soil to determine structural strength of the ground as well as testing the soil for contaminants. They do not want their construction workers or the community to be faced with being exposed to toxins in the soil. He indicated that they found oil in the soil after they had done core samples and received approval for the project. The oil was present from a former explosion at a local oil refinery that caused the soil to have a "slow underground spill" of oil. The problem was that PVC pipe was specified for the job as conduits underground. PVC will deteriorate in the presence of oil. Therefore, a more expensive steel pipe had to be replaced in the specifications.

Planned Assessments

I plan to use what I learned during this interview with Mr. Adams during my bridge building unit with my students who are competing in the NJIT Science Olympiad. Now that I know more about the process, I will share the in-depth information with them regarding the "scoping" process of coming up with many ideas that fit 75% of the criteria of the bridge. I believe that this will inspire my students to come up with a variety of designs and to select the best option based on the narrowing process.

Jonassen's Theory of Problem Solving

During my conversation with Mr. Adams, I described how we are implementing a new STEM program and how I am attempting to transition my students to problem solving. He was interested to hear that students are typically taught using "algorithmic" or "story" problems which are "well-structured" problems with a guided solution. The problem solving category of a "design problem" is "ill-structured" and "problem situated". It makes sense in speaking to Mr. Adams and then reviewing Jonassen's "Table I A description of problem types", that design problems do not have right or wrong, only "better or worse". (Jonassen, David 2000) Mr. Adam's discourse on "scoping" shows this process in action. The narrowing down of solutions to one best design will indeed "produce an artifact"(Jonassen, David 2000), a new cable-stayed Kosciuszko Bridge.

Jonassen states, "…learning to solve problems is too seldom required in formal educational settings." Yet, "Few, if any people are rewarded in their professional lives for memorizing information and completing examinations, yet examinations are the primary arbiter of success in society."(Jonassen, David 2000) By speaking to Mr. Adams, it is crystal clear that the problem solving taught at Penn State enabled him to succeed in an important field. Yet, in the high school where I teach, I struggle to come up with fair assessments that are hand in glove with applying knowledge rather than memorizing a list of the anatomy of a bridge.

I mentioned to Mr. Adams that my students were pleased to hear a term that they learned in my Computer Applications class, "chord", the main horizontal load-carrying members of a truss bridge, in their geometry class. I was disappointed to learn from my students that their geometry teacher told them that, unless they are doing accurate measurements, the chord in the bridge building software was not valid. I reiterated to Mr. Adams that math classes are imbedded in the algorithmic approach to problem solving. I asked him how I should handle comments from fellow faculty such as the one the geometry teacher made to my students. Mr. Adams indicated that, "The math teacher is focusing on detailed design. "Approximate" is not a bad thing. Frequently we start with a broad stroke and give ranges that can be in between x and y. There is a screening process that is done. The math teacher is criticizing dimensions of a physical model compared to a computer generated model. In engineering, "close enough gives a good visual as to what it looks like."(Mr. Robert Adams; Mrs. Sharon Mistretta 2015)

In Kirkley, we learned that, "…the mental model is the synthesis of declarative knowledge into a structure which is optimized for solving a certain class of problems."(Kirkley, Jamie 2003) The visual that Mr. Adams is talking about is the figurative "bridge" from algorithmic problem solving in math class to solving design problems in Computer Applications class. Jonassen states, "Problem solving requires manipulation of the problem space be it an internal mental representation or an external physical representation."(Jonassen, David 2000)

My math colleague falls well within the statement that Jonassen makes, when he states, "A major reason, I argue, is that we do not understand the breadth of problem-solving activities well enough to engage and support learners in them."(Jonassen, David 2000) Algorithmic problem solving has its place, but making correlations of a chord in geometry and a chord in Bridge Building was a golden opportunity for student to make crucial connections from concepts to the real world.

Conclusions and Further Study

In conclusion, it was very beneficial for me to talk to Mr. Adams about a bridge that I had covered in class with my students. I learned the "scoping" technique and will apply this concept with my students. I have a group of bridge builders that will be creating truss bridges out of balsa wood and I will be able to share more in-depth information with them about what goes into the design of a bridge. My struggle is to create projects and fair assessments in grading their work so that they will be released from the burdens of the "quick right answer" syndrome. It was interesting to discover that there are eleven different types of problem solving outcomes as per Jonassen and I can now see why my math colleague is under the impression that she is "problem solving" in the context of a "well-structured, algorithmic" approach without deference to the students who have to compete in careers that utilize the "ill-structured, design approach."(Jonassen, David 2000)

Bibliography

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