High School Students Make Campus Sustainable with Digital Technology Learned from New BIM Workshop

Course Based on Bentley Systems Platform Boosts Engineering Skills of Technical Pupils in Mexico

Center for Industrial Technological Studies and Services (CETIS) is a chain of high schools in Mexico that offer students the opportunity to attain a technical-professional level degree. CETIS is a part of the General Directorate of Industrial Technological Education (DGETI), the largest technological upper secondary education institution in the country.

Located in Mexico City, CETIS No. 33 "Carlos María de Bustamante" teaches human resource administration, architecture, construction, automotive maintenance, and office automation. Martha Velia Mendez Soriano, project coordinator, vocalized the need to update the digital software taught in the school's architecture and construction workshops.

"In the past, the computer-aided design (CAD) software classes that were given were limited to 2D and 3D drawing," Soriano explained.

The CAD applications that they had previously used were unable to digitally combine planning, design, and engineering methodologies. Because the software did not incorporate all building information modeling (BIM) processes, each project phase showcased in the workshops were carried out individually.

Soriano had previously taught architecture and construction workshops with a digital platform that integrated design, projection, supervision, and development at other institutions, and she understood the value this brings to engineering students. She sought to develop a digital workshop that showcased how all phases of an engineering project could be integrated and how engineers make design and construction decisions based on multidiscipline information and analysis for optimized benefits.

"Using a digital model as a didactic teaching tool for […] construction procedures, work quantification, and budgets are basic and indispensable topics for technical careers in architecture and construction," said Soriano.

The school amassed a project team comprising both CETIS No. 33's construction and architecture teachers and software specialists at Bentley Systems to create a digital BIM workshop.

"The Bentley tool is widely used in the architecture and engineering sectors, which means that having a workshop for BIM technologies will boost academic excellence at the campus, providing more job opportunities to students within the country's productive sector, by training competent technicians in the professional field," Soriano said.

A Physical and Digital Classroom

The workshop classroom on the CETIS No. 33 campus contains a central data processing and integration server, 30 individual computers with Bentley Systems' applications as the platform, and an unmanned aerial vehicle.

"The open BIM workshop is a physical space, a classroom that was transformed for students to incorporate knowledge and develop learning about BIM methodologies with the use of Bentley software," Soriano described. "It is called a workshop because students learn by doing; they develop construction and architectural projects established in the study plan of the technical career of construction and architecture."

Licensed to use the software, students can access the workshop on campus or virtually at home, and all project data and processing is executed through the workshop server. The BIM workshop's curriculum spans five semesters. Students will develop distinctive projects each semester with the assistance of the Bentley platform.

A Beneficial Workshop Needs a Beneficial Project

Since DGETI is currently implementing sustainable energy initiatives, the project team decided to use one of these environmentally friendly plans as the basis for the project carried out in the BIM workshop. The eco-friendly project was developed in cooperation with CETIS No. 33 students using Bentley software. In this regard, the project was utilized for training and education and showed how integrated design software can deliver specific results.

Some of the green initiatives that the school was carrying out included rainwater use for sanitary purposes and powering electricity with solar panels. The project team decided to incorporate both proposals into the digital model upon which the workshop was based.

The project team performed a photogrammetric survey of the campus with an unmanned aerial vehicle to create a reality mesh. They accurately calculated rainwater harvest volumes from the reality mesh to decipher the precise dimensions of the water storage tank required. They found that construction of the water storage tank would decrease water depletion on the campus by 50%.

For the solar panel portion of the initiative, the project team determined where on the campus the photocells should be located to maximize solar energy absorption throughout the year based on the planetary position of the school. They were able to conserve energy resources through the solar exposure calculator used on the digital twin. It was determined that placement of the photocells would reduce the campus' energy consumption by 25% to 30%, saving an estimated 50% on electricity bills. Using solar energy to this extent also reduces carbon emissions by 32 tons per year.

Sustainability Comes to Fruition

Creating the BIM workshop ultimately led to the production of a sustainable campus. As a result of the student project, there is now a rainwater harvesting system and 20 solar panels that provide electricity to the campus government building, which was identified as the building

receiving the most solar exposure. Therefore, the BIM workshop not only taught students innovative engineering software, it also helped the school understand how their proposed environmental plans would save them money and greatly diminish their carbon footprint.

“In addition to widely promoting the use of these technologies, [the workshop] allowed us to determine the viability of the rainwater harvesting project, as well as the harvesting of solar energy through photocells,” Soriano said. “These projects have a useful life of 25 years at maximum efficiency, since once the campus’ digital twin was available, the appropriate design data was obtained to be able to generate maximum efficiency, thereby supporting and justifying the use of the campus’ economic resources to allocate them to said project.”

A Pilot Workshop and Project

The digital workshop directly impacts over 900 students studying architecture and construction every semester at CETIS No. 33. Currently in use, the BIM workshop has already started its courses both for teachers and students.

“They will use tools such as ContextCapture, MicroStation, Descartes, and OpenBuildings, all integrated under the study plan and the sustainability master project,” Soriano explained.

The solar and rainwater project of CETIS No. 33 is used as an example of how teachers and students can learn BIM methodology on Bentley applications within the school’s architecture and construction framework. This study has also confirmed the practicality of rainwater harvesting and solar energy on a CETIS campus and encourages other DGETI schools to investigate clean energy solutions.

“We consider that CETIS No. 33 is a technological prototype as it is the only campus that has its 3D mesh, a solar exposure study, a digital twin in the making, and its own BIM workshop, all of which can be replicated in other campuses of the same educational system,” Soriano said.

If the BIM workshop and sustainability initiatives are carried out at the approximately 75 DGETI campuses that teach construction and architecture, many more students will receive BIM training and tons of carbon emissions would be reduced every year.

“All of this was developed so that students can benefit from more up-to-date professional skills, the latest generational tools, in addition to being able to support other DGETI campuses in the development of their infrastructure projects, thus making the most of available resources,” said Soriano.

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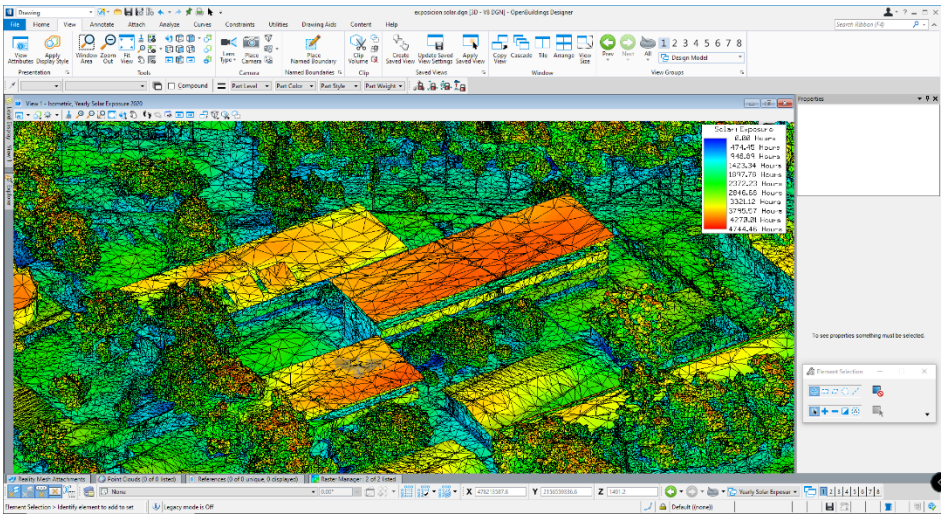

Caption: A computer image showing the yearly solar exposure of the CETIS No. 33 “Carlos María de Bustamante” school building in Mexico City. The school teaches human resource administration, architecture, construction, automotive maintenance, and office automation. Martha Velia Mendez Soriano, project coordinator, vocalized the need to update the digital software taught in the school’s architecture and construction workshops.