

School of Thought



Pre-manufactured skylight and fluorescent fixtures - Tecumseh High School Art Room.

Lighting in K-12 Facilities

By Wendi Sawchuk, Associate Editor

Photos courtesy TMP Associates, Inc.

One of the most important aspects of any building's design is the lighting. Many people may think lighting is only a means to brighten a given space for visibility. However, those in the design and engineering community know that there are numerous other factors that impact a lighting scheme other than just visibility. Lighting plays major roles in mood, retention, and overall quality of space. This is especially true for educational facilities, namely K-12 school buildings. A roundtable discussion about lighting in K-12 facilities was held at TMP Associates, Inc., Bloomfield Hills. Participants included several school design professionals from TMP, as well as Darko Banfic, a project leader and certified lighting design consultant with Peter Basso Associates, Inc., Troy. They all emphasized that lighting design is very strategic and specifically adapted to each space.

ARTIFICIAL LIGHT WITH NATURAL LIGHT

A lighting design does not only deal with placement of artificial lights, but also creating ways to optimize natural daylight as much as possible. The challenge is how to effectively and efficiently complement the artificial light with natural light. "One of the things that we really like to try to do is play the natural light off of the artificial light," said Eric R. Sassak, AIA, LEED AP, TMP Associates, Inc. "We know that these facilities will



External louvers and fritted glass - Cass Technical High School Media Center.

obviously be used during the day, but also at night for various functions. So we do want to achieve as much daylight as possible, but we also want the same spaces to remain bright and happy after the sun has gone down. It is very important that the building not change its mood with the absence of daylight."

The inclusion of natural light into certain school spaces is key for many reasons. People seem to enjoy spending time in an environment that is open with clear views to the outdoors. In addition, features such as skylights and clerestory windows open the area from above. It's usually a two-fold design that gives users opportunities to look outside, while at the same time allowing the natural light to brighten the space. "Users and opera-

tors of educational facilities really appreciate the fact that they can harvest natural light because it's such a wonderful free resource," said Sassak. "It keeps their operational costs down, and it's great for the students because it's very important for humans to be emotionally tied to the outside. When you're in a windowless box, studies have shown that it has an overall negative impact on the person."

The second key to natural light is the decrease in operational costs for facility owners. Banfic believes that although it is such a beneficial resource, it must be adequately balanced with other forms of controlled lighting, including specific glazing products. He said, "There is a very thin line on where lighting systems have to be maximized so that it works to

both the owner's and user's advantage. From a mechanical standpoint, we have to consider how much energy is being put into the building to make the day lighting work. There has been a trend to just add more mechanical cooling in spaces with a lot of natural light. It's the easy way out that ends up costing the owner more in energy costs. The design community must put more effort into adequate control of the systems (lighting, cooling and shading), as well as limiting the surface area for proper quantity of daylight. This includes various shading systems and specifying a certain glass product. We always have to ask ourselves, 'What light do we allow and what light should we reject?' It's not just a matter of adding one or the other (artifi-

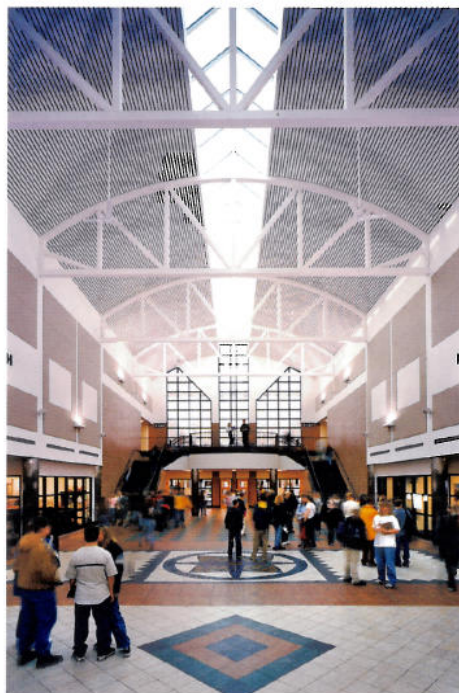
cial/ natural light or cooling). All systems really have to work in conjunction with each other. At the same time, providing a balance of light quantity, along with light quality, must also produce an encouraging learning environment for students."

A representative TMP project that successfully integrated natural lighting with artificial lighting is the new Cass Technical High School in Detroit. The building design includes several day lit common areas, along with areas like the glass and louver-clad Media Center and Competition Arena, with its indirect-lit vaulted ceiling. TMP incorporated materials such as semi-transparent fritted glass to allow daylight to brighten everything, but not overwhelm the space. "We tried to make it as energy efficient as possible," said Jeffrey P. Boes, AIA, LEED AP, senior associate, TMP Associates, Inc. "For example, the classrooms have up/down controllable light, which was important for glare reduction. We also tried to maximize the amount of daylight coming through the windows. We wanted to be able to control that with different light levels. In the public spaces, we relied heavily on natural light throughout the entire building. We also used occupancy sensors to turn off the lights when they're not needed."

Derek W. Dinkeloo, AIA, associate, TMP Associates, Inc., stated, "It's really all about a strategic layering of light (indirect, direct and natural). We have code issues and uniform measures that we have to do in every school, but different spaces require different forms of lighting, whether it's a business or elementary classroom. It seems to me that we are using a lot more controls for space lighting and a lot more layers of lighting. It's just getting much more sophisticated and the day lighting plays into that. We try to control our interior lighting so if we have more daylight, we are not using as much energy to power the interior lights."

EMERGING TECHNOLOGY

The roundtable participants also recognized the need to continually educate themselves, as well as facility owners, on emerging technologies. This includes the advanced media technology used in today's schools and the lighting products on the market to correspond with it. "We



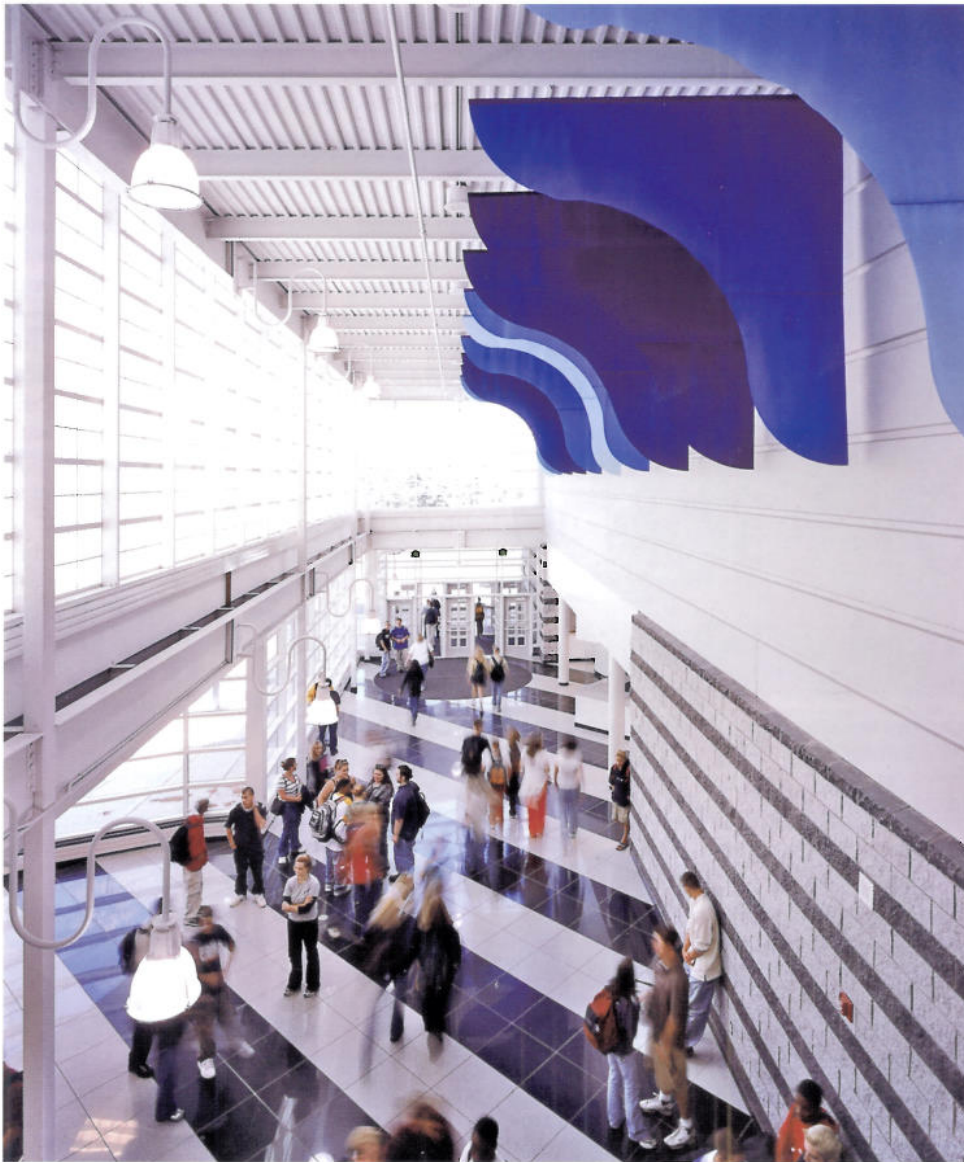
A gabled linear skylight - Pinckney High School Atrium.

now have to work with technology such as different light boards, projected media, flat screens and distance learning, among others," said Richard B. Borrelli, AIA, principal, TMP Associates, Inc. "In terms of distance learning, we have to be able to light the vertical surface and the face of the individuals being broadcast to and from. So there's a whole series of challenges that we did not have prior to the advent of this technology. We are scrambling to keep up with the lighting industry because they have so many products on the market to balance it all. We find ourselves challenged by that on a daily basis. We have all different light sources and different temperatures that must coordinate with the space and equipment. We have to be able to provide appropriate lighting so we are not washing out the white board or competing with the image on a screen, and yet have a room that allows us to be flexible in its use. For example, we do not want to have a room with distance learning that only gets used for two hours a day. We have to be able to leverage the owner's money."

As the design community learns more about various lighting products, they must educate the owners at the same time. Owners have to be aware that cer-

tain products are used for specific applications, depending on the required light level of the space. Banfic provided an example of two similar products applied in different situations. He said, "Many people think that a T5 lamp is the best on the market because it's newer, smaller and more aesthetically appealing. Yes, it does have a greater number of lumens per watt than the older T8 lamp. However, in a typical classroom we never use a single T5 lamp in a fixture. It's always at least two T5 lamps per application. Once we marry that with a specific ballast, I can prove that the T8 lamp with the proper ballast is no less efficient than the T5 system. So in a majority of standard classroom lighting designs, the T8 can still remain the correct lamp rather than the heavily marketed and more expensive T5 lamp. Now, in larger areas such as gymnasiums, swimming pools and music rooms where a brighter light source is necessary, a high-output T5 lamp is absolutely proper because it instantly turns on instead of having to warm up, as with H.I.D. lamp products. So there are advantages and disadvantages, application specific, to going toward some of the newer lamps. We have to educate owners and tell them that we cannot design their project most efficiently and effectively with just one type of lamp. Once they understand the reasons why, they can assist us in deriving proper lighting solutions for their facilities. We need to show the benefits of each type of product and apply each one in a responsible way."

Borrelli reinforced that lighting design always involves a delicate balance between aesthetics and functionality. While the designers must follow certain standards and codes, as well as evolve with technology and keep operational costs at a minimum, they also want to add creative touches to the space. The creativity is what subtly keeps students invigorated and in the mood to learn. He said, "We always have to keep in mind economy; not just initial project cost, but future operational costs of the lighting systems. What we get into with a lot of our clients is that they have to maintain parity with their other facilities, and we need to focus on replacement costs and ease of replacement. But, at the same time, we (on our end) are pushing to create dramatic effect or to increase visual



Translucent glazing and industrial fixtures - Walled Lake Central High School "Avenue".

acuity or to improve the overall environment. So quite often, we contend with aesthetic versus functional."

TRENDS IN SCHOOL LIGHTING

Current trends in school lighting design were also discussed by the panel. They mentioned that K-12 facilities are beginning to transition to a more fluid and active learning environment, even at the high school level. "Schools want to make things more participatory and prompt investigation," said Sassak. "So, they are moving toward spaces with different seating and interactive arrangements; it's not just about kids sitting in

rows of desks." Obviously, elementary level facilities have always followed that pattern because young children readily respond to active and bright environments. The lighting design in these buildings complements that style. Now, the design community has also seen an increase in these types of learning environments at the higher level. Again, it's a learning curve for the lighting designers because they must adapt with the changing trends.

School buildings, especially high schools, are also being opened and used heavily for evening functions. This has prompted the inclusion of spacious gath-

ering areas, such as Commons Corridors. During the school day, the Commons Corridor acts as a thoroughfare for students, but then it doubles as a large public space for after-school events. "School owners feel that since the public taxpayers paid for the building, they should be able to use it," said Borrelli. Added Sassak, "It was a major criteria for Anchor Bay High School in Fair Haven. Again, we did not want the building to change its brightness and mood just because the sun went down. We tried to compensate for it the best way possible by introducing both down and indirect light sources that help to keep the ceiling from becoming some dark plane with bright hot spots at only certain points. The pendant indirect lighting also has done a great job to brighten up the ceiling plane to prevent it from appearing so dark."

Another trend that is slowly making its way into more K-12 facilities is color lighting. Although it's used in many elementary schools, the designers have specified some color lighting in other learning environments, as well. "We have been seeing more of the color lighting with the advent of LED technology," said Boes. "Right now, it's a bit too entertainment-oriented for many school facilities, but I think a little bit of that will eventually filter in, but only in appropriate places. There are certain areas, like in the special education end of the spectrum, where color is a good interaction tool."

ENLIGHTENED EDUCATION

As K-12 facilities continue to evolve in terms of overall design, the lighting designs must evolve with them. Proper lighting, whether for functional or aesthetic purposes, is a major concern when a project is on the drawing board. Improper lighting within a school facility can negatively affect a student's learning retention. "There is a certain quality that we try to incorporate into our buildings," said Boes. "It's hard to describe sometimes, but I think of it as an overall uplifting feeling. We want students to feel good when they walk into a room, which can transform into a positive learning experience."