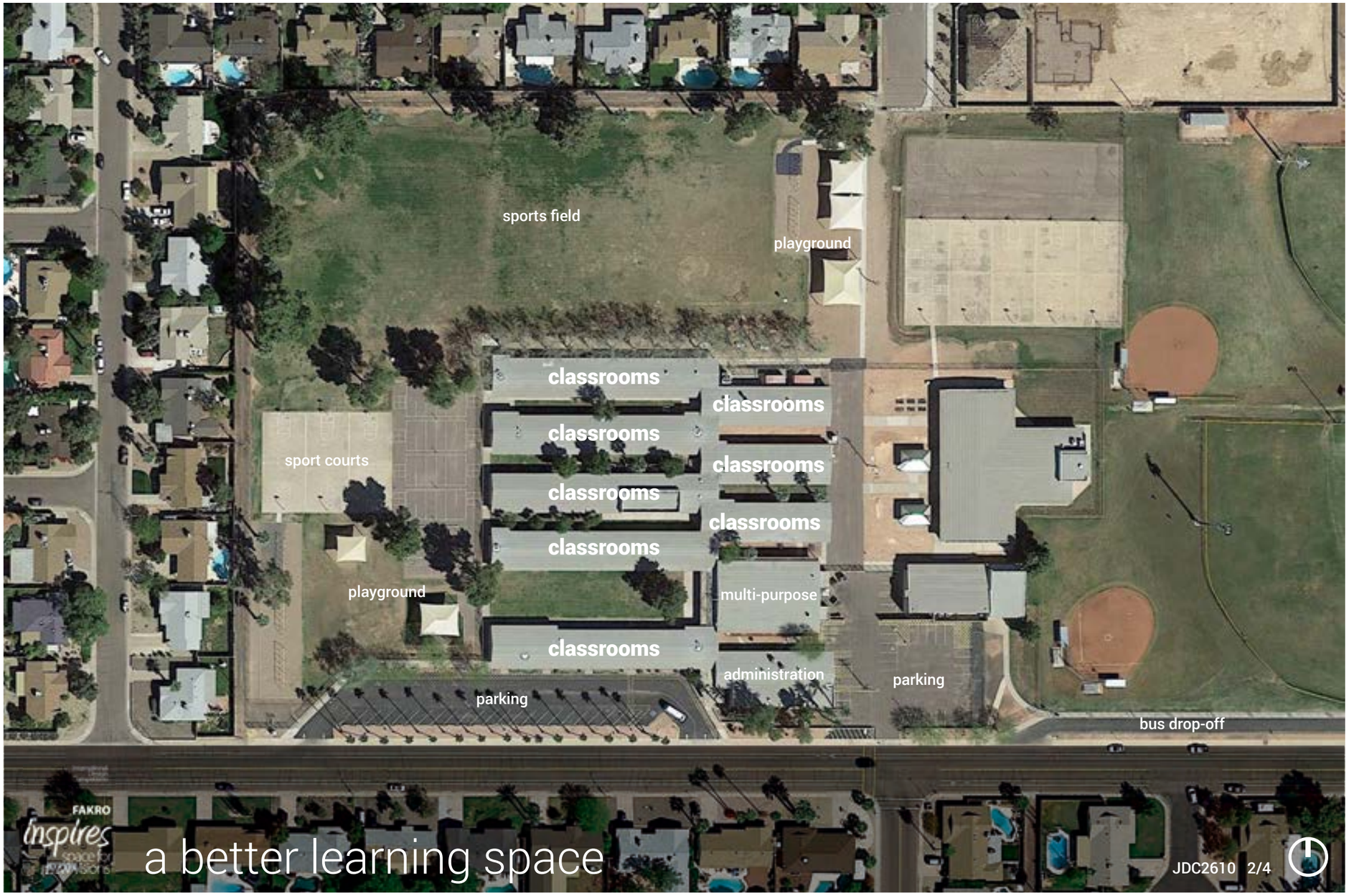
a better learning space

An extraordinary amount of a child's social, mental, and emotional development takes place within the confines of a school classroom. In a study published in the journal 'Building and the Environment', it was discovered that "classroom design could be attributed to a 25% impact, positive or negative, on a student's progress over the course of an academic year. The difference between the best and worst-designed classrooms covered in the study? A full year's worth of academic progress." [1] The study looked at ten characteristics of space: light, sound, temperature, air quality, choice, flexibility, connection, complexity, color, and texture. While some of these factors can be altered through interior design, others require a more surgical (architectural) intervention. The typical classroom, especially those housed in dated facilities (a common occurrence), certainly do not allow for adequate daylighting and ventilation. Windows, when present, are often placed well above the students' sight-lines to the outside world, creating a dark and isolated environment that feels more like a prison than a space for discovery. Furthermore, these windows are rarely operable, preventing the ability to ventilate the space naturally. Mechanical ventilation, therefore, is necessary. As a result, electricity is relied upon heavily. Similarly, harsh, energy-consuming fluorescent lamps are used to light the spaces, rather than natural daylight, in the process concealing views to nature. Studies have shown that "views allow minds and eyes to take a break" and that they "should not be blocked by curtains, blinds, or other obstructions." [2]

In this case study, a typical elementary school classroom found in Scottsdale, Arizona, USA, provides us with a situation that is no different. The school itself possesses a world of potential. Through a handful of small architectural interventions, including the replacement of single-pane windows, the typical classroom is transformed into a light-filled world of wonder and exploration (pictured above). Natural breezes flow through the single-loaded rooms with ease, fostering an environment in which students are comfortable, relaxed, and ready to learn.

1. Vanhemert, Kyle. "Study Shows How Classroom Design Affects Student Learning." FastCoDesign. 18/01/13. Web 23/07/16. https://www.fastcodesign.com/1671627/study-shows-how-classroom-design-affects-student-learning

2. Tanner, Kenneth C. "Essential Aspects of Designing a School." School Design and Planning Laboratory. The University of Georgia. 04/00. Web 24/07/16. http://sdpl.coe.uga.edu/research/principlesofdesign.html



existing condition

Pima Elementary School, located in Scottsdale, Arizona, was constructed in the 1950's as single-loaded brick classroom "bars" separated by thin slivers of vegetation (predominately grass). In its current condition, these green "fingers" are not used in any meaningful way except to separate buildings. The buildings, themselves, have excellent "bones". The brick structure could certainly provide a more than adequate framework for a minimally invasive renovation. As a result, the school district could conceivably save money by remodeling the aging facility rather than build a new facility, as has often been the preferred method for dealing with outdated schools in the United States.

The classroom interiors also show signs of age and of the teaching methodologies of the time. Views outside are not permitted. Fluorescent lights provide much of the illumination. Dropped acoustic tile ceilings make the 600 sf classrooms feel even smaller. As teachers' storage needs have grown with an expanded curriculum, the classrooms have become cluttered, further reducing the usable learning space. Backpacks are currently stored on racks outside the classrooms, which is inconvenient for students.

01 High, single-pane, energy-inefficient windows along the classroom buildings' north facades limit daylight and prohibit views outside. These windows are inoperable, as well, preventing natural breezes.

02 High windows along the south facades are also inoperable, preventing natural ventilation and requiring massive amounts of mechanical heating and cooling throughout the school year (a large expense for the school district). Space between buildings is under-utilized with little shade (a key component in the Arizona desert where temperatures can reach 120°).

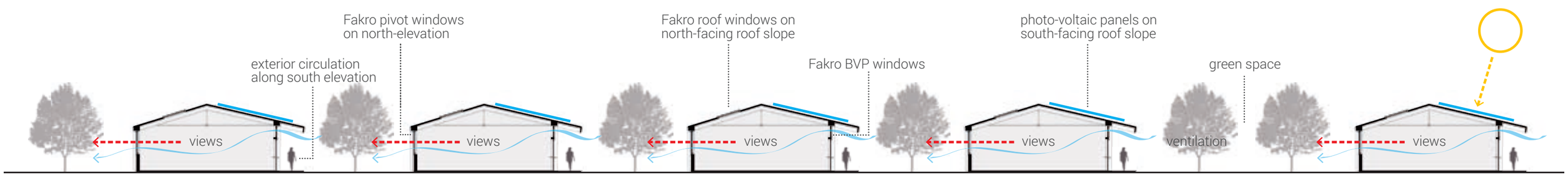
03 The interior of the classroom contains low, dropped ceilings with fluorescent lights that are always on to compensate for ineffective daylighting. No views out are prohibited. Vertical blinds are the only means of controlling daylight.

04 The classroom space is cluttered and lacks efficient storage space.

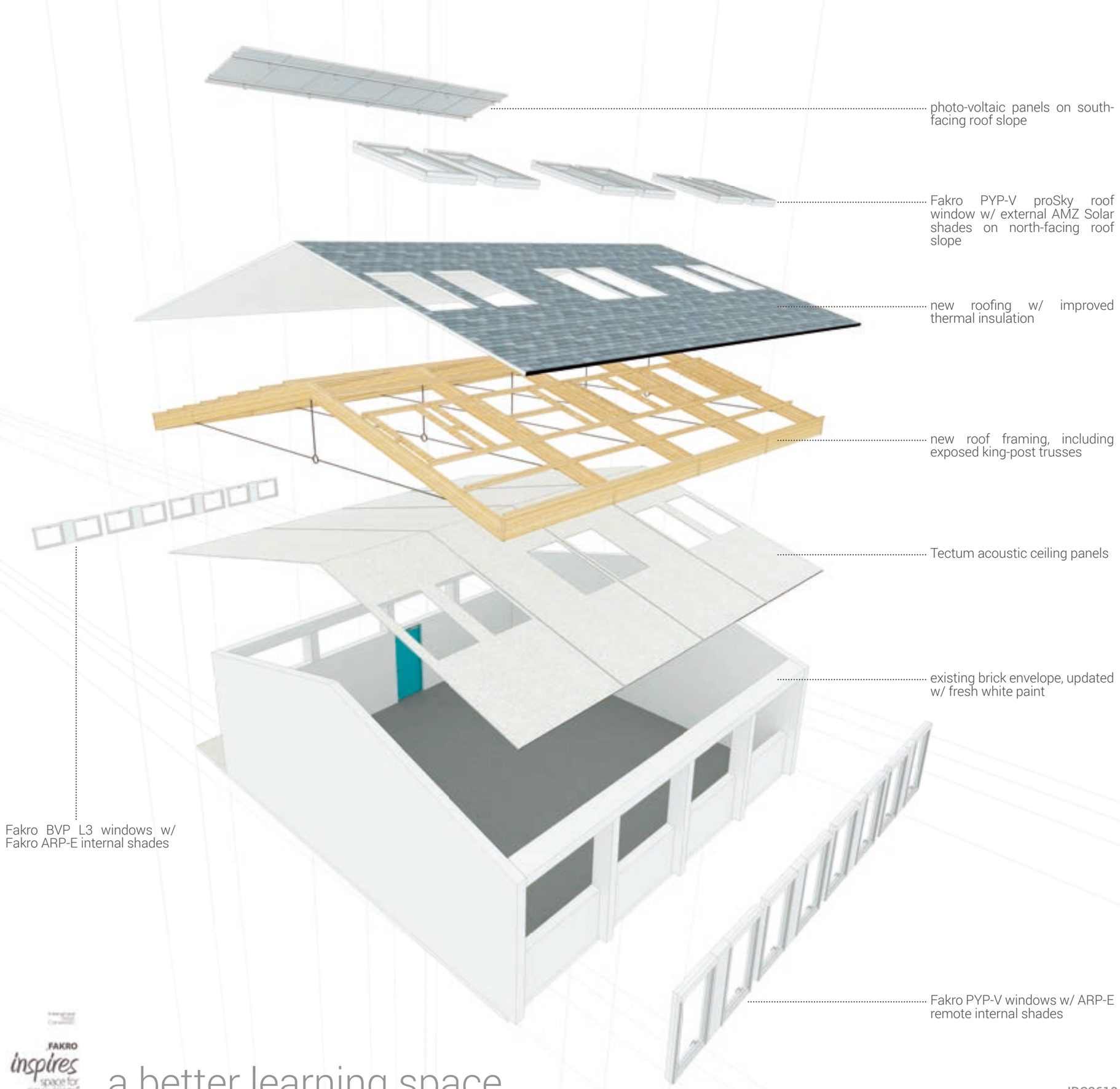
a better learning space

JDC2610 3/4

The re-envisioned grade school takes advantage of the existing site plan configuration, which consists of long, single-loaded classroom bars separated by a currently under-utilized exterior space. All circulation is located on the exterior south side of the buildings. By enhancing these green spaces between the classrooms with shade trees and exterior learning/gathering spaces and by replacing the existing high windows on the classrooms' north elevation with larger Fakro windows, the revised concept now allows beneficial views to nature, while simultaneously affording plentiful natural light. By replacing the south elevation's high windows with operable Fakro windows the classrooms are exposed to natural breezes. The result is a brighter and more comfortable learning environment for the students, as well as a massive reduction in energy consumption for both lighting and ventilation (cost savings).



school section . looking east



construction

The renovation strategy takes advantage of the school's solid brick structure, maintaining all walls in order to reduce unnecessary costs. The walls are, however, given a simple coat of white paint to brighten up both the exterior and the interior. The bright white interior walls allow daylight to bounce and illuminate the entire space.

The aging roof structure, however, is removed, along with the suffocating drop tile ceiling. New king-post trusses are added, becoming an architectural feature within the classrooms and allowing the students the opportunity to see/understand how a building's structure works. New roofing with additional insulation replaces the existing batt insulation. On the interior Tectum acoustic ceilings panels provide the ceiling finish and help reduce noise reverberation. Punched openings along the north face of the new roof provide space for Fakro PYP-V proSky roof windows. The north face is used in this desert climate to reduce direct sunlight entering the classroom and heating the space. Winter temperatures are mild and heating is rarely necessary. External Fakro AMZ solar shades further reduce heat gain, if necessary, and provide the teacher with a means to control interior lighting levels via remote control. In many cases, darkening of the room is desirable for showing educational films. Photo-voltaic panels are added along the south-facing slope of the roof to further reduce energy costs for the school district.

All windows on the existing classroom buildings are removed. The larger windows on the north facades are replaced with Fakro PYP-V proSky roof windows that occupy the full opening in the brick wall. The previous window units had steel panels covering the lower portion to prevent views out by the students. The high windows along the south facade are replaced by Fakro BVP L3 windows. Fakro ARP-E internal window shades give the teacher the ability to reduce light levels remotely.

01 Fakro ARP-E internal shades and Fakro AMZ external Solar shades provide a means for the teacher to control the amount of natural daylight entering the space. In this case, the classroom is essentially blacked out to allow for a film to be viewed. Note that increased built-in storage space allows for a more flexible space. Desks can be pushed to the back of the classroom to free up floor space.

FAKRO inspires space for new visions

a better learning space