

DOVE MOUNTAIN CSTEM PREK-8 SCHOOL

MARANA UNIFIED SCHOOL DISTRICT | MARANA, ARIZONA



2020 SUBMISSION | JAMES D. MACCONNELL AWARD

EXECUTIVE SUMMARY



PROJECT GOALS

- Inspire students to learn, engage their minds, and foster innovation.
- Create an immersive CSTEM learning experience and pedagogical pathway.
- Provide architecture that exemplifies 21st century learning.
- Elevate the district's brand as a leader in CSTEM education.



EXECUTIVE SUMMARY

INSPIRE | ENGAGE | INNOVATE

Overall Goals: As the first ground-up PreK-8 CSTEM school in Arizona, Dove Mountain fosters a vision of a new pedagogical future for elementary school students. Driven by the superintendent's commitment to CSTEM project-based learning and with extensive input from additional district leadership, community members, and business partners, this vision sought to create a school where a CSTEM-based curriculum would be taught and experienced in a more visceral and profound way within an environment that exemplifies the district's guiding principles in architectural form. These principles – “to inspire students to learn, engage their minds, and foster innovation that they will be prepared to lead tomorrow” – served as a programmatic compass to guide all design decisions that emerged as the team developed the project program into a tangible reality.

Following these principles, the team set out to first orchestrate the school's curriculum into a series of educational venues to create “the learning pathway.” This learning pathway would then be set within the backdrop of an architecturally immersive CSTEM experience embodying 21st century pedagogical principles where computer coding, science, technology, engineering, and mathematics are incorporated into the curriculum for every class and subject.

THE LEARNING PATHWAY

The learning pathway at Dove Mountain is a series of pedagogical venues, which are repeated across the school's three distinct “grade bands” – grades K-2, 3-5, and 6-8. Resources within each space are tailored for a particular grade band. Key venues supporting each grade band include the following:

- **Flexible Classroom Spaces:** Student project ideation begins in the classroom. Furniture is varied, modular, and easily reconfigurable to suit the needs of a diverse student group as they embark on their project journeys. Operable glass classroom partition walls span one complete side of each classroom to provide additional flexibility and collaboration, expanding the classroom space into adjacent learning corridors.
- **The Learning Corridors:** Also known as “flex corridors,” these spaces offer students a smaller, more intimate setting where they develop their concepts. Flex corridors incorporate operable pivoting gridded marker board wall panels, offering students and teachers the option to cross-collaborate between classrooms on either side of the double loaded flex corridors or separate the corridor into more intimate collaboration spaces.
- **zSpace Business:** Partnerships with organizations such as zSpace led to the incorporation of integral augmented reality (AR) and virtual reality (VR) zSpace labs throughout the school. Rough two dimensional ideas can evolve into multi-dimensional concrete student project plans in these visualization laboratories.
- **Makerspaces:** Once project ideas are fully conceptualized, makerspaces and wet labs allow students to construct their projects and learn through hands-on experience.
- **Outdoor Learning Labs and Presentation Spaces:** In this environment, students can test, complete, present, and celebrate their project that began with an idea and became their own creation.

CONTEXT

Site: The Dove Mountain CSTEM PreK-8 School occupies a 20-acre site northwest of Tucson, Arizona. Located on moderately-steep sloping topography surrounded by two mountain ranges and a thicket of Sonoran Desert vegetation, the site provides a rugged and beautiful backdrop, inspiring the form and aesthetic. Nearby natural desert arroyos became inspiration for the school's primary circulation paths. Classroom wings are attached through a main circulation path, which sweeps up a moderate 56-foot-incline across the site. The natural structural forms found in desert cacti helped inspire expression and celebration of the building's key structural elements.

Outdoor learning seating utilizes the natural topography to create an amphitheater focal point where students can learn, collaborate, and present their work. Rock strata found in nearby mountain geology becomes emulated in architectonic masonry forms and textures that come alive with light and shadow as the desert sun shifts throughout the day. Ultimately, the design respects its natural setting, harmonizing with the colors and textures of the terrain. Existing flora was preserved in place or relocated on the site.

Marana Unified School District: Founded in the early 1920s, Marana USD's boundaries include 550 square miles of land and is comprised of 18 schools in Pima County, Arizona. As of December 2018, the district had over 12,200 students and 1,600 employees.

Telling the District's Story: Facing increased competition from successful charter, private, and public schools in neighboring districts, Marana USD assessed new ways to elevate the district's brand and story. The district's program required a design that provides curb appeal while successfully embodying and expressing the guiding principles and responding to community needs.

Community Requested Programs and Services: Through district and design team outreach, community voices were placed front and center of the schools' functional program. The resulting additional programs and services provided at Dove Mountain include full day free kindergarten, preschool, gifted education, special education, fine arts, before and after school care (LEAP), a full-time master-level school counselor, health services, music classes, physical education, a media room, and athletics.

Final Outcomes: The programmed curriculum, interactive learning environments, and services provided at Dove Mountain effectively allow students to take risks and solve problems, preparing them to meet the demands of jobs of the future. By implementing hands-on learning opportunities, students are more aptly prepared for continuing education and entering the workforce.

To date, the success of this community-inspired curriculum has been unprecedented. The excitement generated in the broader community has already attracted more than 175 students from beyond the district borders in the first year of operation alone, with future growth anticipated. The school is currently nearing completion of its first classroom wing expansion to address the current demand. The additional six classrooms will be complete and ready for occupancy by the second anniversary of the school's opening.



SCOPE OF WORK AND BUDGET



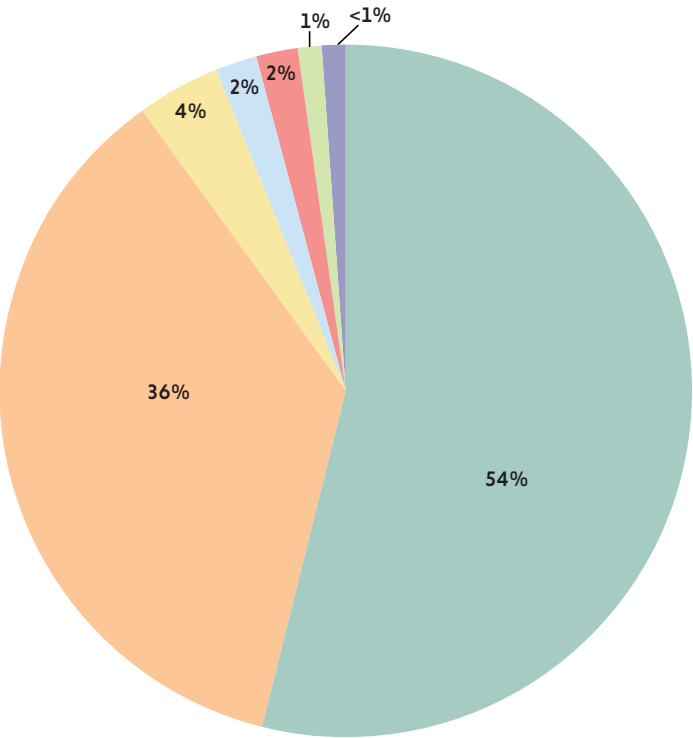


SCOPE OF WORK AND BUDGET

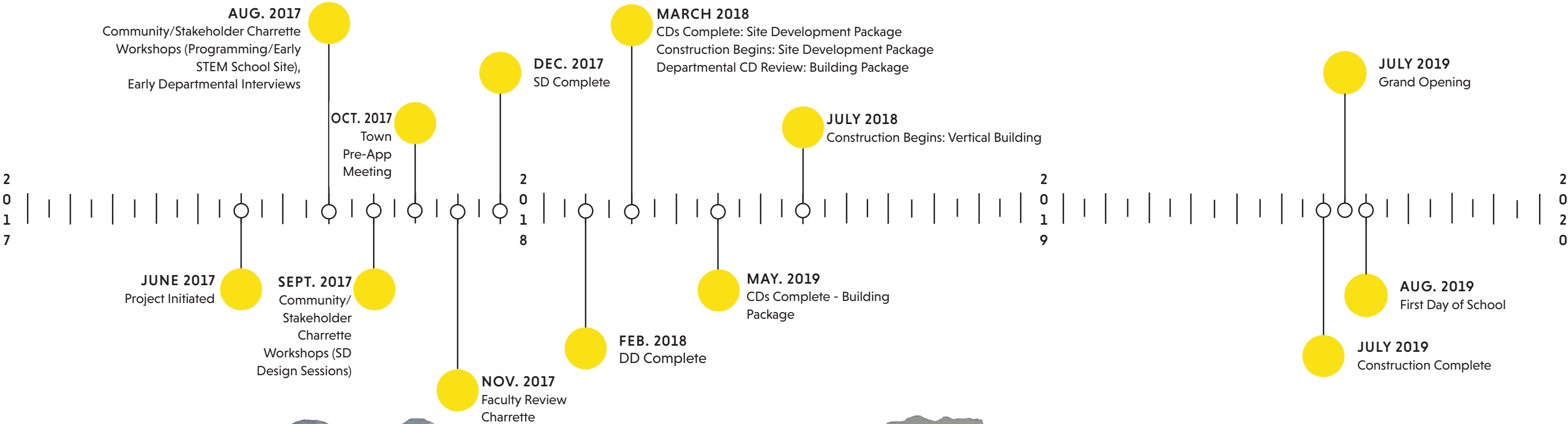
PROJECT DATA

- Size of Site:** 20 acres
- Capacity of Students/Occupants:** 1,045
- Gross Area of Bldg/Space:** 100,960 GSF
- Space per Student:** 96.6 SF
- Project Cost:** \$30,000,000
- Project Completion:** July 23, 2019
- Occupation Date:** August 1, 2019
- Number of Stories:** 2

WHITE	54%
HISPANIC	36%
TWO OR MORE RACES	4%
BLACK	2%
ASIAN	2%
NATIVE AMERICAN	1%
NATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER	<1%



PROJECT DATA



SCHOOL & COMMUNITY ENGAGEMENT



"Everybody that walks through this space is really fascinated by how open it is, and I think that what it does is it provides opportunities for kids to feel a level of confidence."

Dr. Doug Wilson, Superintendent, Marana USD

VISIONING & PROCESS

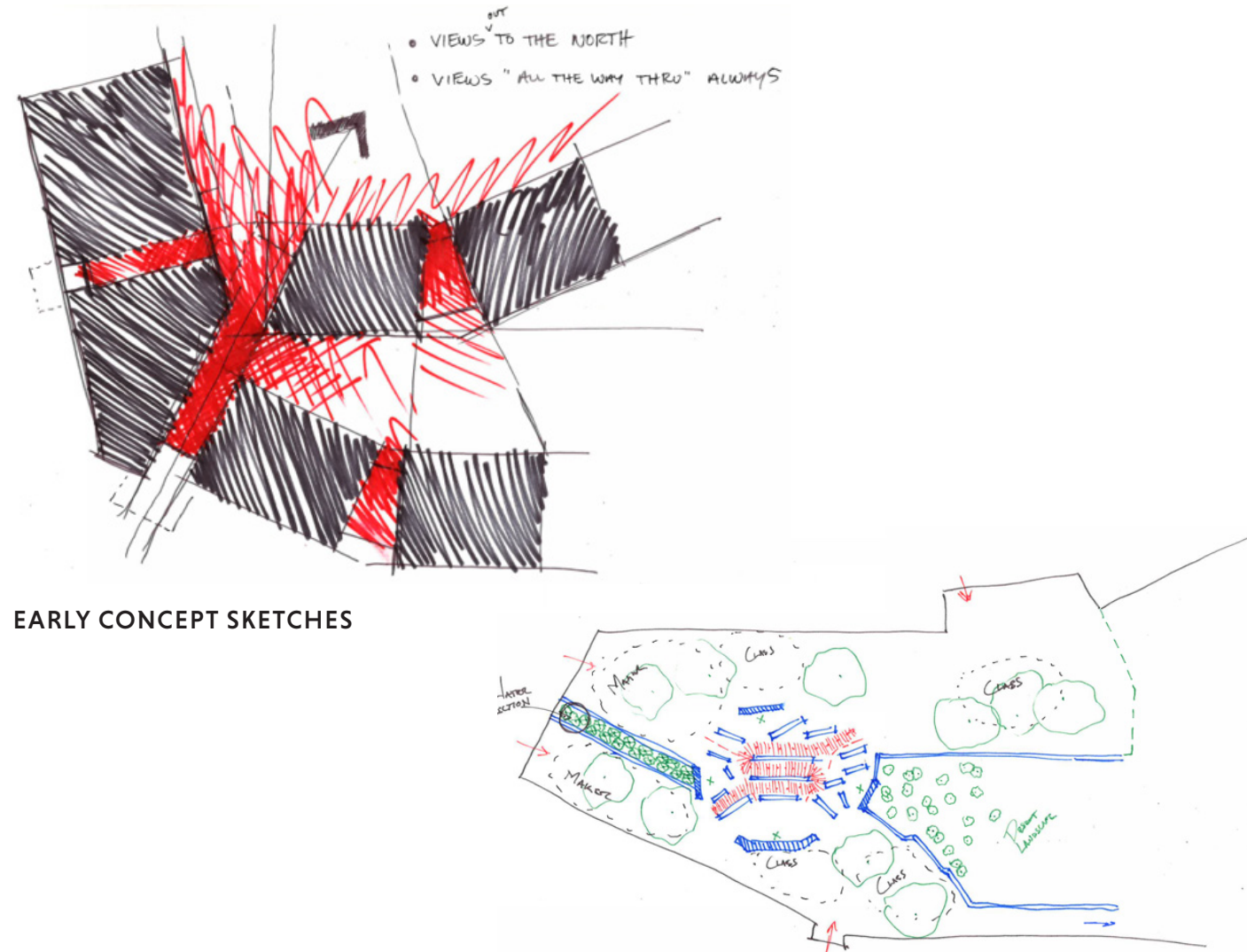
A BLANK SLATE

Winning the commission for Dove Mountain came with a promise – the ability to start with a blank slate. District leadership, including the Superintendent, Assistant Superintendents, CFO, and Director of Bond/Capital Projects, wanted to keep minds open at the onset of the programming process. The design team responded by conducting a series of early exploratory exercises with district leadership to begin establishing the core functional and philosophical project parameters that would become ingrained in the project program. Exercises included the following:

- **Site Tours:** District leadership toured numerous STEM and CTE schools, both within and outside of Arizona. Visiting and interviewing faculty at a variety of the nation's most successful STEM/CTE programs provided both a sense of perspective on what was possible and a basis for dialog between design team members and Marana USD leadership.
- **Departmental Interviews:** The architecture and engineering teams interviewed each user group, allowing everyone to have a voice early in programming. Recurring interview sessions included operations and maintenance teams, IT directors, energy efficiency leaders, food service leaders, and transportation directors, among others. With open ears and minds, the team thoroughly documented and incorporated departmental feedback and requests into the evolving program narrative and spreadsheets for final review and approval by district administrative leadership.
- **Project Stakeholder:** Charrettes were conducted on a weekly basis following the initial project kick-off and site tours. Using an array of design communication methodologies including hand-sketching, BIM spatial planning, and VR design concept walk-throughs through HTC Vive, the design team received accurate and thoughtful feedback.
- **Construction Team Integration:** The construction team served as a close partner throughout the design and programming process, attending site tours, departmental interviews, and project stakeholder charrettes to create synergy between design, budget, and constructibility requirements. Throughout all phases, the design and construction teams met with the project's major sub-trades multiple times to review system designs, making sure all participants were aligned regarding system specifications, design, cost, and expectations.



VISIONING & PROCESS



ENGAGING THE COMMUNITY

With the district leadership's feedback and guiding principles of "inspiring students to learn, engaging their minds, and fostering innovation," always in our sights, we provided a thoughtful and integrated response to the community's goals. Students, teachers, parents, community members, and neighborhood homeowner's associations participated in several visioning sessions to capture interests, ideas, and goals. Using a variety of techniques, we were able to establish the core values of the community that would ultimately challenge the outdated traditions of siloed teaching and replace them with a school environment that emphasizes collaborative, project-based, hands-on learning in a didactic environment that provided ample natural light and flexible venues.

VISIONING SESSION TECHNIQUES

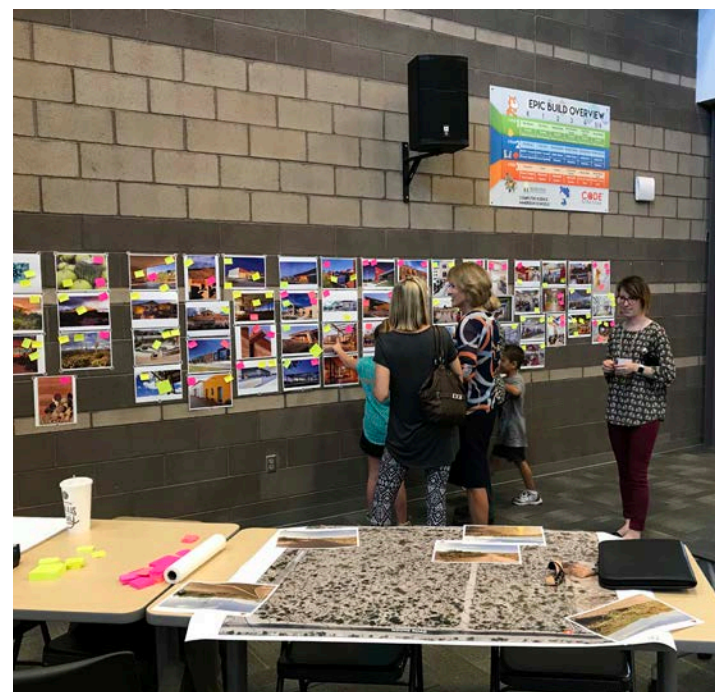
Visioning sessions included hands-on, interactive physical modeling, inspirational imagery voting and commentary exercises, formal community surveys, concept sketching exercises, early concept 3D walk-throughs viewable via smartphone or cardboard VR headsets and issued via scannable QR code, and programming diagram studies.

EDUCATIONAL COMMUNITY PARTNERSHIPS

Organizations such as Discovery Education, Code To The Future, zSpace, Eureka Math, MobyMax, and Raz-Kids contributed to the development of the Dove Mountain CSTEM curriculum and school design. In particular, the design team engaged zSpace to provide hands-on AR demonstrations to the community and assist with planning the incorporation of zSpace design labs throughout the school.

PROGRAM DISTILLATION

With the wealth of data gleaned from these visioning sessions including primary pedagogical philosophies, inspirational design ideas, community feedback, and departmental functional necessities, Marana USD and the design team proceeded confidently knowing that a solid, inclusive, and responsive programmatic foundation had been put in place for the new Dove Mountain CSTEM PreK-8 School.





EDUCATIONAL ENVIRONMENT

THE LEARNING PATHWAY



Flexible Classroom



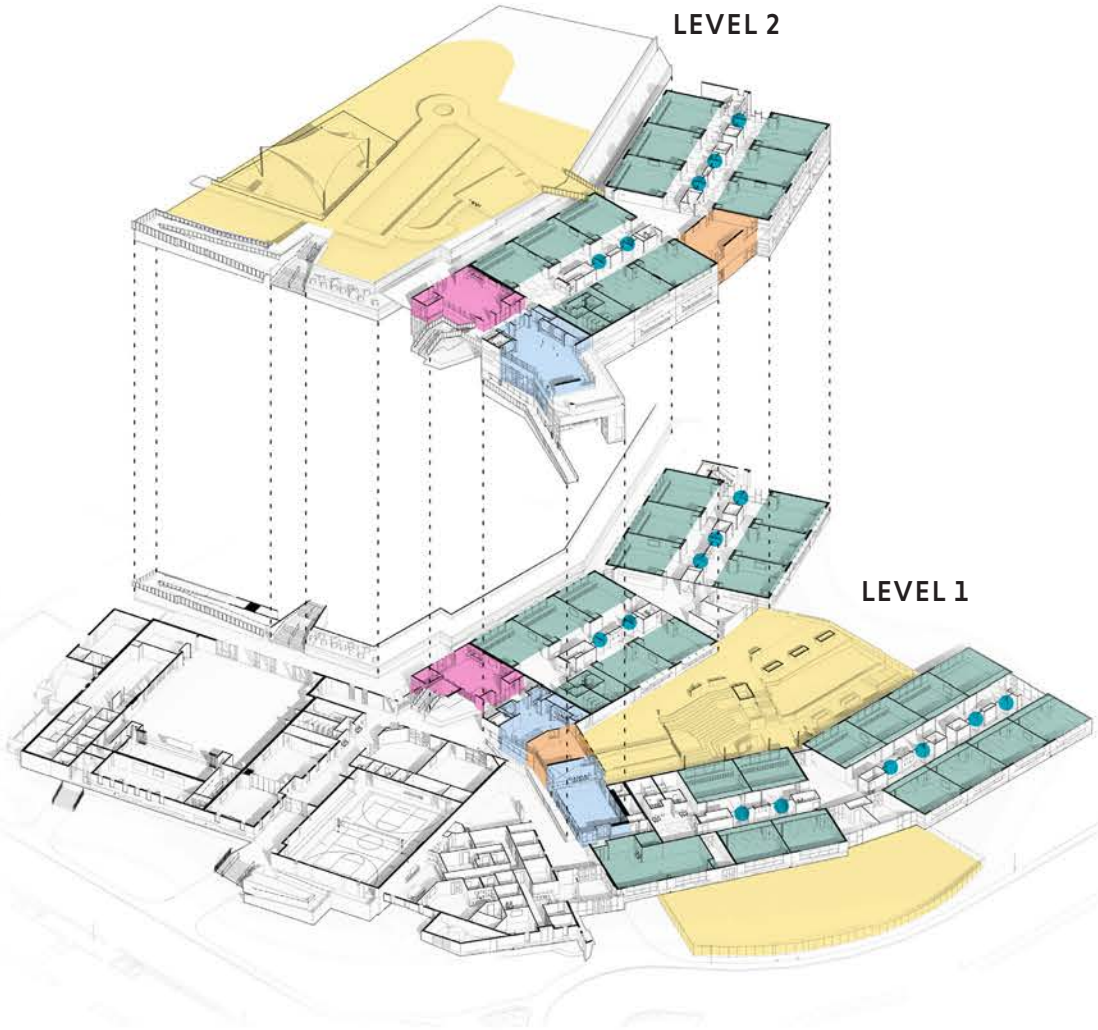
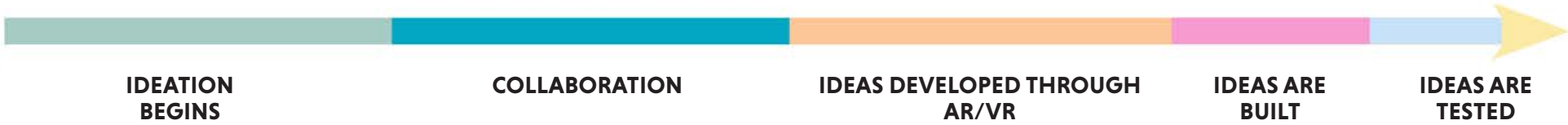
Adaptable Learning



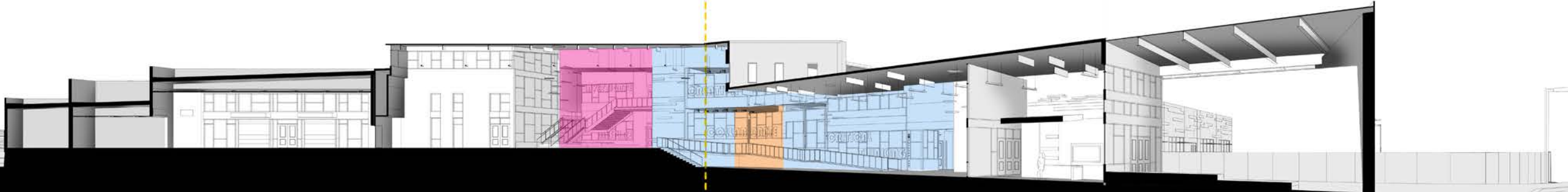
AR/VR Labs



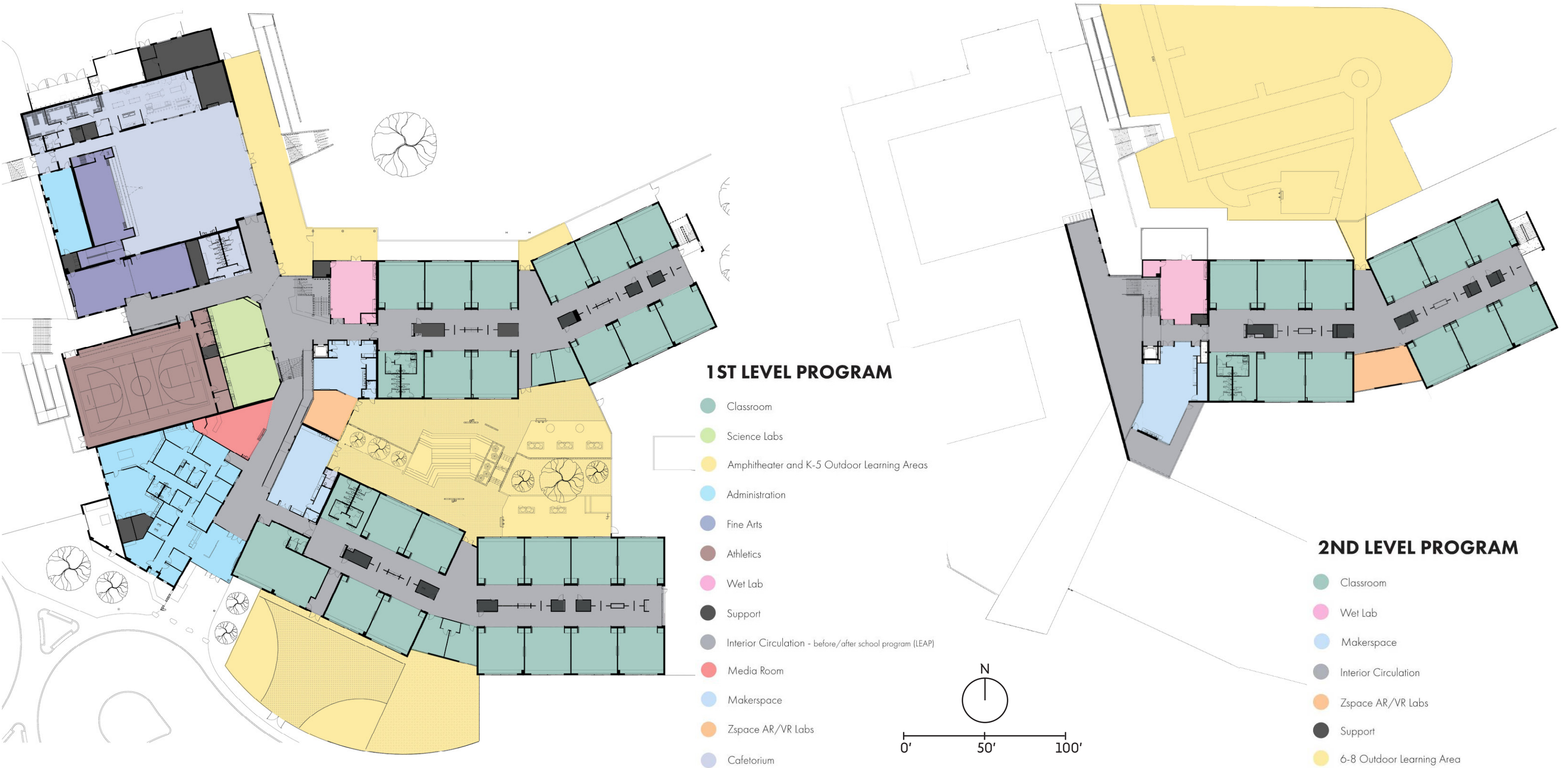
Makerspace



SECTION



FLOOR PLANS





EDUCATIONAL ENVIRONMENT

THE LEARNING PATHWAY

VISION AND GOALS

After establishing the district and community's programmatic vision and goals, the design team defined and orchestrated the school's curriculum into a series of key educational spaces to create "the learning pathway." The learning pathway is not a linear path, but rather a series of primary learning spaces set in each grade band — grades K-2, 3-5, and 6-8 — that students engage in a sequential manner as they work through their project-based learning curriculum from start to completion.

Once the spatial typologies of the learning pathway were established, the design team evolved their formal and functional parameters while following the programmatic compass. By providing an "immersive" CSTEM learning experience that celebrates 21st century learning and the district's fundamental guiding principles, students are inspired to learn and remain mentally engaged, having access to the tools and resources necessary to foster innovation. The architectural aesthetic becomes a learning device, providing the backdrop that inspires and engages students. Visual continuity between spaces, physical pathways that put learning on display, and the anticipation of discovery along key circulation routes define the learning experience.

LEARNING PATHWAY VENUES: IDEATION IN FLEXIBLE CLASSROOM SPACES

Ideation is the first step in project-based learning, starting with the flexible classroom. Several key strategies foster student creativity and support a variety of learning and teaching styles. Modular furniture and workstations allow students and teachers to quickly adapt and easily reconfigure their classroom to suit a variety of needs while conducting group and individual learning exercises. Adjustable touch screen flat panel TV's combined with WiFi, Bluetooth, and 1:1 Chromebooks provide students with a key accessible interface for learning about, exploring, and sharing project ideas in a group setting. Additionally, operable glass partitions span the entire classroom corridor wall, allowing teachers and students to open and expand their classroom space into the adjacent "learning corridor" when additional classroom space is needed.

FLEXIBLE LEARNING CORRIDOR: EXPLORING IDEAS THROUGH COLLABORATION

At Dove Mountain, primary classroom wing circulation pathways are a key component to support the philosophical idea of the "learning pathway." The corridors serving each grade band provide multiple functions including additional classroom expansion space when operable glass partitions are open or a more intimate collaboration setting when operable glass partitions are in a closed position. A series of collaboration alcoves arrayed along the center learning corridor partition offer flexible furnishings, additional cabinetry, and gridded marker and tack boards. The partition allows flexibility to either separate classrooms on either side of the classroom wings or open up through operable rotating markerboard panels to allow permeability and additional cross-corridor collaboration.



THE LEARNING PATHWAY

ZSPACE COMPUTER LABS: PROJECT VISUALIZATION

Following classroom-based CSTEM instruction and group collaboration exercises, students continue their journey along the learning pathway by developing and visualizing project ideas using advanced augmented and virtual reality (AR/VR) laboratories located throughout the school. Developed by the design team in conjunction with the district's education business partner, zSpace, these AR/VR laboratory classrooms provide students with an exciting "next level" tool for comprehension of CSTEM-based subjects. Through the use of zSpace labs, students engage in educational lessons by viewing and manipulating virtual models in three-dimensional space. Objects appear to physically "float" in front of the zSpace computer monitors where groups of up to three students can examine them in detail from all angles and manipulate them using a stylus pen, effectively bringing learning to life.

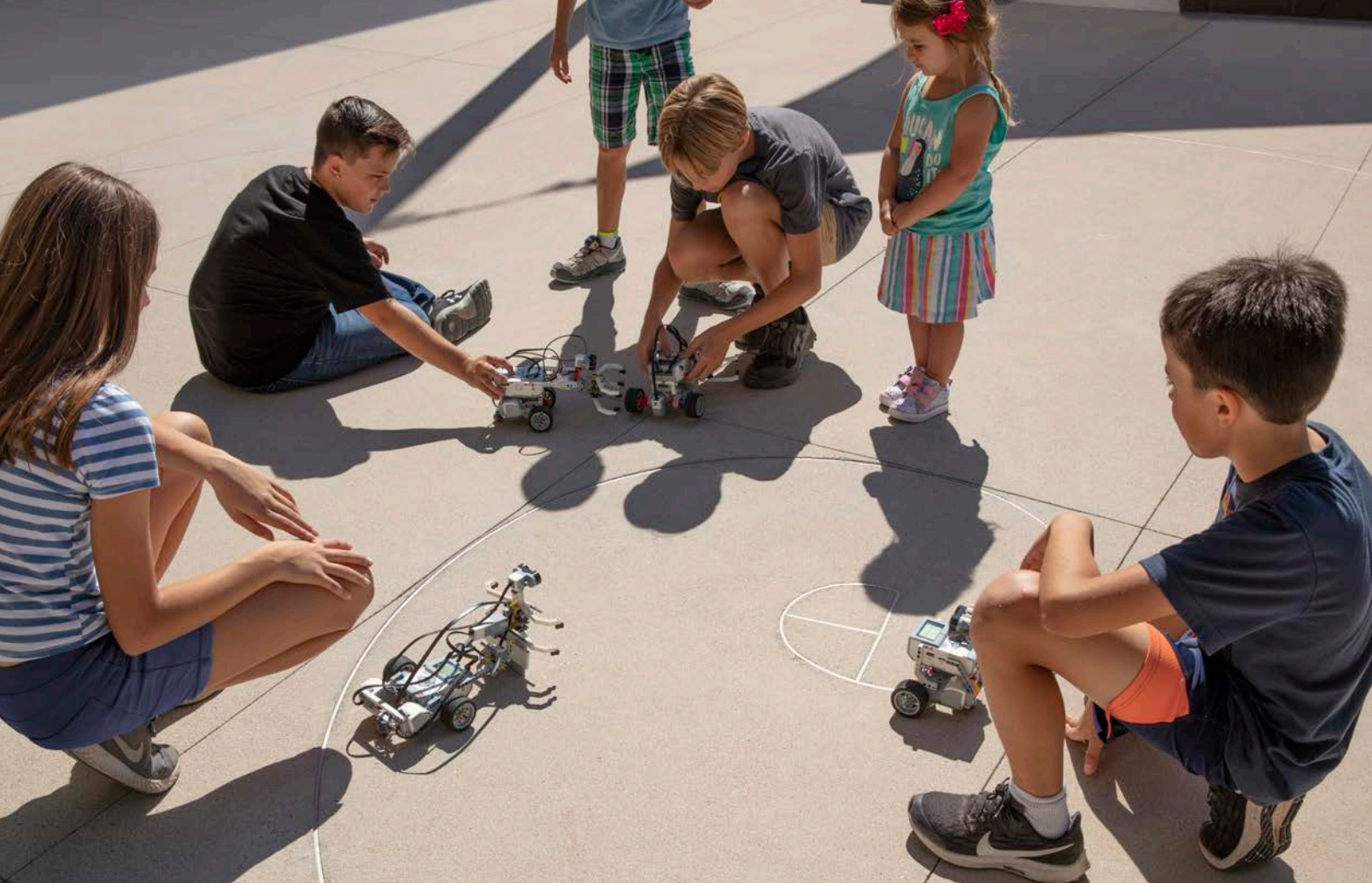
MAKERSPACES: PROJECT CONSTRUCTION

The superintendent's concept of "grandpa's garage," a place full of tools, workbenches, and more where you can put your mind to work. Makerspace workshops are placed at the heart of the school, empowering students to put their work on display. Arrayed along the glass walls of the school's primary circulation pathway, or the "arroyo", these spaces put student ingenuity and discovery on display as they construct their projects. Students are able to explore the physicality of their project ideas and then construct them using an array of power tools and equipment tailored for each grade band (K-2, 3-5, and 6-8.) Casters on student workstations allow for easy movement and reconfiguration to serve the varied curricula as needed. Additional flexibility is provided via ceiling-hung electric cord reels distributed throughout the makerspaces.



"It really fulfilled a lot of dreams of what school and classrooms should be for children. I love seeing the lightbulb go on. I love inspiring the next generation to be greater than the last."

Kristy Hollandsworth, Teacher, Dove Mountain CSTEM PreK-8 School



EDUCATIONAL ENVIRONMENT

THE LEARNING PATHWAY

OUTDOOR LEARNING LABS — PROJECT TESTING

Entering into the final stage, the student's learning pathway now shifts from a pedagogical sequence to a "cycle." Students test their physical project constructs in a variety of conveniently located outdoor learning spaces with direct adjacency and access to both the interior makerspaces and the three classroom wing floor levels. Once initial testing is complete, students may then return to the makerspaces where they can adjust, modify, or reconstruct their projects before returning for additional testing. Students repeat this cycle until the project is complete and conclusions are established.

Given this cyclical process of testing, rebuilding, and retesting — and the resulting back-and-forth movement between the makerspaces and outdoor learning spaces — the necessity for immediate adjacency and quick access between the learning pathway venues was clear. Responding to this need, the design team capitalized on the site's unique sloping topography to provide direct and quick access to each outdoor learning area via walk-out pathways from each of the three classroom wing floor levels.

Once outside, students have a variety of amenities at their disposal, including three grade band-dedicated hardscaped pad areas with charging stations and WiFi and a series of raised student-use planters. Additional amenities include animal habitat space, a nature preserve trail area, outdoor trough-type wash basins, and exterior accessible restrooms.

DEMONSTRATION AND OUTDOOR TEACHING

At the conclusion of the learning pathway, students are ready to present and demonstrate their projects to their teachers and peers in the jewel-like, shaded outdoor amphitheater, which the design team situated as a focal point on display in the center of the campus between adjacent outdoor learning areas. Carved into the natural topography, this fully wheelchair accessible outdoor seating area provides a flexible presentation space for the students, complete with charging stations, WiFi, and presentation lighting for evening use as well as daytime activities. The amphitheater also functions as an additional outdoor classroom venue where earlier ideation-based stages of the learning pathway may be conducted.



INSPIRING STUDENTS

With the planning framework set in the learning pathway, the design team continued to develop the programmatic focus on its key bearings, aligned with the district’s mission and values. Programming and design at this stage included systematic identification of the most crucial and valued ideals elucidated by the community visioning charrettes with classification into the fundamental mission goals. Core programmatic amenities developed at this stage include the following:

- **Learning on Display:** Creating a community CSTEM culture through visual continuity. The makerspaces and science labs are not only at the heart of the CSTEM curriculum, but also at the heart of the school. By locating these learning environments along the school’s primary circulation pathway, also known as the “arroyo,” the CSTEM culture is on full display with ample windows looking into all of these creative spaces. The hardline separations between grade levels are diminished as younger students are encouraged to see what the higher grades are working on, thus inspiring them and creating a sense of anticipation for the years ahead.
- **Creating Pathways:** Inspired by the project work put on display, these curated opportunities seek to open the minds of younger students to the many educational pathways they can use to explore their curiosity as they progress to more advanced grade levels and project work.
- **CSTEM Branding:** The district’s and school’s core ideals are further integrated into the design through translucent jumbo graphics located on the central makerspaces along the arroyo.

“This school is designed for project-based learning. You’ve got an environment where you actually have the space to do it—you can move your tables, you can adjust, you can collapse the wall, as well as the sound absorption—that’s a huge factor.

I have seen some students that you can truly see they’re inspired, they’re proud of their school, their space — they enjoy being here.”

Kelly McGarity, Teacher, Dove Mountain CSTEM PreK-8 School





EDUCATIONAL ENVIRONMENT

FOSTERING INNOVATION

TECHNOLOGY

Provided by the district to support a 21st century CSTEM education, students have access to numerous technologies, including 1:1 Chromebooks with mobile charging caddies and integral charging cabinets for laptop caddie storage, extensive WiFi access for all students, adjustable height touchscreen flat-panel TVs in every classroom, and ample remote charging throughout building and site including outdoor learning and presentation areas.

MULTIPLE AUGMENTED REALITY (AR)

AR computer labs, known by the proprietary title Z-Labs, are provided as part of the learning pathway planning model, allowing students to visualize, develop, and virtually construct their projects in a three-dimensional space.

MAKERSPACES

These spaces were designed with the superintendent's "grandpa's garage" vision in mind. Grouped by grade bands, these spaces provide ample age-appropriate tools and powered equipment to construct their projects based on their vision. Each makerspace provides direct access to learning spaces for outdoor projects including horticulture, as well as testing, experimentation, and demonstration.

FLEXIBILITY IN LEARNING AND INSTRUCTION

Every wing includes classrooms, collaborative flex-corridors, makerspaces, and outdoor learning areas to provide maximum flexibility. Workstations and student furniture have castors for easy room reconfiguration. Additionally, makerspaces feature drop-down power cord reels for easy and safe power access in any room layout. Classroom corridor walls are constructed with 20-foot operable glass partitions, allowing classrooms to grow and expand into the flex-corridors. These flex-corridors include operable rotating marker and tack board walls that foster cross-corridor interaction and coordination.

ENGAGING MINDS

DIDACTIC ARCHITECTURE

Students are immersed in an environment where the architecture itself is used as a learning tool through a profound real-world expression of CSTEM culture. Each major building system is visibly expressed and celebrated through bright coloring that is keyed to system elements. Structural framework is expressed in green, mechanical systems are orange, and electrical systems are red. Electrical rooms and IT flashing server racks spaces are in full view with artful glazing, located along key student collaboration areas to provoke curiosity. Students can see color coded data cabling leaving the server rooms and then reappearing in exposed corridor ceilings.





EDUCATIONAL ENVIRONMENT

ENGAGING MINDS

AMPLE NATURAL DAYLIGHT

Studies have shown that exposure to natural sunlight is an effective way to improve student health, wellness, concentration, and academic performance. As such, the design incorporates abundant natural lighting via insulated solatubes and low-E glazing throughout all learning spaces. To provide equity, every classroom is the same size, features the same number and size of windows, and shares the same amenities.

VISIBLE CONTINUITY

The easy connection between the interior and exterior spaces create continuity. By putting the CSTEM process on display through research and development projects, the indoor and outdoor space connect students to the larger CSTEM community.

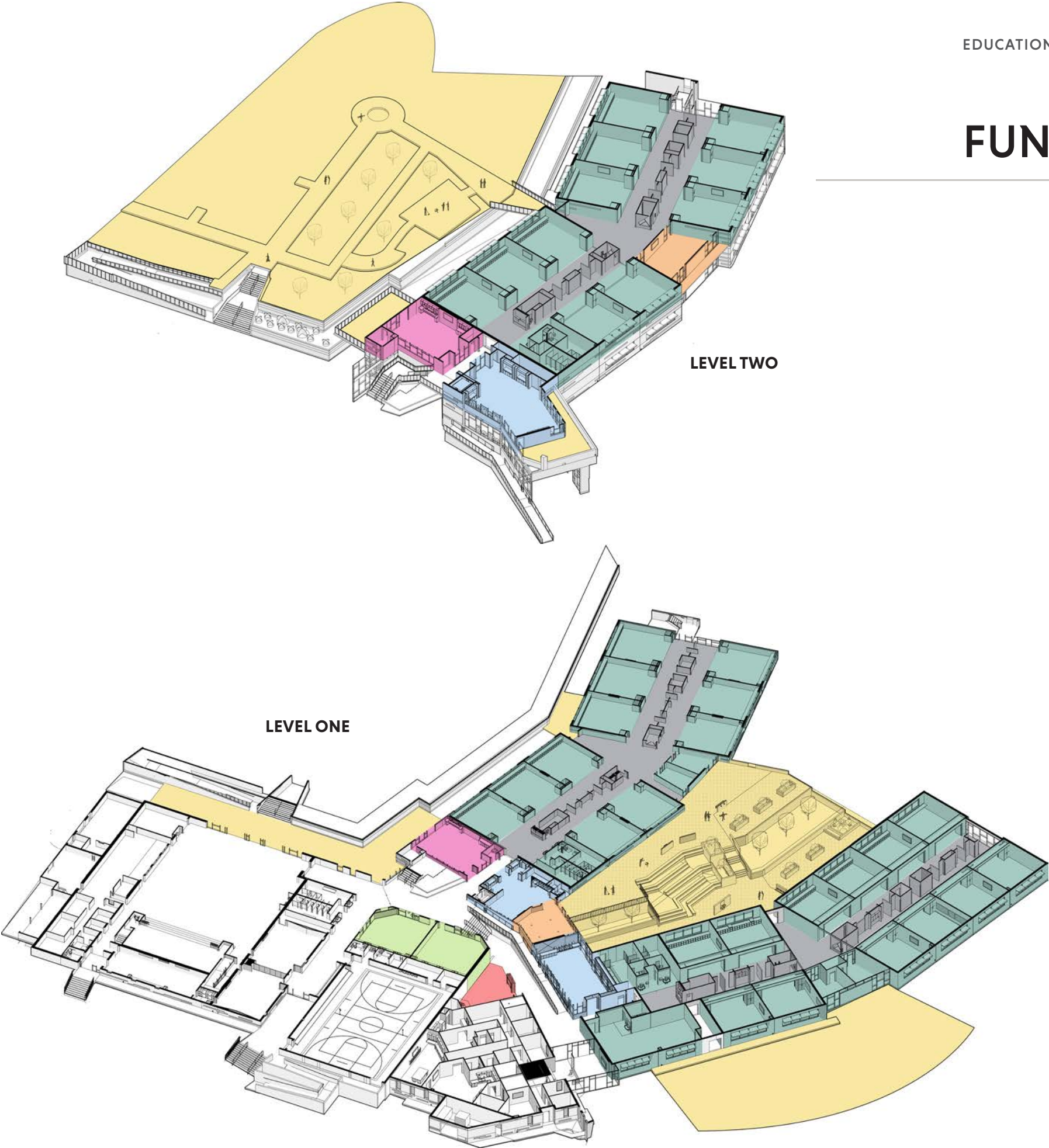
BUILDING AUTOMATION SYSTEMS (BAS)

Normally visible only to facility maintenance personnel, BAS may be observed on a graphic dashboard. Through this system, students can study the school's energy usage and production via the site's photovoltaic arrays. The BAS "dashboard" is accessible for viewing on any interactive flat panel throughout the classrooms.

The building itself is a learning tool. Structural and MEP elements are color-coded and on-display in transparent technology hubs to teach the students how the building is constructed and how the systems work together to create their learning environment. Vibrant color, texture, and daylight energize the learning environment and enrich the daily life of faculty and students.

FUNCTIONAL ADJACENCIES

- SCIENCE LABS
- SCIENCE CLASSROOMS
- ZSPACE AR/VR LABS
- OUTDOOR LEARNING AREA
- MAKERSPACE
- MEDIA ROOM
- CLASSROOM
- FLEXIBLE LEARNING CORRIDORS



PHYSICAL ENVIRONMENT



INDOOR | OUTDOOR

Site and Context: The rugged beauty and rich complexity of the Sonoran Desert surrounding the 20-acre school site northwest of Tucson, Arizona, both informed and inspired the fundamental aesthetics and circulation layout. Before “putting pencil to paper,” the design team studied the harsh beauty of this surrounding desert environment with reverence for its stark contrasting shadows and textures of rock strata found in the nearby Tortolita and Catalina Mountain ranges, its varied sloping topography and natural dry arroyo watersheds, and the rich array of colors, textures, and structures found in the site’s indigenous desert flora, such as the Saguaro cacti and palo verde trees. Myriad images documenting these qualitative aspects of the site were amassed and incorporated into the many design charrettes where the architectural team worked with project stakeholders, community members, and students to understand and discern what qualities of this natural environment would best synergize with the district’s goals to inspire learning, foster creativity, and engage minds.

Aesthetic Responses: Exterior CMU walls come alive with the visually kinetic interplay of light and form experienced through sometimes subtle and sometimes pronounced manipulations in texture, color, and masonry block position, creating an organically flowing series of masses reminiscent of the nearby mountains. Masonry colors are subtle and blend with those of the nearby mountains while utilizing the effects of distance perception by employing darker field color tones in classroom wings closer to the main entry and lighter tones for the wings further away.

Natural structures found in local flora, such as the Saguaro cacti and Palo Verde trees, inspired the building’s inner steel structural framework as part of the school’s didactic approach to architectural system expression.

Circulation and Layout: The experience of discovery while walking in a winding, dry arroyo in the desert adjacent to the site gave formal inspiration to the school’s circulation pathway layouts. Students are drawn into flexible learning corridors out of curiosity about what will be discovered around the next bend. The primary pathway, dubbed the “arroyo,” hearkens to the feel of a “technological” canyon winding up a desert mountain valley as students gradually ascend from the main entry arrival level through the arroyo ramp and stairs to the upper outdoor learning plateau at the north end of the school.

CPTED Principles: All outdoor learning areas are positioned for maximum “natural surveillance,” which is a core component of the Crime Prevention Through Environmental Design (CPTED) philosophy. CPTED credentialed design team staff helped to orchestrate the design of these spaces for both enhanced safety and to further build on the concept of providing inspiration to students by putting learning on display.



District and Community: The new state-of-the-art school resides within the nearly 100-year-old Marana USD, located in Marana, Arizona approximately 15 miles northeast of Tucson, Arizona. Founded in the early 1920s, MUSD’s boundaries include 550 square miles of land, 18 schools and 1,600 employees serving over 12,200 students. Dove Mountain is both the first of its kind to be built within the district and the first ground-up CSTEM school to be constructed in Arizona.

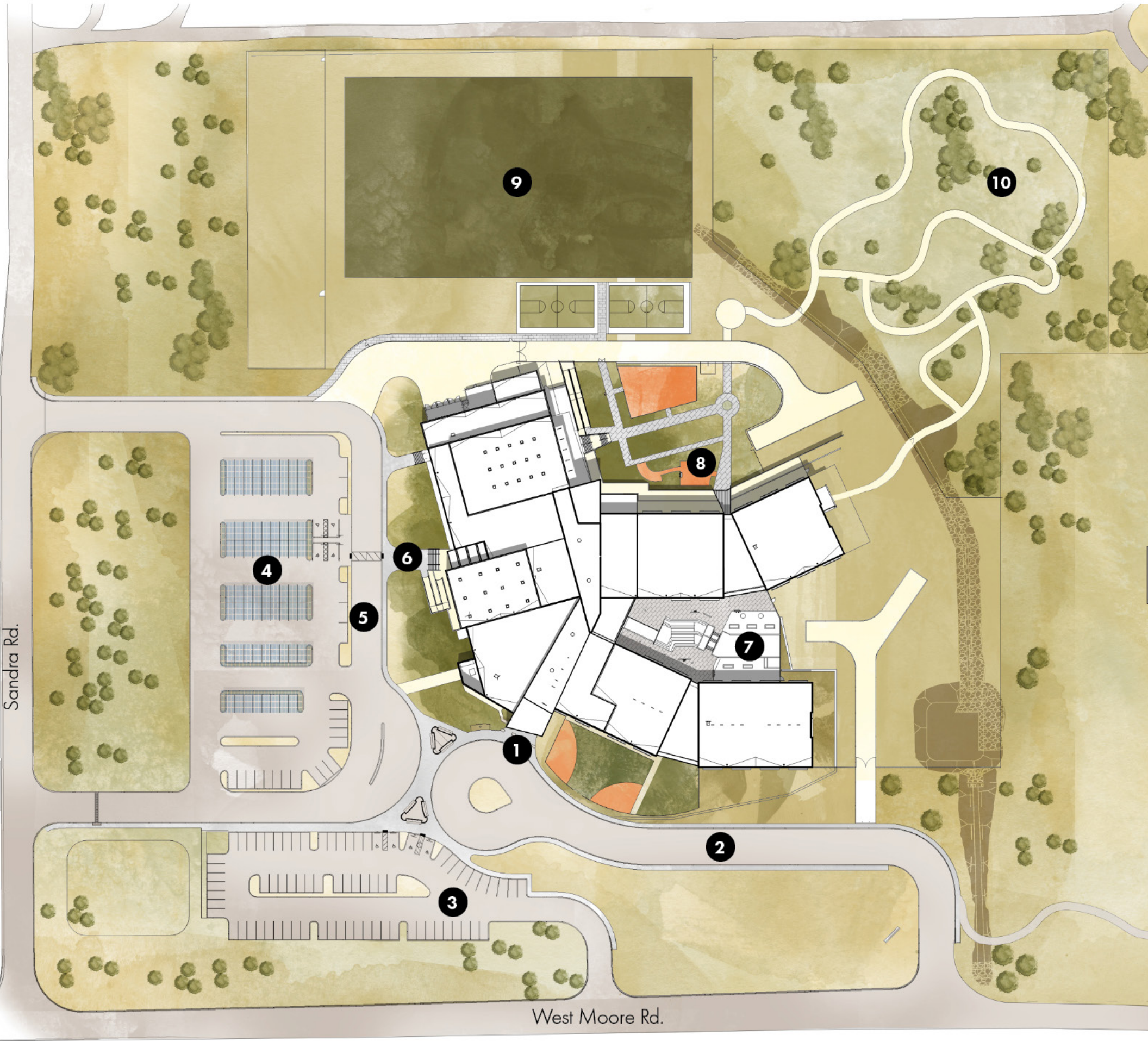
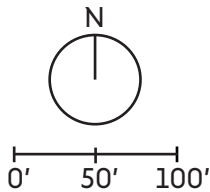
The community is taking notice as this new school raises the bar and sets higher standards for educational facilities throughout the region. As integral collaborators throughout the programming and design process, community members – consisting of parents, faculty, students, and neighbors – provided key input informing the physical space planning development as well as the school’s many curriculum and outreach programs that contribute to the adjacent neighborhoods and broader school district. Community-requested, curriculum-based programs currently offered include a full-day free kindergarten, preschool, gifted education, special education, a full-time master level school counselor, health services, music classes, physical education, a media room, and athletics. A few examples of community outreach programs include the Jaguar Community Action Team (JCAT) whose mission is to create a close relationship between home, school, and community by providing an opportunity for all parents/guardians to become involved in the school, the LEAP before-and-after school care program, Marana Winds musical group, Watch D.O.G.S. family and community engagement program, the No Student Goes Hungry and Summer Food Programs, and more.

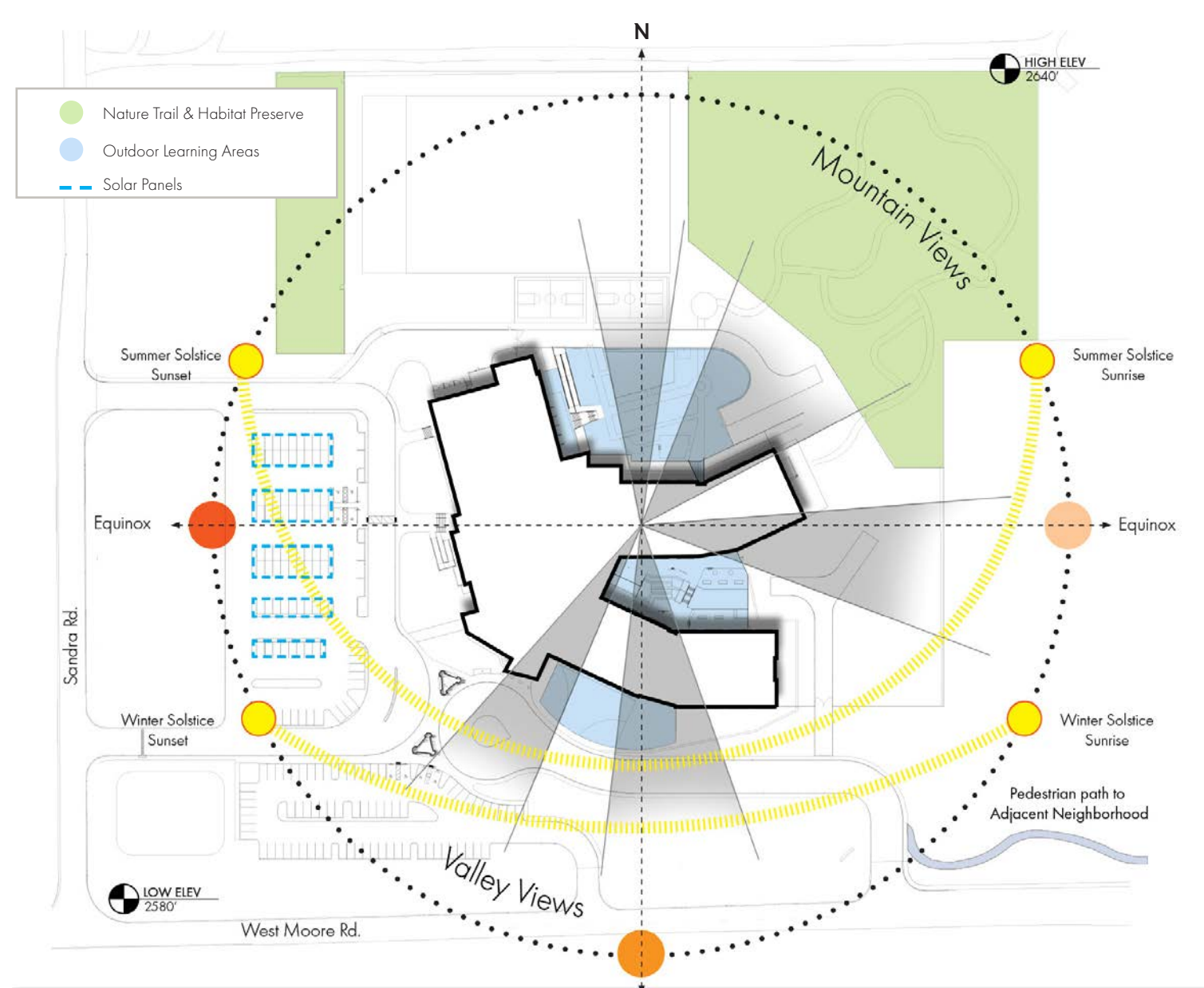
SITE & LANDSCAPE



SITE PLAN

- 1 Main Entry
- 2 Parent Drop-off Loop
- 3 Visitor Parking
- 4 Staff Parking
- 5 Bus Drop-off Loop
- 6 Community Entry
- 7 K-5 Outdoor Learning Lab & Amphitheater
- 8 6-8 Outdoor Learning Lab
- 9 Athletic Field
- 10 Nature Trail & Habitat Preserve





PHYSICAL ENVIRONMENT

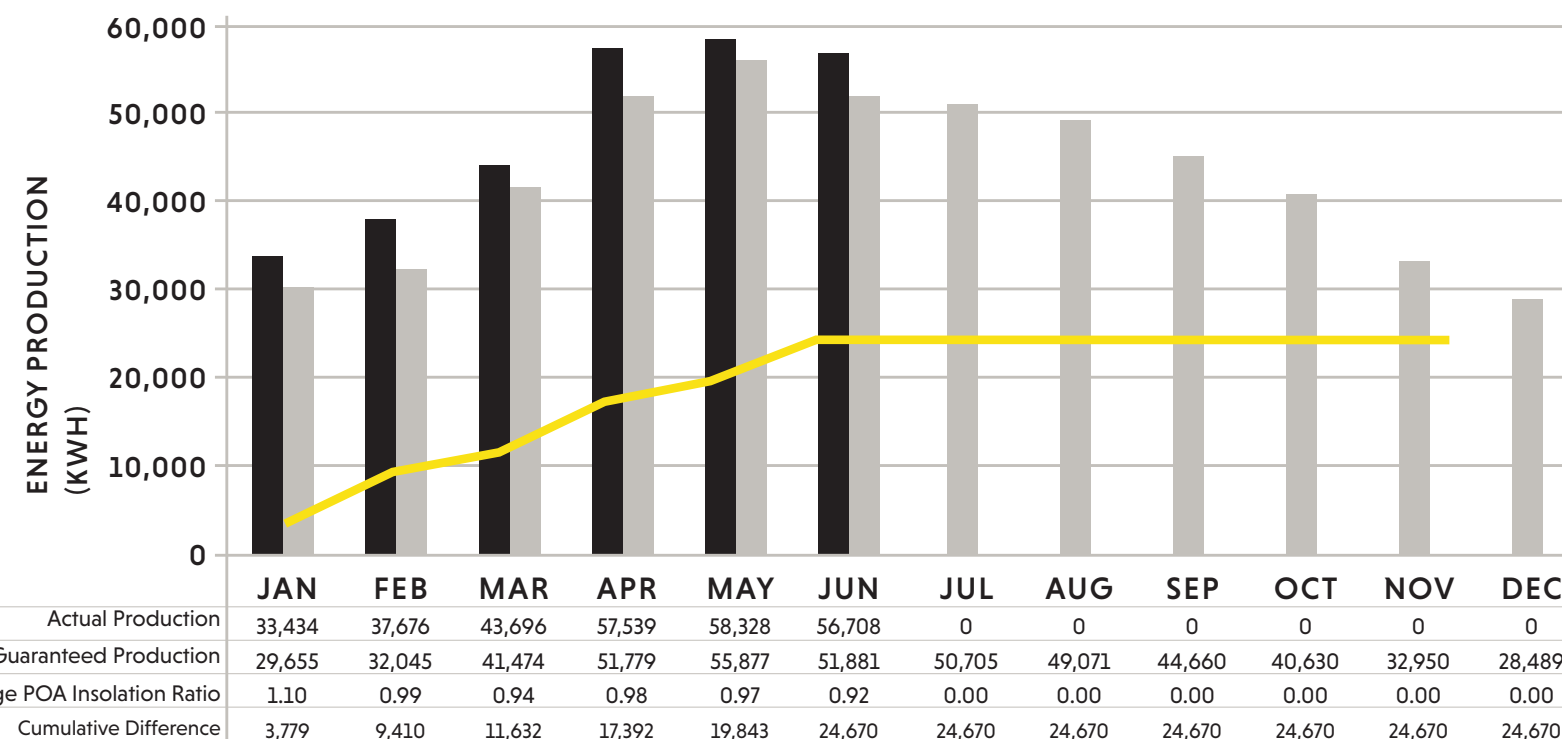
SITE ANALYSIS

SUSTAINABILITY AND ENVIRONMENTAL RESPONSE

Solar arrays consist of a 297 kW-DC system spread over five shaded parking areas, each with their own inverter. The arrays include 792 solar panels, each capable of generating 380 watts at full capacity. The expected kWh output of this system was 519,748 kWh in the first year of operation, and actual production is running approximately 2% higher than planned. This array was sized to provide approximately 90% of the required power for the site based on TRICO Electric's net metering requirements.

Appropriate siting and orientation maximize the south and north elevations for optimal daylight harvesting and minimal east/west fenestration. Combined with a high efficiency building envelope, this alleviates harsh sun conditions and provides an effective passive response to the Sonoran Desert climate. All classrooms utilize ample natural daylighting in conjunction with photometric sensors to adjust/dim the already low-energy use LED light fixtures. Sola-tubes with Fresnel lenses and adjustable dampers are incorporated throughout the arroyo, gymnasium, and cafetorium to provide additional daylight harvesting and further offset the sites power consumption. Occupancy sensors tied to the HVAC system are employed throughout the school to manage air conditioning utilization, reducing energy consumption in unoccupied spaces. Also, the school adheres to the American Institute of Architects' 2030 Challenge goals of designing carbon-neutral buildings by 2030.

Additional site sustainability responses include extensive efforts to maintain, preserve, and/or relocate existing desert vegetation. All existing saguaro cacti were either left in place or preserved in a temporary nursery during construction for later relocation on and off-site. Approximately 30% of the project site was left untouched as a natural preserve. Student projects will work to develop a system of trails and indigenous plant labeling/signage through this area. Finally, the project siting and outdoor spaces are orchestrated in a manner that celebrate views of the surrounding mountain ranges, further enhancing the environmental experience of students and teachers within the learning environment.

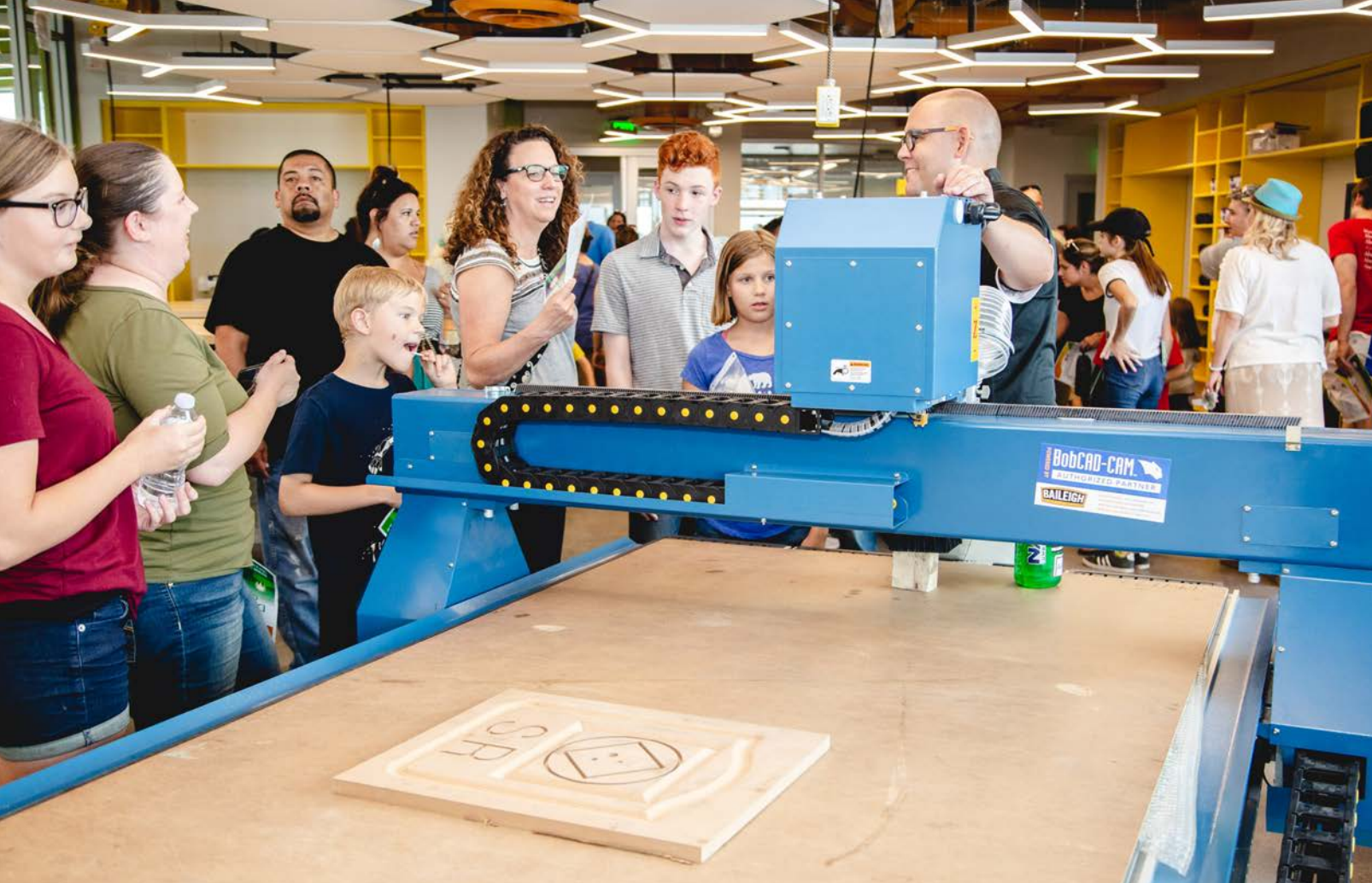


	Actual Production	33,434	37,676	43,696	57,539	58,328	56,708	0	0	0	0	0	0
	Insolation Adjusted Guaranteed Production	29,655	32,045	41,474	51,779	55,877	51,881	50,705	49,071	44,660	40,630	32,950	28,489
	Average POA Insolation Ratio	1.10	0.99	0.94	0.98	0.97	0.92	0.00	0.00	0.00	0.00	0.00	0.00
	Cumulative Difference	3,779	9,410	11,632	17,392	19,843	24,670	24,670	24,670	24,670	24,670	24,670	24,670



RESULTS OF THE PROCESS AND PROJECT





RESULTS OF THE PROCESS & PROJECT

RESULTS OF PROJECT

EXCEEDING EXPECTATIONS

The Dove Mountain CSTEM PreK-8 School has been a huge success for the Marana Unified School District, not only attracting new students to the growing district, but also attracting students that had left for charter schools and adjacent Tucson school districts. During the design process the square footage of the building was reduced to meet the anticipated opening enrollment of 850 students. When the community open house occurred in late July 2019, the expected community participation of about 500 people turned out to be 2,000 people to everyone's surprise. The community of Marana, Arizona, which had participated in the programming and design process for this new school, was so proud and supportive of the new learning facility that there was an immediate wait list of 150 students.

The surprise was that although the school was planned to grow and expand to anticipate new enrollment in the future, this expansion had to begin immediately to meet the demand. The existing two classroom wings are being expanded to accommodate six new classrooms that will be ready for the 2020 fall semester. The design process also planned for a third classroom wing to be added to the north and the Marana Unified School District will go out for a bond this year to do just that. The response from the diverse community of Marana has been overwhelming.

The new Dove Mountain CSTEM PreK-8 School also validated that an elementary school curriculum focused on discovery and hand's-on learning was what the community and business leaders deemed important for a successful future for all residents. This school is a first in the state of Arizona and this commitment to innovative learning has allowed Marana to rebrand their progressive school district as one of the best in Arizona.

The images to the left attest to the open house excitement and to the quality of the makerspaces that support this unique curriculum.

"We hit a homerun here, and the community, I think, has really embraced that. We wouldn't have 850 kids enrolled here if we didn't have that kind of acceptance from our community, and I think it will just grow from there."

Dr. Doug Wilson, Superintendent, Marana USD

EDUCATIONAL SPECIFICATIONS & VISIONING DOCUMENTS

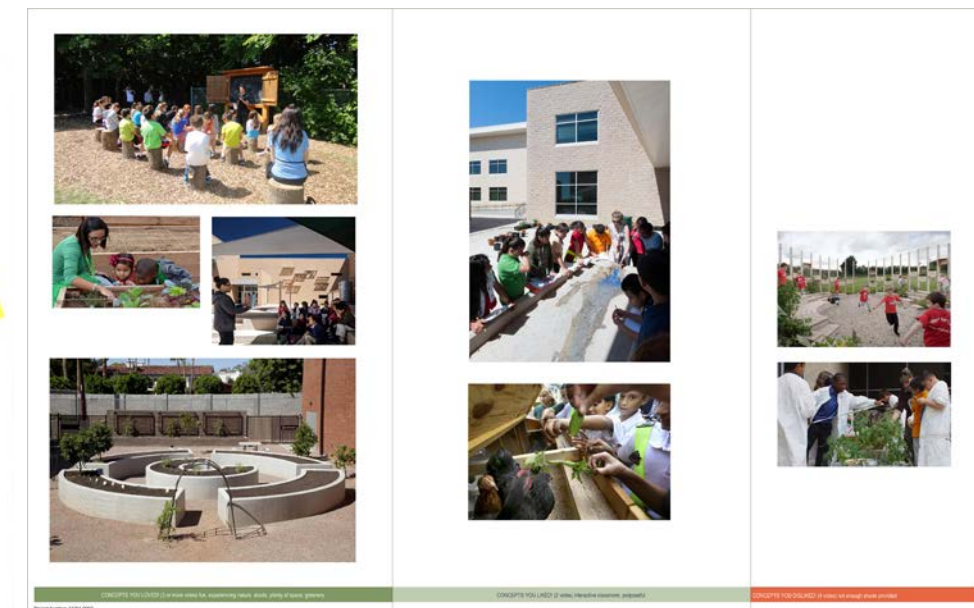
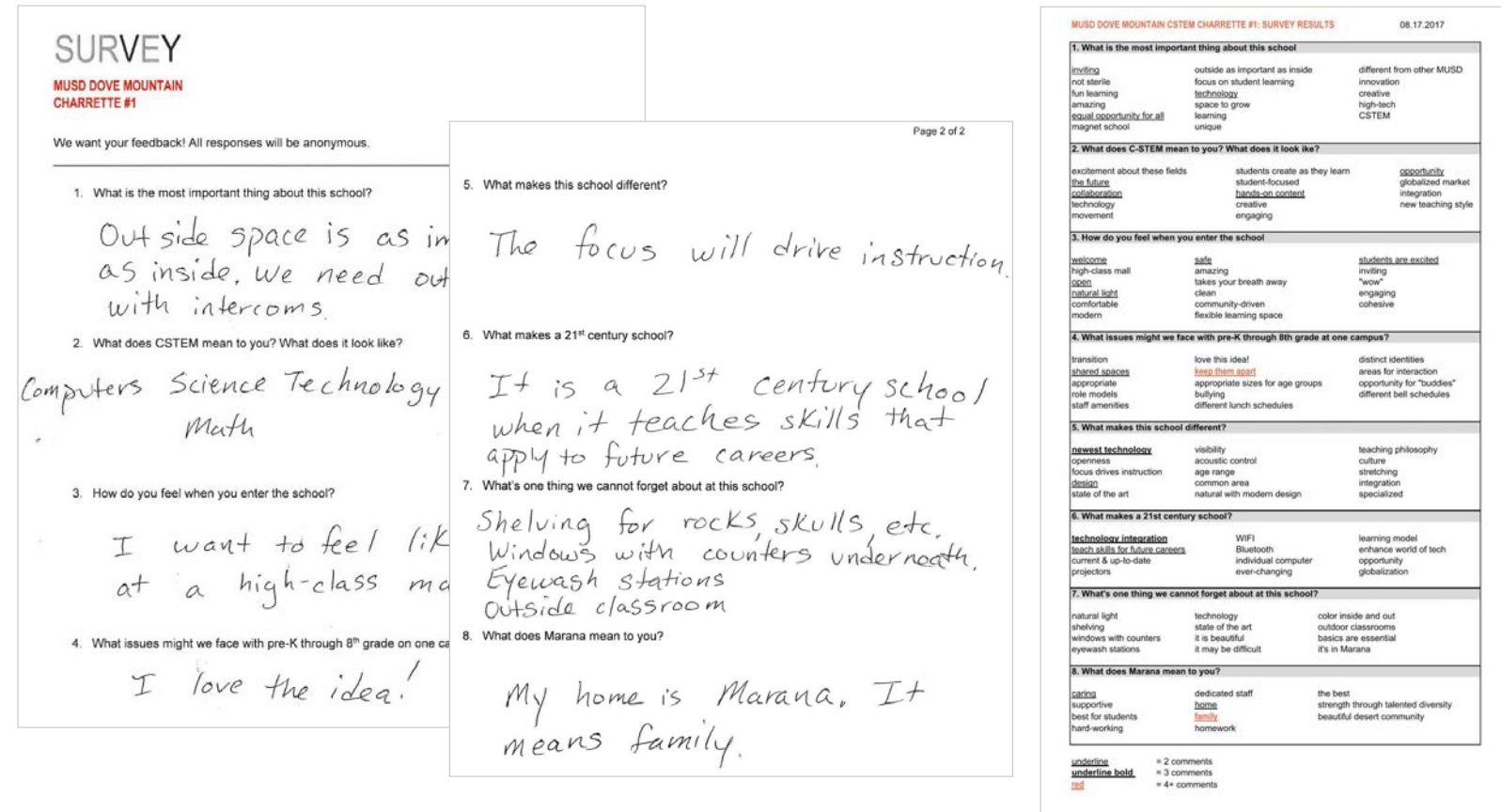


EDUCATIONAL DESIGN VISIONING TECHNIQUES

CASTING A VISION

Numerous visioning sessions held early in the programming process elicited the core values, programmatic needs, desires, and project goals from the community and stakeholders. Examples of visioning sessions included the following:

- **Community Charrettes:** The school's community (students, parents, teachers, administrators, and local neighborhood residents) attended multiple group visioning sessions. Attendees were presented with inspirational image boards for voting and commentary via color coded post-in notes expressing likes and dislikes. Additionally, a physical topographical site model with programmatic "puzzle" pieces was utilized as a tool at these sessions. This empowered community members and helped create a genuine sense of buy-in by allowing them to express their design ideas by laying out their own ideas of what the school should look like. Results were quantitatively summarized and presented at a secondary follow-up session for review by stakeholders.
- **Community Surveys:** Written questionnaires were sent out to future Dove Mountain faculty, students, and key stakeholders. The resulting responses were studied with commonalities quantitatively documented and compiled.
- **Site Tours:** In state and out-of-state site tours of some of the country's highest performing STEM schools were conducted with key stakeholders.
- **Faculty Charrettes:** Charrettes with district teachers were conducted as the initial planning concept options began to emerge with commentary and feedback recorded in detail and presented to key project stakeholders for final consideration in the project program.
- **Neighborhood Association Presentations:** Q&A sessions and project development presentations were conducted including both a group presentation and one-on-one conversations at the project booth. Attendees at this session had the opportunity to view smart phone-based virtual reality walkthroughs of early design concepts and provide feedback to the team.
- **Weekly Stakeholder Design Check-ins:** As the program solidified, a series of recurring check-in charrettes were conducted with key stakeholders to continually validate the project design's alignment with the established programmatic course based on the district leaderships vision. Check-ins included frequent plan review and occasional use of full room virtual reality.



EDUCATIONAL BRIEF

CORE PEDAGOGICAL CONCEPTS

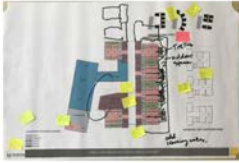
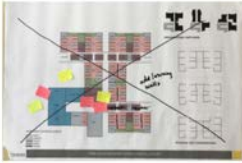
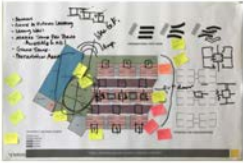
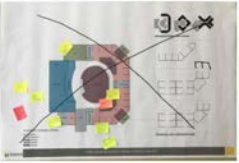
The "learning pathway" is the programmatic concept that emerged from the community visioning sessions as the key planning delineation of the fundamental CSTEM process embodied in the school's design. This concept calls for key spaces that serve the project-based learning progression of a CSTEM curriculum. These spaces include the following:

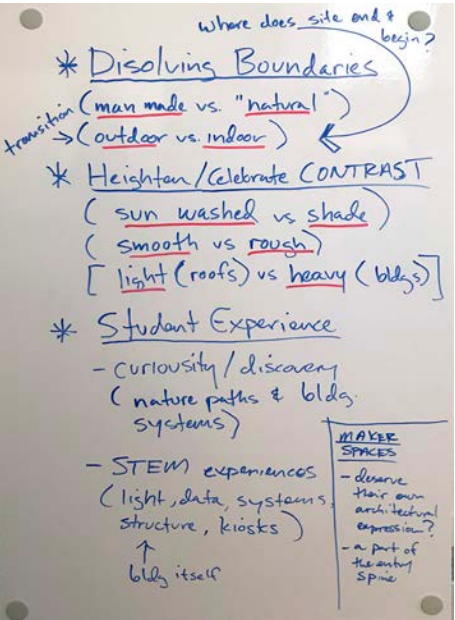
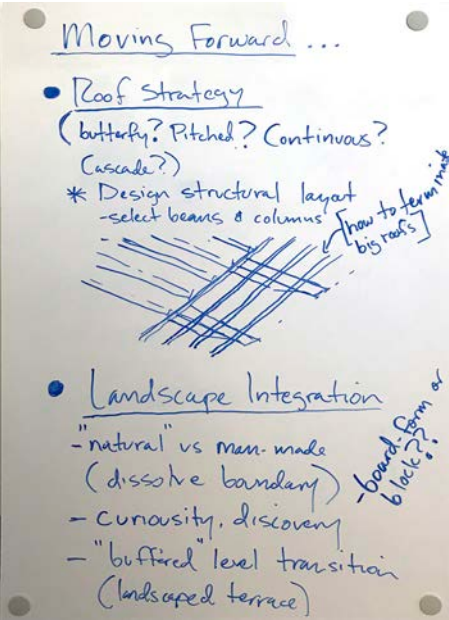
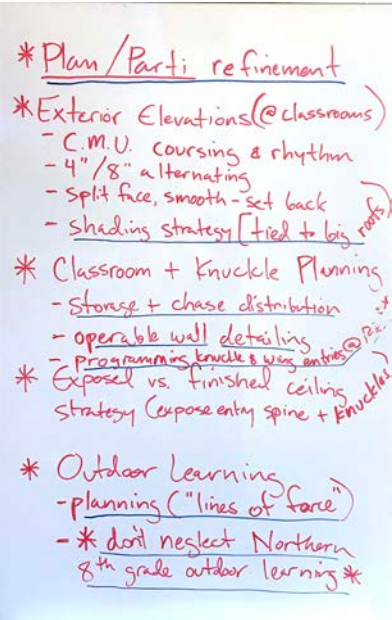
- **Project Ideation Begins in the Classroom:** Classrooms are designed as flexible spaces with operable glass partitions along corridor walls, enabling the classroom to expand into a "flexible learning corridor." All furniture is designed for easy mobility and reconfiguration.
- **Collaboration:** Students utilize the flexible learning corridors for group project collaboration and ideation. Learning corridors include operable markerboard wall panels, which provide inter-classroom access across the flex-corridor. Movable furniture, pin-up space, and storage areas are also provided in these flexible corridors.
- **Visualization:** Student groups of three collaborate utilizing augmented reality computer labs (Z-Labs) to finalize project conceptualization.
- **Construction:** Five makerspace/wet lab spaces are provided to students for the construction stages of their project development.
- **Testing, Demonstration and Presentation:** Students utilize outdoor learning labs for this final stage in the testing and overall success of their projects.

CORE DISTRICT GUIDING PRINCIPLES

With the planning framework set in the learning pathway, the design team continued to develop the programmatic focus on the key concepts in the district's core guiding principles. Programming and design at this stage included systematic identification of the most crucial and valued ideals and requests elucidated by the community visioning charrettes and alignment of these ideals with the learning pathway and the District's fundamental guiding principles which included the following:

- **Inspiring Students to Learn:** Key concepts to meet this requirement included the implementation of a variety of architectural devices that both inform and inspire (e.g. didactic architecture), breaking down the hardline separations between grade levels by employing concepts of visual continuity between younger and older grade levels, inspirational graphic messaging, and putting the construction and testing stages of the learning pathway on display throughout the campus as students traverse the schools key circulation pathways (e.g. the arroyo).
- **Fostering Innovation:** Makerspaces with ample power tools and constructive supplies, flexibility in all aspects of the design (including architecture, electrical receptables, and furnishings), ample outdoor learning amenities, and cutting-edge technological provisions, such as the augmented/virtual reality labs, a 1:1 student Chromebook use, touch-screen flat panel displays at all classrooms, and extensive WiFi access, form the backbone of support for this guiding principle.
- **Engaging Student Minds:** Encouraging curiosity through the colorful expression of architectural buildings systems (structure, mechanical, electrical, etc.), use of ample natural daylighting, providing visual continuity between primary pathways and creative spaces (learning on display), and giving students the opportunity to understand the building's inner workings through visual dashboard display of the automation system are a few of the key concepts incorporated from the visioning sessions to serve this guiding principle.

DOVE MOUNTAIN CSTEM - CHARRETTE 2 - ADJACENCY DIAGRAM RESULTS			
AGAVE CONCEPT	CACTUS CONCEPT	ARROYO CONCEPT	VORTEX CONCEPT
Good	Good	Good	Good
<ul style="list-style-type: none">- outdoor vertical space for more open land- leap accessible- balance of outdoor and media space- labs close to the classrooms- outdoor space close to classrooms- curved parti	<ul style="list-style-type: none">- lots of extra classroom (lab, maker) space- plenty of outdoor space- multiple maker spaces	<ul style="list-style-type: none">- large natural outdoor learning space- grade level pods- compact pods- creates a great community- separation of grade level bathrooms	<ul style="list-style-type: none">- the two story school is a positive- large, centralized media center- close proximity to all spaces- no direct visibility from classroom to classroom- outdoor patio space
Bad	Bad	Bad	Bad
<ul style="list-style-type: none">- wasted space in the middle pod configuration	<ul style="list-style-type: none">- disconnection between maker spaces and the media center- media center should be considered as a large assembly space- consider space for the stage in the cafetorium	<ul style="list-style-type: none">- two media centers will be tough to staff- no mixing of the grade levels- no special education classrooms	<ul style="list-style-type: none">- n/a
			



SETTING THE DISTRICT APART AS A LEADER IN CSTEM EDUCATION

Through open enrollment, the increased competition from successful charter, online, private, and other public schools caused the district to assess new ways to improve their story as a great school district. With this necessity firmly in mind, one of the driving goals of the design was to exemplify the district's mission, story, and aspirations through the architecture and design of the school. Key aspects of the design that supported the district's brand message included the following:

- **Curb Appeal:** The pronounced school entry with celebrated astronomical themes incorporated into shade canopies and play areas draw attention from the public and most importantly, the students themselves. These features spark curiosity, which encourages potential parents and students to learn more about the school.
- **The "Arroyo":** Once inside, project-based learning is constantly on display to both students and visitors via the glazed arroyo.
- **Messaging:** Messaging incorporated into the glazed arroyo walls via translucent super graphics reinforces the district's goals within the CSTEM context.

The secure but welcoming design includes a celebrated entryway and reception space but still maintains the capacity to quickly lock-down these areas and other key zones from multiple physical points throughout the school, by remote phone/tablet access.