You can have STEM too!

Case studies in STEM Upgrades to Existing Schools

ASSOCIATION FOR LEARNING ENVIRONMENTS

Enhancing the Educational Experience

April 1, 2019 2:15 pm

2019 North Carolina Conference

Session Leaders

MCKISSICK ARCHITECTURE

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MCKISSICK ARCHITECTURE

In an ever-changing, increasingly complex world, it's more important than ever that our nation's youth are prepared to bring knowledge and skills to solve problems, make sense of information, and know how to gather and evaluate evidence to make decisions.

These are the kinds of skills that students develop in science, technology, engineering and math—disciplines collectively known as STEM.

~ *United States Department of Education*
Office of Innovation & Improvement

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Enhancing the Educational Experience

MCKISSICK ARCHITECTURE

Science

Atmospheric Scientist; Biochemist; Chemist; Conservation Scientist; Geneticist; Hydrologist; Life Scientist; Microbiologist; Physicist

Technology

Business Intelligence Developer; Cyber Security Analyst; Computer Game Designer; Network Administrator; User Interface Developer

Engineering

Aerospace Engineer; Architectural Engineer; Chemical Engineer; Electrical Engineer; Industrial Engineer; Nanosystems Engineers; Robotics Engineer

Mathematics

Biostatistician; Cartographer; Economist; Mathematician; Statistician; Survey Researcher; Transportation Planner

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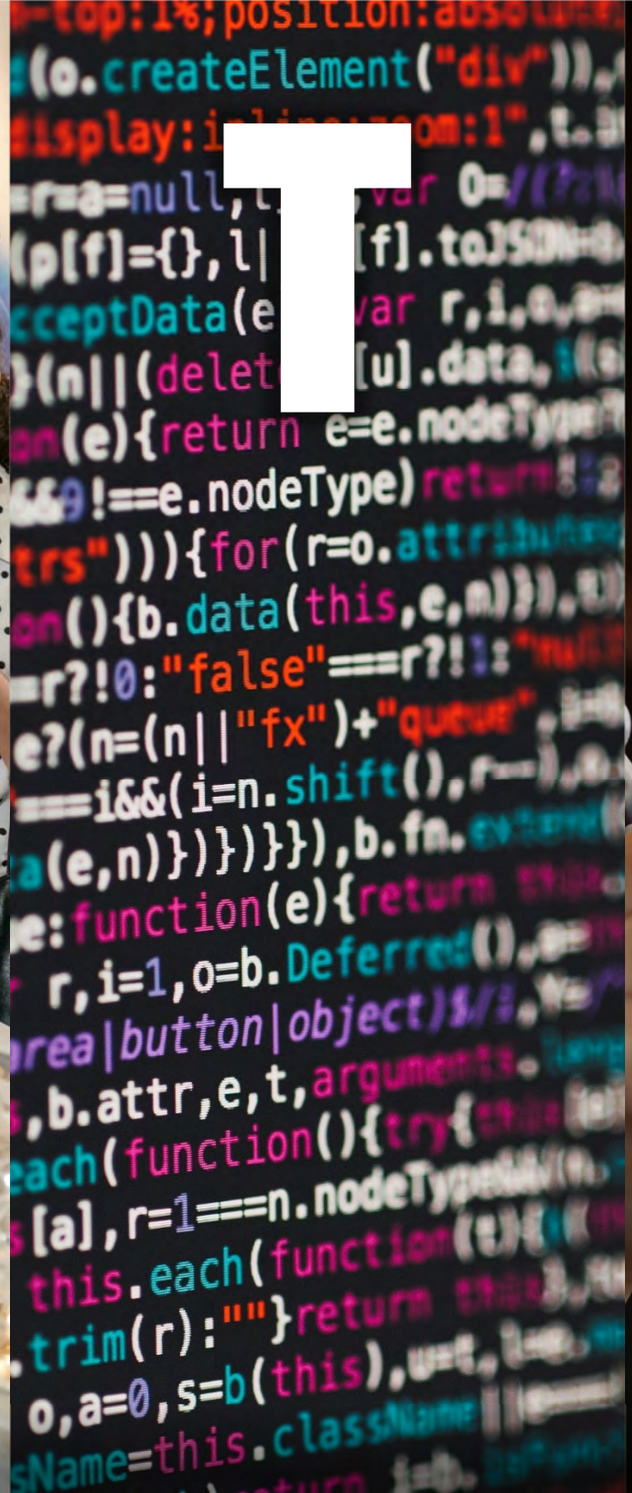

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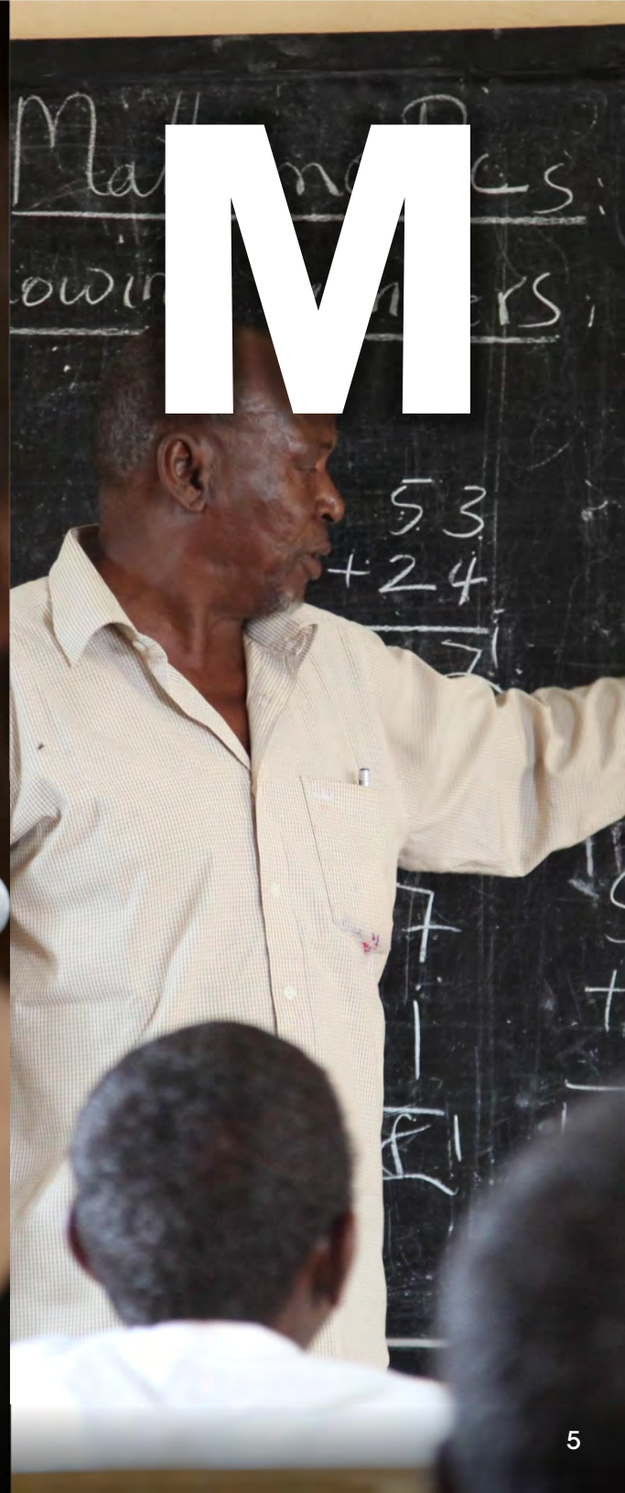

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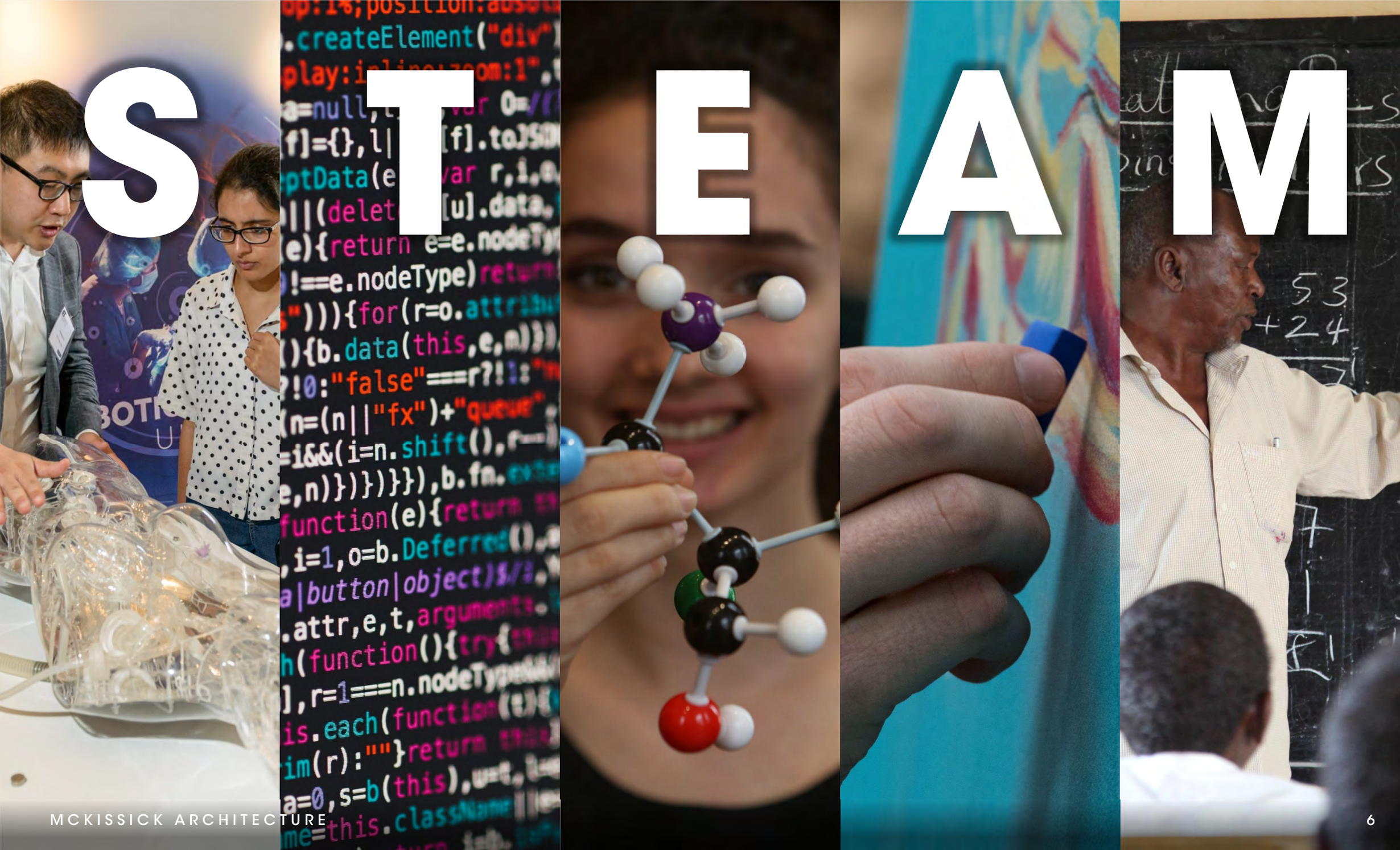
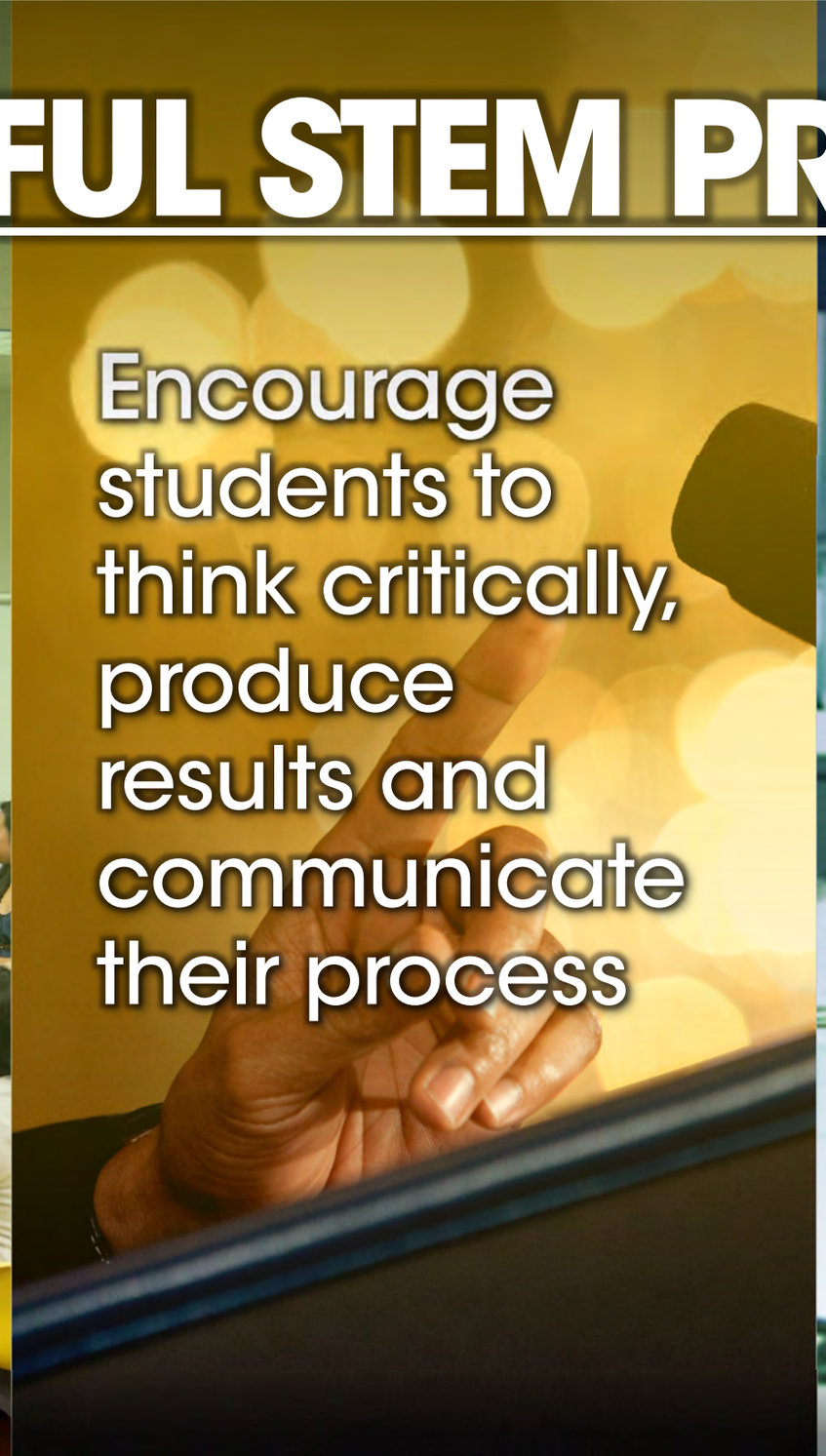

STEAM

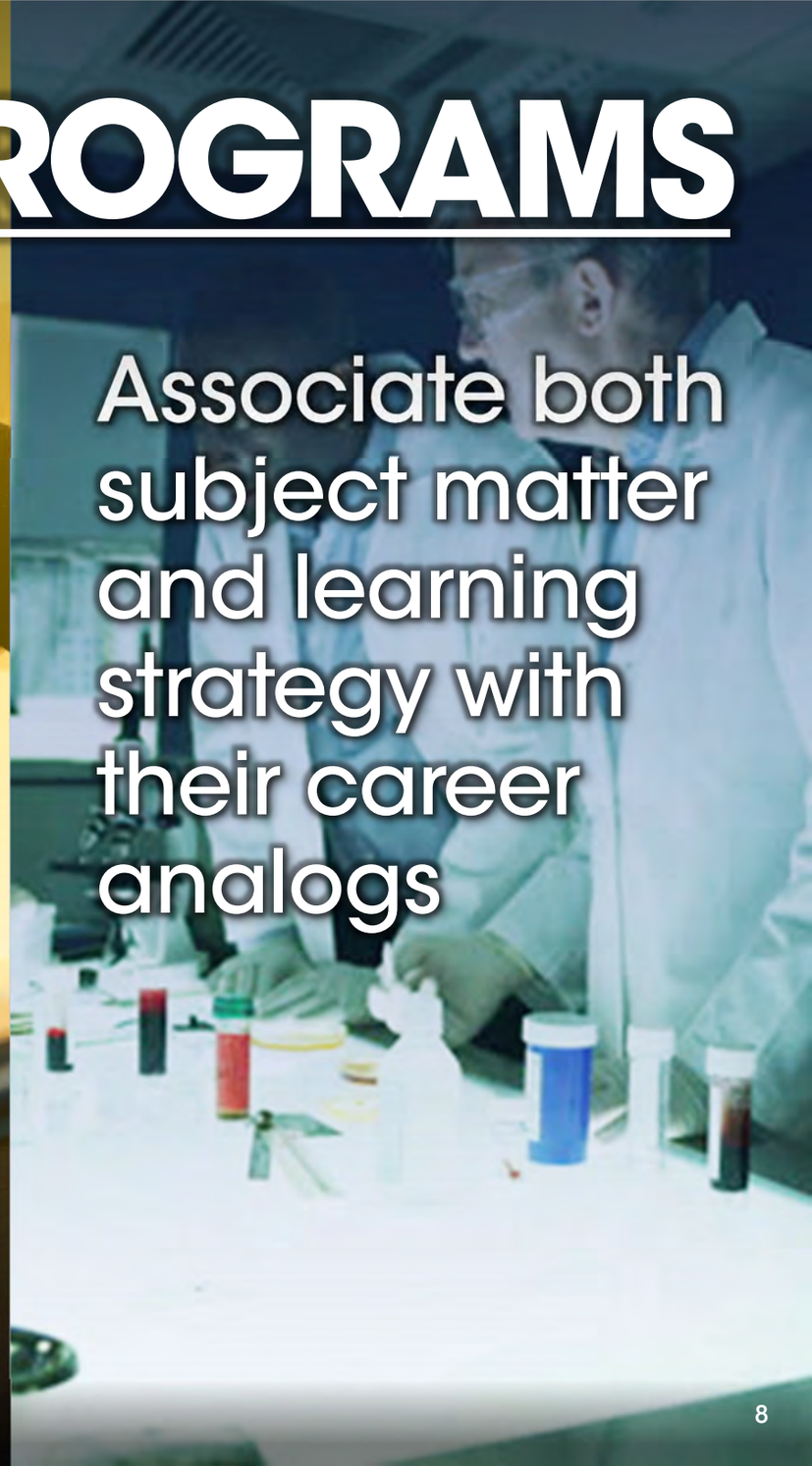

STREAM

SUCCESSFUL STEM PROGRAMS

Employ multiple teaching strategies – guided & independent – active & passive



Encourage students to think critically, produce results and communicate their process



Associate both subject matter and learning strategy with their career analogs

What core elements facilitate STEM program implementation?

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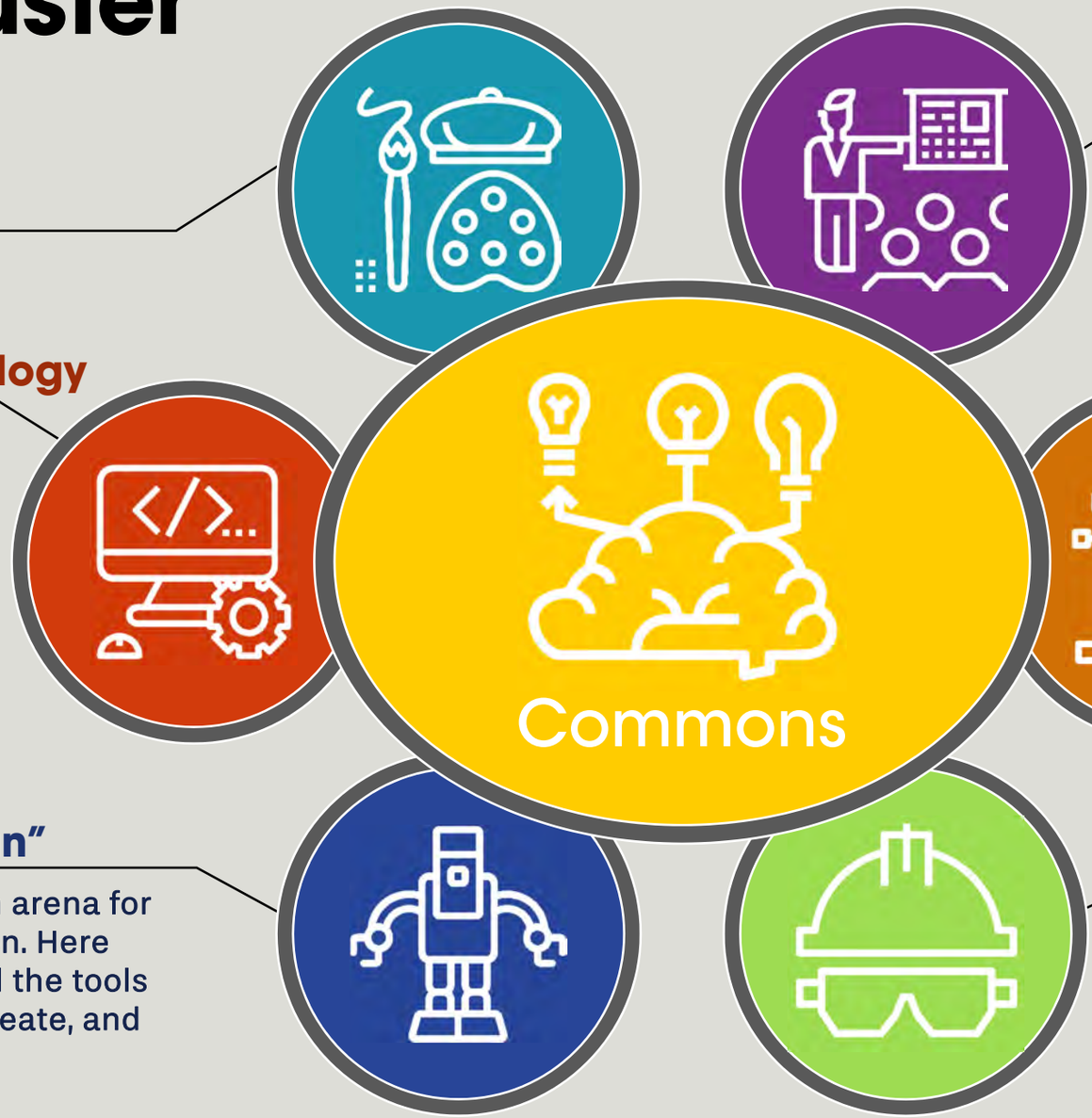
Core Learning Activity Formats

- Instruction & demonstration for large class & multi-class groups
- Instruction & demonstration for small groups or individuals
- Independent learning with monitoring & supervision
- Student project collaboration & group team development
- Student presentation & rhetoric in varied formats such as discussion panels or debates
- Display of student work for ongoing critique and inspiration
- One-to-one device use
- Research, concentrated study & testing

Core Learning Activity Formats

- Specialized instructional space appropriate to programs
- Specialized laboratory & workshop space appropriate for interactive projects
- Flexible space for small or medium-sized group assemblies
- Community/collaborative workspaces
  (with passive supervision and monitoring)
  - *For individual and small group project teams*
  - *For presentations and open discussions*
  - *For research, study & testing*
- Community display and gallery space

STEM Cluster



Visual Art

Presentation Area

Shared across disciplines, a presentation area gives students both an outlet for constructive feedback and a way to showcase their work.

Graphics, Coding, Robotics & Technology

The "Computer" lab as it developed in the early 2000s has been reimagined to serve a broader set of STEAM goals from coding and gaming design to digital imaging and web design.

Physics & Applied Sciences

Makerspace "Clean"

Makerspaces provide an arena for students to get hands-on. Here they have the space and the tools to experiment, invent, create, and tinker.

Workshop & "Dirty" Prototype

Can utilize and improve existing facilities, providing integrations with new technologies such as CNC and 3D Printing

Identify Available Resources / Advantages

- How can STEM integration impact the holistic modernization of a facility?
  - *Access to multi-use areas (cafeterias, LGIs)*
  - *Expanded use of underutilized areas (cafeterias, libraries)*
  - *Extended use of all areas*
    more accessible after traditional school hours
    with blended social functions
    (like a donut shop)

Identify Available Resources / Advantages

- How can shared building resources allow staff to function more efficiently?
- How can staff already present and engaged augment passive security & supervision?
  - *Knowledge concierge (librarian & IT support)*
  - *Guidance suites*
  - *Faculty work rooms & break rooms*

Supporting the Evolution of Staff & Learning Resources

Staff Resources

- Knowledge concierge:
  IT Support + Library & Research Assistance
- Traditional staff
  in expanded roles:
  Guidance & administrative staff as passive supervisors with on-demand assistance
- Traditional shop or vocational technical staff augmenting programs or immersed within STEM

Supporting the Evolution of Staff & Learning Resources

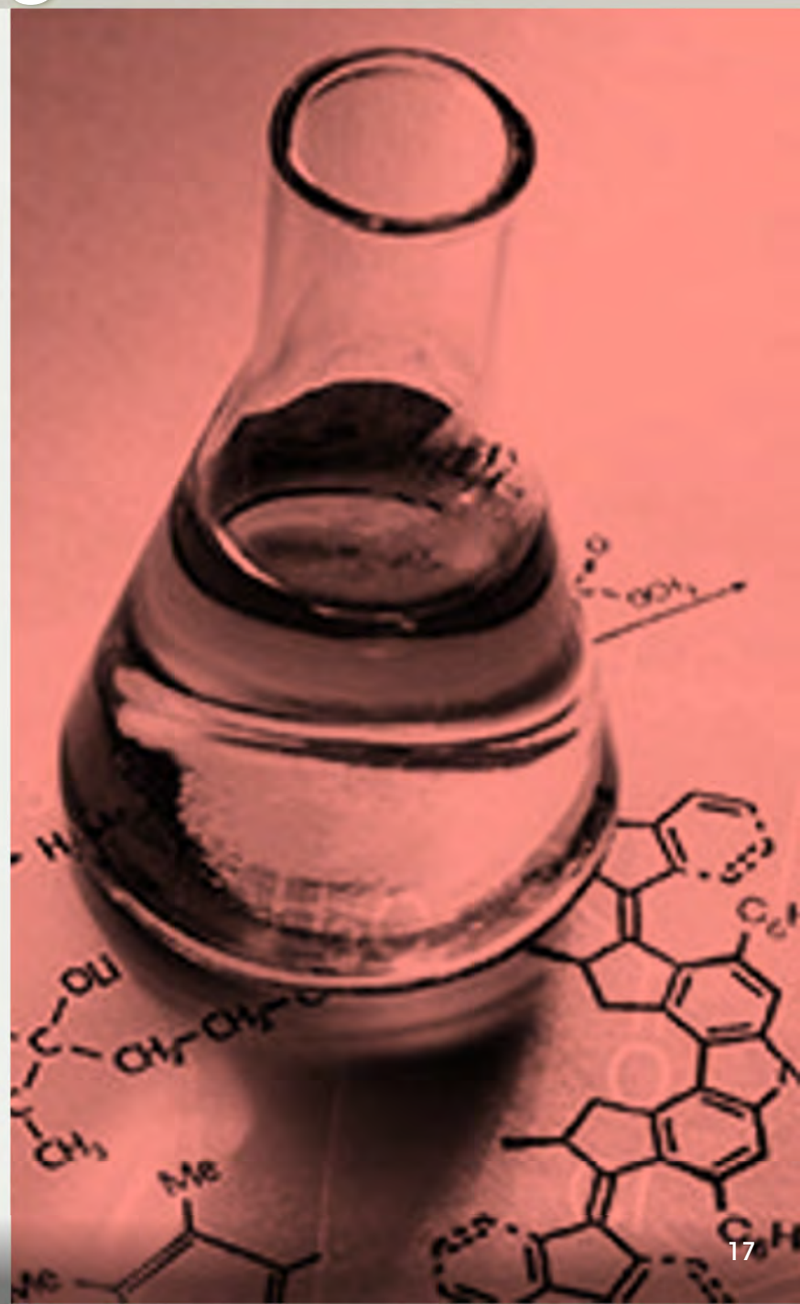
Equipment Support

- Specialized workshop and lab equipment to directly support programs
- Scanners, 2D & 3D printers or other prototyping equipment
- One-to-one devices including charging, storage & maintenance
- BYOD support tools
- Appropriate work surfaces to reduce static and withstand wear from maker tools
- Open area and safe rigging for motion capture activities and virtual reality interaction
- Furnishings that foster flexible use

Supporting the Evolution of Staff & Learning Resources

Infrastructure

- Additional power and charging requirements including redundancy to maintain projects through service interruptions
- Network demand for internal servers and internet access
- Supply of water, chemicals & safe hazardous material disposal
- Safety support stations for labs
- Dust and fume protection
- Secure display and presentation systems for projects
- Appropriate heights to facilitate use or testing of automated flight technologies



How does planning for STEM in renovated space differ from new construction?

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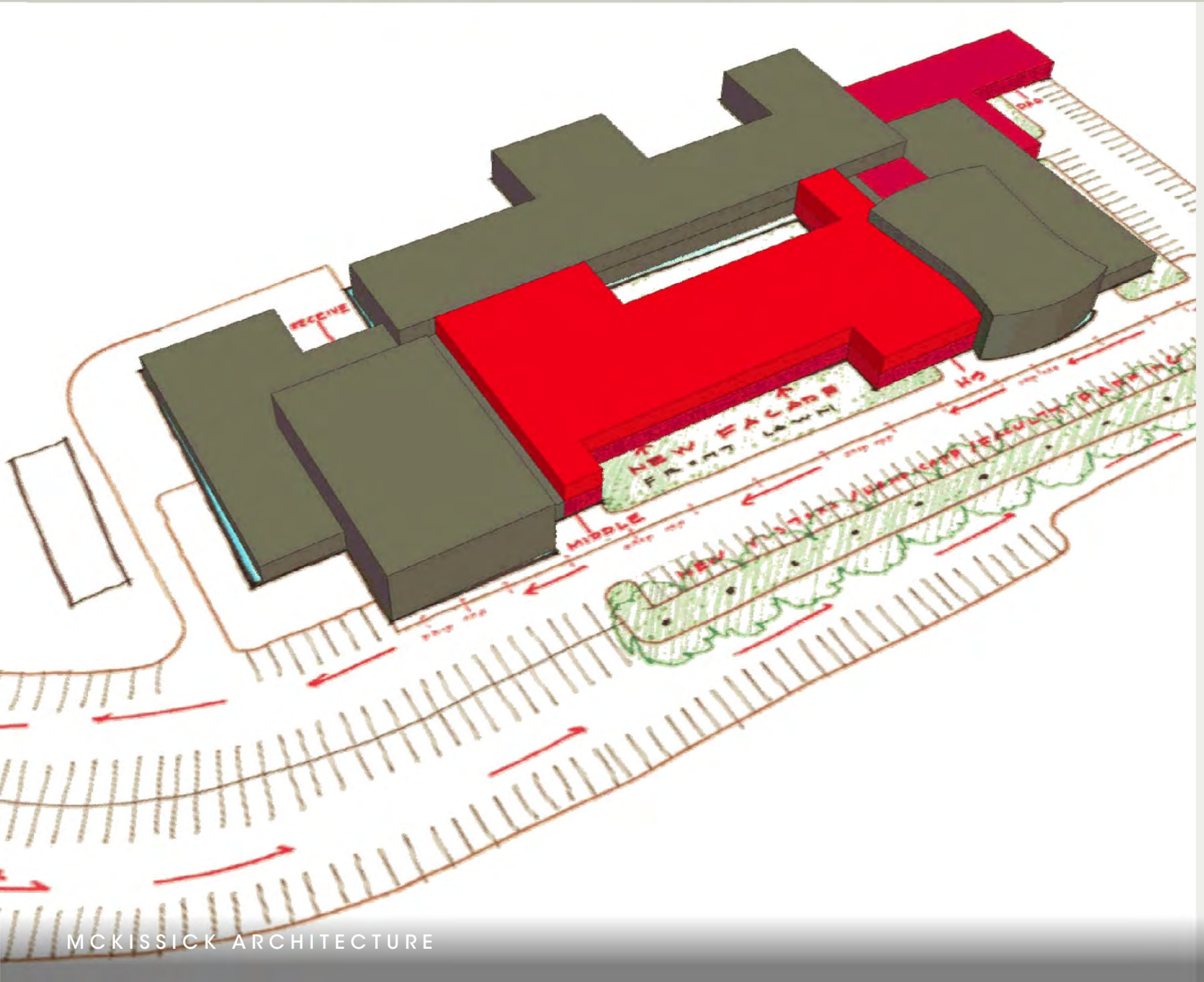
Don’t Underestimate the Value of What You Have

Common Elements	New Demands…	Current Value…
Student Transportation	• more busses, student parking • separation from staff & deliveries	• grading and road networks already in place
Staff Transportation	• after dark safety	• site lighting utilities in place
Community Use	• before & after school + year round	• large volume interior spaces (gym, multipurpose, auditorium)
Restrooms	• accessibility & privacy	• water utilities in place with building plumbing and basic infrastructure
Basic Classrooms	• power & data	• power utilities in place with some conduit and wiring in building
Roof, Walls, Windows	• insulation for comfort & sound	• bricks & mortar envelope under cover
Furnishings	• collaboration	• reusable in traditional areas? • reusable in other buildings?

Holistic Approach to Renovations



Build on what you have while bringing aging facilities up to the rigorous standards of a 21st century education.

- Maximize shared resources
  - *increase utilization*
  - *provide passive supervision*
- Improve delivery of services
  - *teacher communication & collaboration*
  - *accommodate new technologies*
  - *elevate standards of comfort*
- Reduce Expenses
  - *maintenance*
  - *utility operations*
  - *optimize staffing*

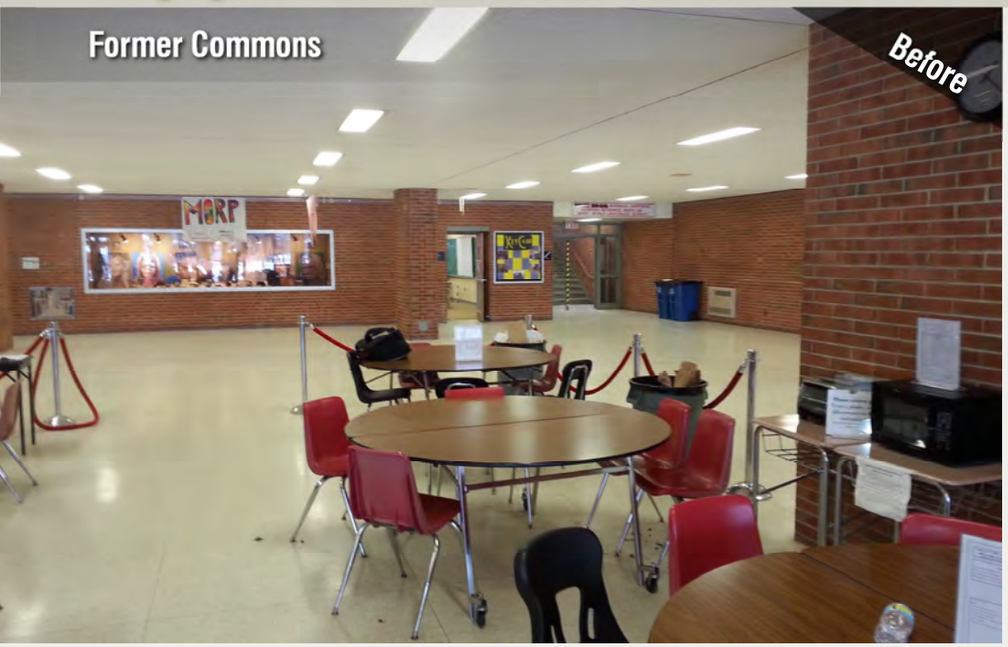
Don’t Overestimate the Value of “New”

- If current needs are addressed, remaining differences are cosmetic (and also upgradeable).
- Appearance of renovated spaces are often indistinguishable from new.
- Quality of renovated space is often better with conserved resources from envelope allowing for repair of superior finishes (tile & terrazzo) or replacement materials of higher quality (rubber or solid vinyl tile vs. VCT)
- Significant investment in infrastructure (roads, utilities, land, building envelope) is retained. Replacement of these reduces available construction budget for all-new building scenario.

Don't Overestimate the Value of "New"

- More area can be retained, renewed or restored in a renovation for the same dollars than can be created as a new facility.
- Existing resources like auditoriums and gymnasiums may be cost-prohibitive to recreate within a new-build budget, especially for middle or junior high level programs.
- If additional area is needed, highly specialized space can be created new.
- Savings from renovations & additions versus all new construction make room in budget for equipment and furnishings needed for STEM programs

Opportunities for Inserting STEM



Large-Volume Space

- Spaces like cafeterias or multipurpose rooms are often not up to the demands of their current use but...
  - *central location ideal for staff resource sharing*
  - *height and open spans ideal for collaboration areas, galleries and maker spaces*

Opportunities for Inserting STEM

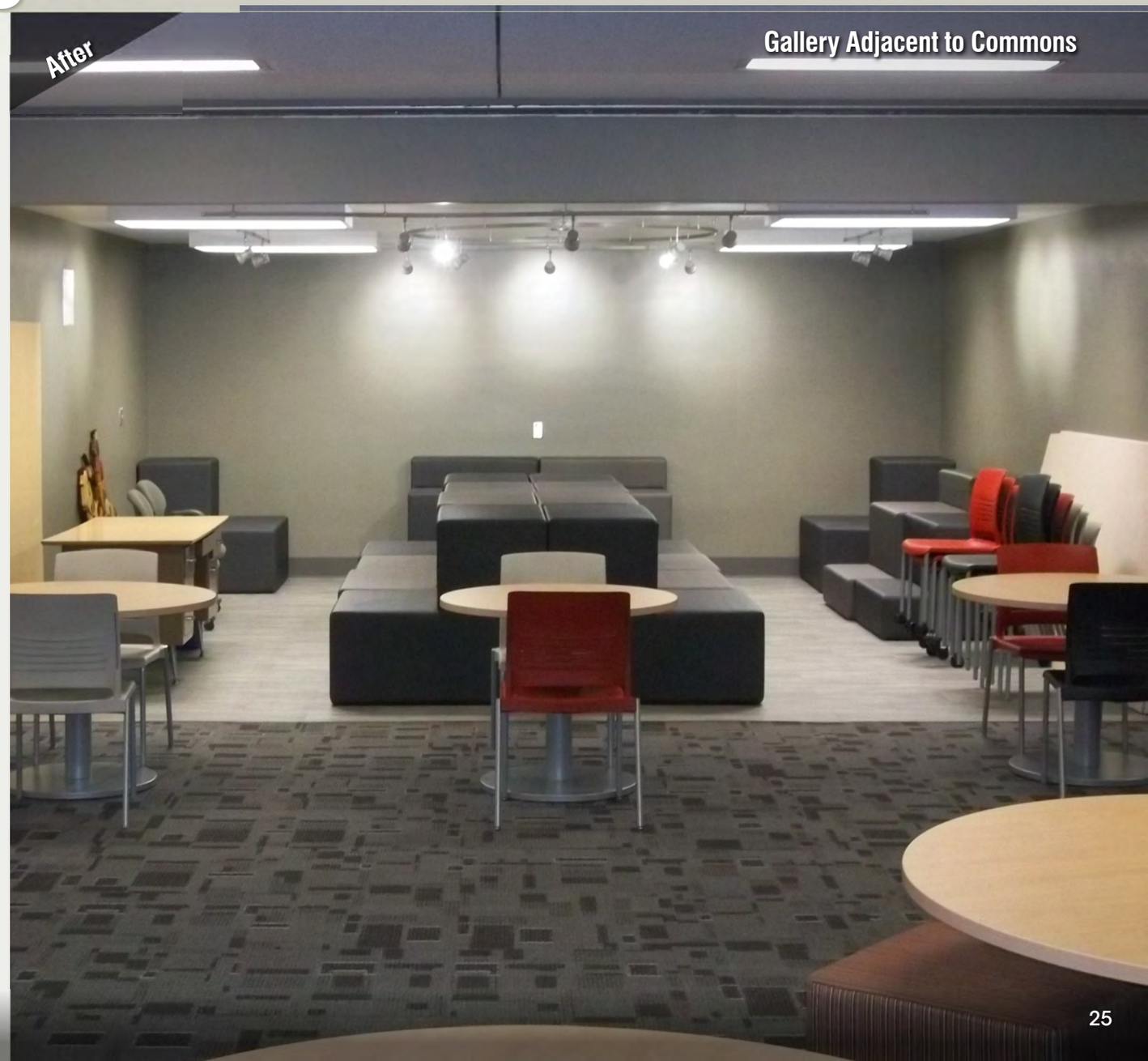
Dual Use Space

- Presentation for STEM projects can happen in areas that support other general programs like black-box theatres

Opportunities for Inserting STEM

Well-Positioned, Underutilized Space

- Underutilized resources or support areas with less positional value can be relocated to open up areas for support STEM demands



Opportunities for Inserting STEM

Well-Positioned Areas for Additions

- Well-intentioned interventions of the past (courtyards, open-plan classrooms, etc.) often become today's problems.
- The location of these areas is often ideal for centralized high-accessibility uses.
- Insertions in these spaces lessens conflicts with growing site needs for athletic fields or site circulation

...A lot of times, people don't know what they want until you show it to them.

~ ***Steve Jobs***

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Evolution of Furnishings…

from Fixed:

- Industrial-age model, with teacher at the front of class
- Boxy rooms with rows of student desks
- Limited ability to change setup, work in groups
- Reflected a "factory" production of students preselected into "tracks"

Evolution of Furnishings… to Flexible!

- Increased focus on group work, collaboration and exploration
- Giving students and teachers more agency and engagement in the learning process
- Reflects emphasis on student/teacher adaptability to achieve individualized results

"Sitting Still" no longer equated with "Paying Attention"

- Furnishings take on the task of adapting to individual learning styles
- Low-conscious physical movement during assimilation of new information improves retention by forming multiple synapses to connect new information with previous knowledge
- Use of color channels focus and reduces tension in learning environment to improve retention.
- Flexible furnishings provide opportunities for teachers to accommodate the individual learning styles of a student.

This high school's blended learning lab takes on the characteristics of a modern office creative suite…

Flexibility and Efficiency Maximizes Utilization

With a smaller footprint or "Right Size", budget can be redirected to quality.

- This commons area...
  - *serves as part of the cafeteria*
  - *is used for podcasting in the evening*
  - *is used for small group pullout throughout the day*
  - *can be monitored from both administration & guidance offices*

Flexibility and Efficiency Maximizes Utilization

When STEM suites can share larger resource areas or allow mixed use of common space, more area is available for additional programs.

Like a cliché date-night movie, after holistically addressing issues you may find that "love was there all along".

STEM space may already be waiting for you.

Westmont Hilltop High School

Case Study

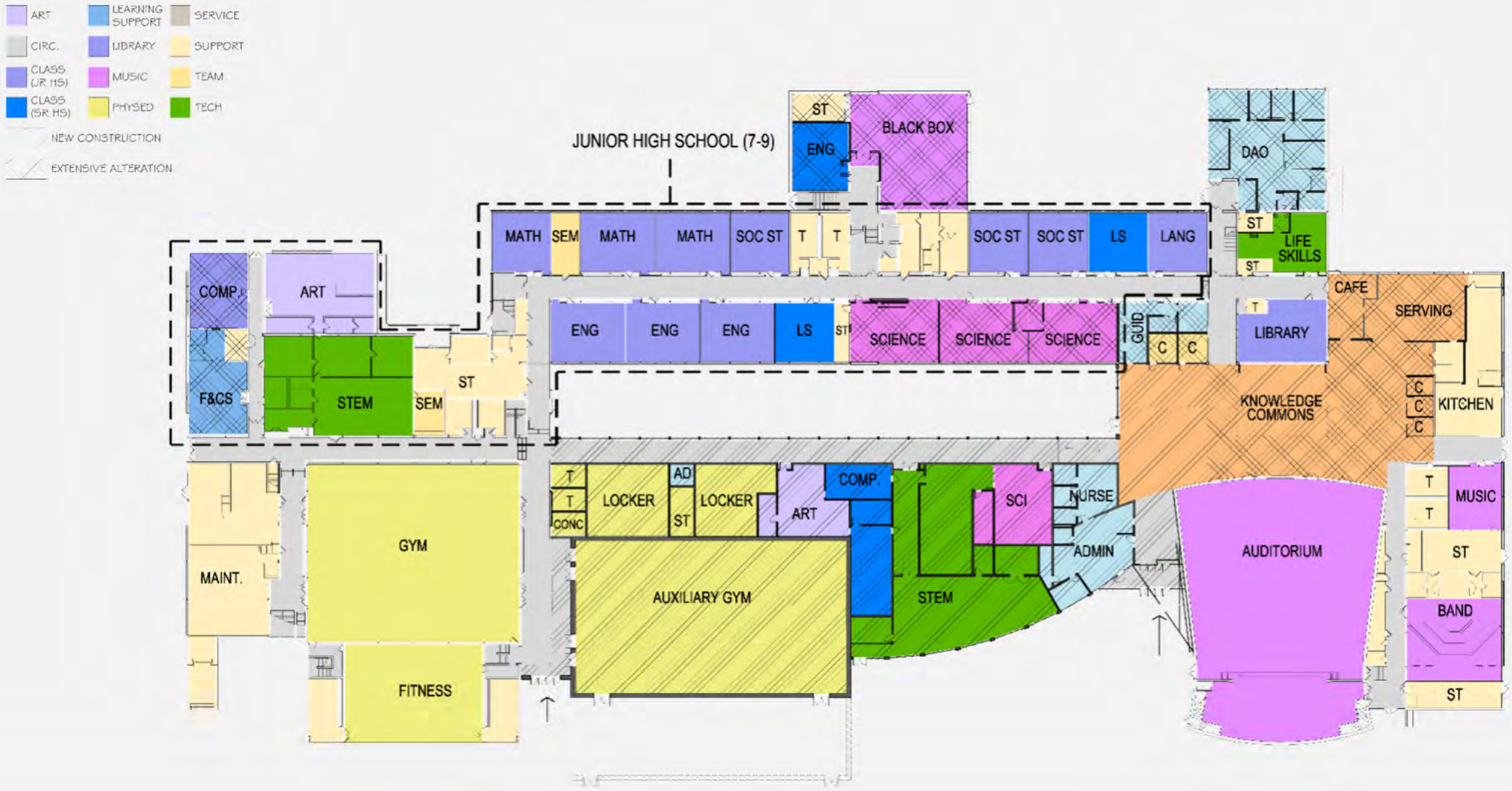
Westmont Hilltop High School

High School built in the1950s

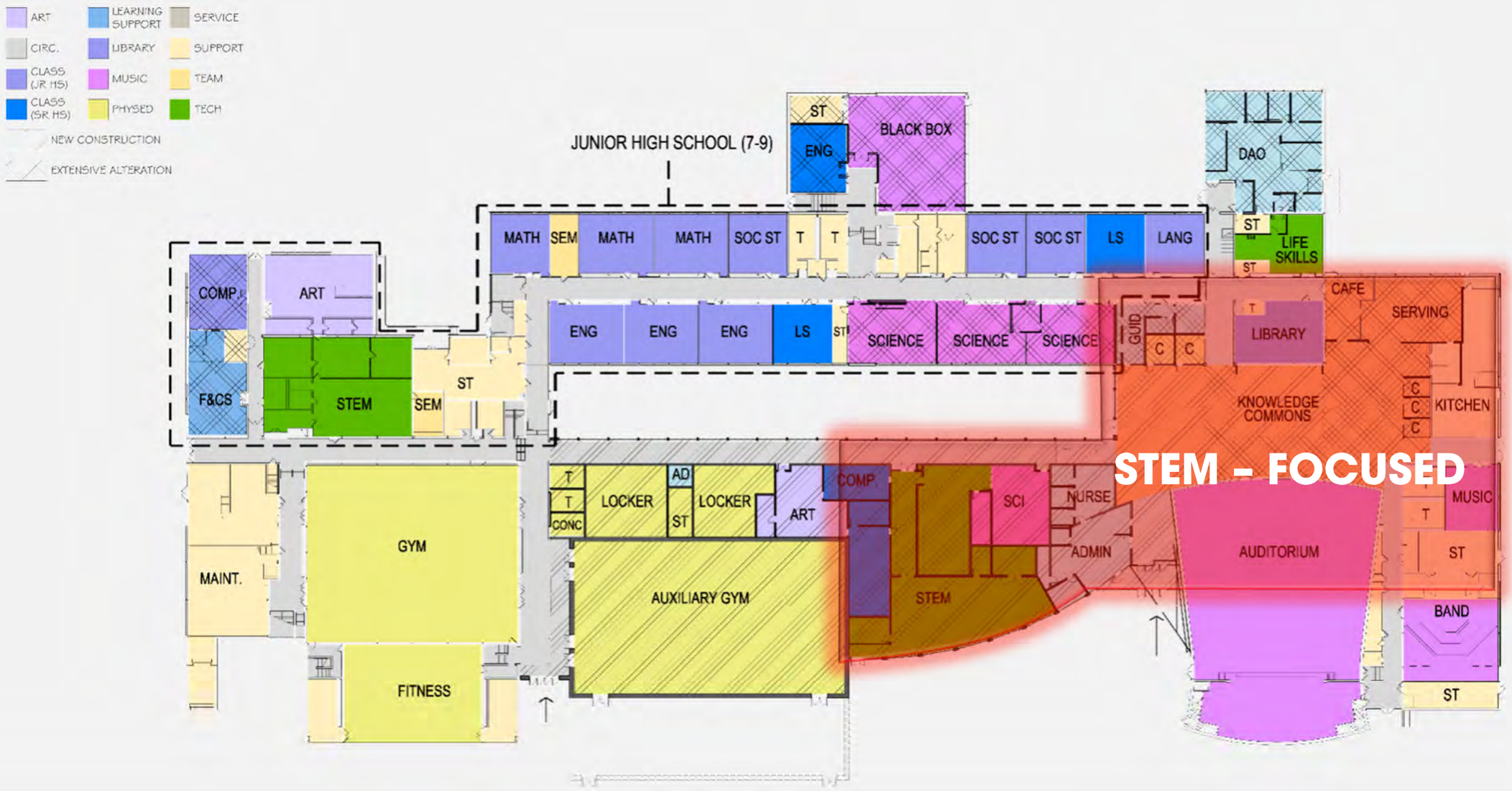
The Issue: District-Wide organization called for student realignment and the creation of two semi-autonomous communities.

Grades 7-9 & 10-12 660 Students

Westmont Hilltop High School



Westmont Hilltop High School



Westmont Hilltop High School

Westmont Hilltop High School

Westmont Hilltop High School

STEM Programming Strategies

More than just HAVING the space, it needs to be AVAILABLE for student use.

Challenge:
Low Student-Teacher Ratio

- Project work time
- Science and tech lab time
- Independent study

Teacher availability for supervision can be tough!

On the up side:

- Students only need basic supervision, not instruction
- Full directed attention of staff may not be necessary
- Exploit opportunities for supervision by proximity

High Availability


10:55

Westmont Hilltop High School

Westmont Hilltop High School

Westmont Hilltop High School

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Westmont Hilltop High School

Commons Support Programming Strategies

Taking advantage of formerly dedicated cafeteria space for small group space

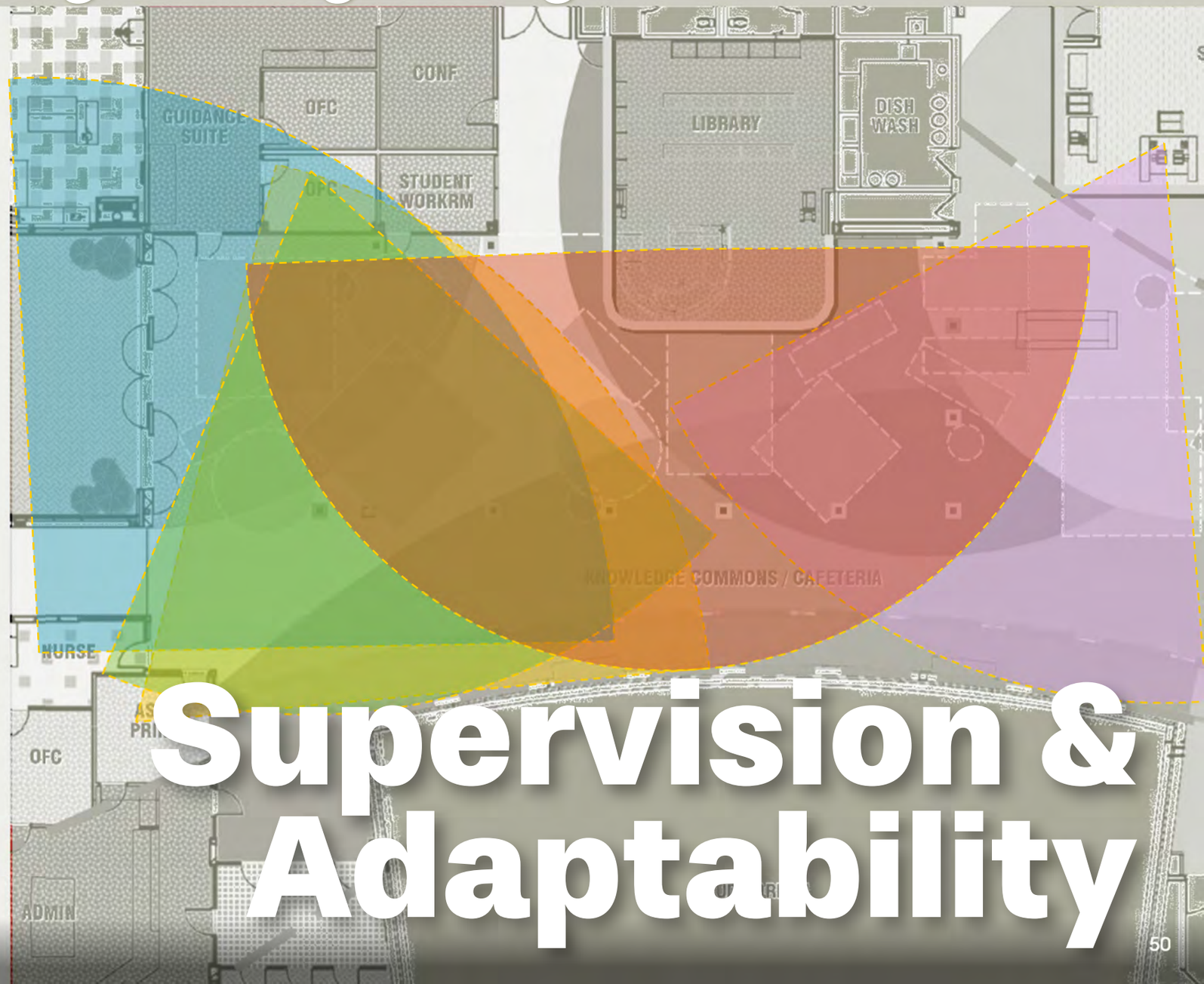
- Classes can utilize the area to create large open cleared spaces for “arena" activities
- Classes can be broken into project groups in an area that allows bigger movements

Using the same area for independent studies

- Supervision can be covered from multiple vantage points
- Double coverage views afforded during peak usage

Community Bonus

- Location allows extended hours usage and doubles as concession and auditorium “reception" space



Supervision & Adaptability

Westmont Hilltop High School

Before

Westmont Hilltop High School

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Westmont Hilltop High School

Indiana Area High School

Case Study

Indiana Area High School

High School built in 1962

The Issue: Inclusion of STEM programs and IDEAL learning program

Grades 9-12 850 Students

Indiana Area High School

Indiana Area High School

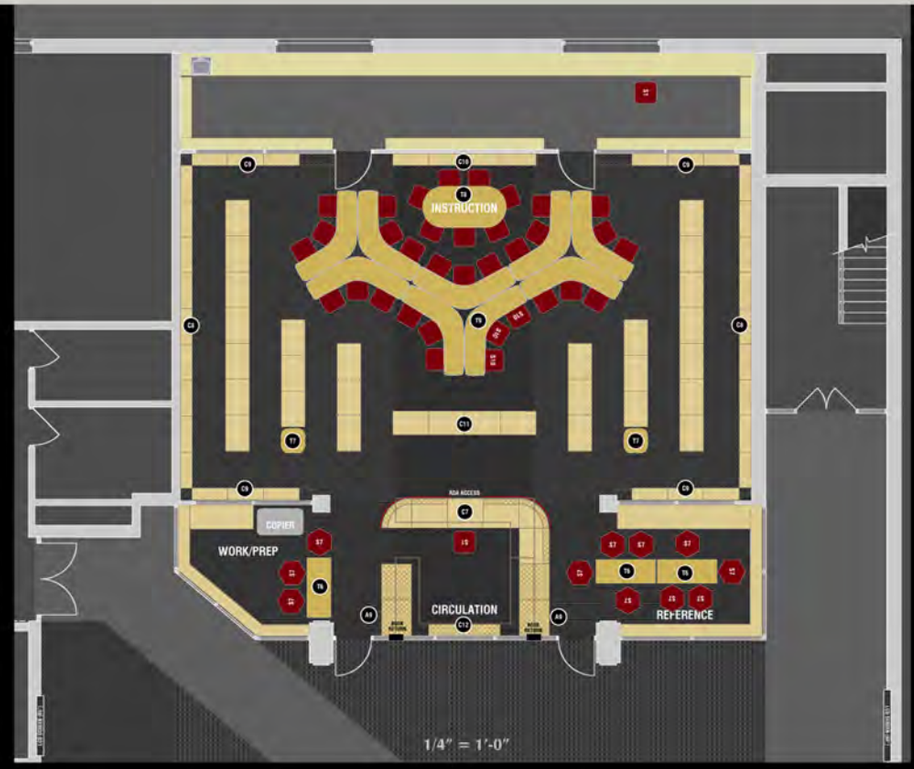
LIBRARY

Teaching Area

- 1 instructors desk at wall
- 27 pupils seated around tables
- Tables are mobile with nested flip-top storage and can be easily reconfigured or eliminated as desired
- Tables can be reversed (pupils seated on outside of curve at 4 per table (accommodating 36 pupils)
- Tables can be moved to commons area and combined with other tables (same series) for training seminars

Shelving

- 18 perimeter units at 82" H x 36" W have 6 shelves each and 12 perimeter units at 42" H x 36" W have 3 shelves each for a total of 420 linear feet
- Rear teaching wall could add 4 single-faced units at 43" or 49" H x 36" W to accommodate a/v viewing adding an additional 23 to 35 linear feet
- 30 double-faced mobile units at 43" or 49" H x 36" W have 3 shelves on each side for a total of 525 linear feet
- Increasing mobile units to 61" H (tallest possible for mobile base) would increase storage by 175 linear feet
- Total shelving capacity is estimated at 1,020 to 1,207 linear feet and does NOT include reference areas to the side of circulation desk or use of any space on top of mobile shelving. *(The width of all units has been reduced by 1" to accommodate the casework itself.)*



Indiana Area High School

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COMMONS & GALLERY

Senior Lunch Configuration (Relaxed)

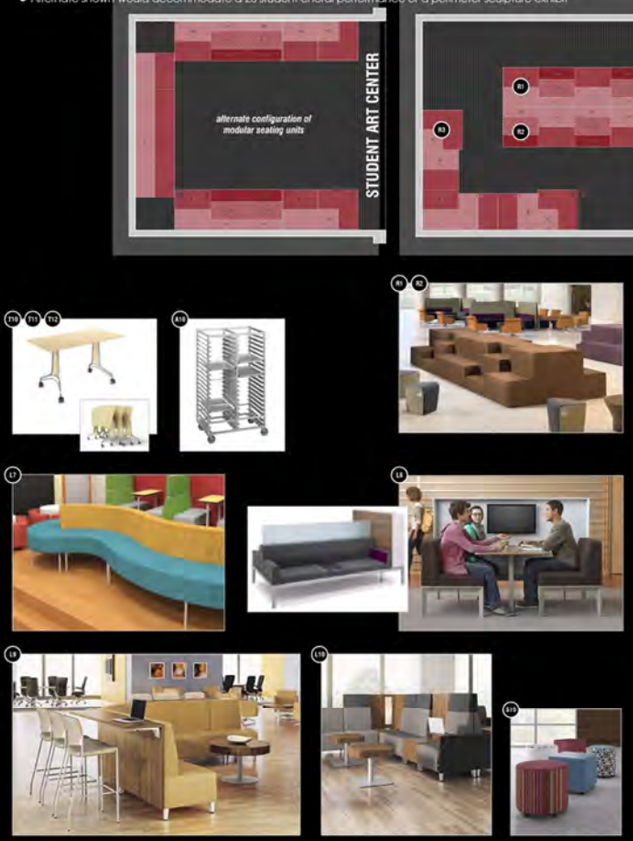
- 76 seated at tables on carpeted area
- 41 additional student seating in café/bar area and booths near entrance

Study Hall Configuration

- 70 seated at tables on carpeted area only (including lounge chairs w/ottomans)
- 11 additional students inside library reference rooms (visible through windows)
- 14 students in senior lunch zone shown oriented for inclusion in study hall group

Gallery with Soft-Seating Modular Bleachers/Benches

- Seating island would serve 8 to 10 students & L-shape perimeter could seat 6 to 7 students
- Alternate shown would accommodate a 20 student choral performance or a perimeter sculpture exhibit



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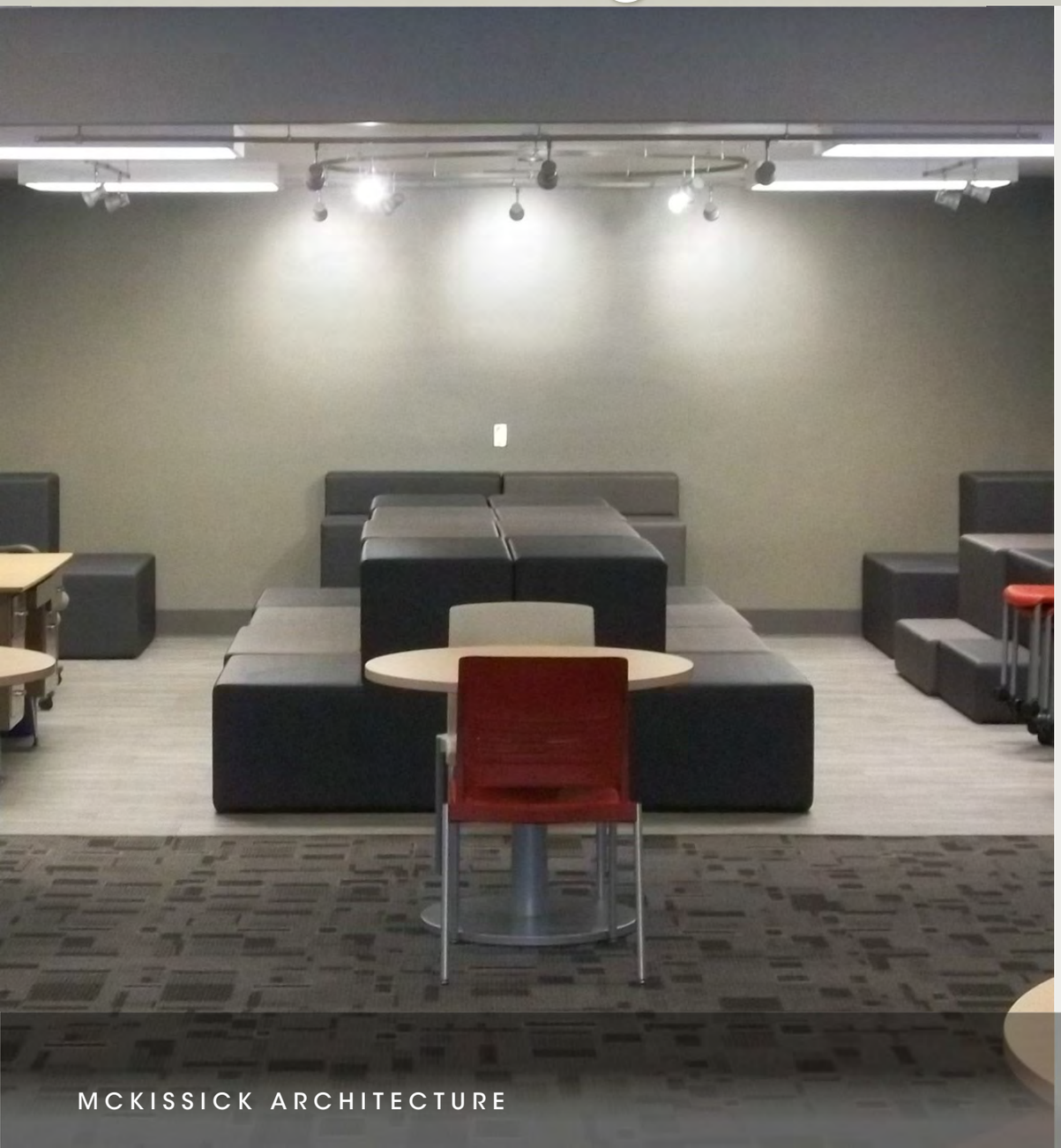


Indiana Area High School

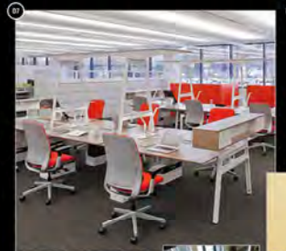
IDEAL LAB

Autonomous Program Support

- Director's office has storage, display and support furnishings to facilitate the wide variety of tasks as required:
  - Typical desk space for computer and paper-based tasks
  - Small conference table for student or parent discussions
  - Lockable file storage for student information
  - Long, cushioned bench to accommodate a student who may feel uncomfortable or unwell within the confines of the principals private space (thus not requiring transfer to the nurses office elsewhere in the building)
  - Glass windows overlook the more comfortable and intimate conversational groupings in order to discourage boisterous or inappropriate behavior
- Conference Room
  - Conference room can be used for private discussions with parents or other educators.
- Itinerant Teacher Support
  - Office with storage and desk to support 2 itinerant teachers which can be supervised by the program director from the director's office.
  - Display wall in office allows visible storage of student teaching tools
  - Office can be used for one-on-one tutoring via use of rails with portable white boards. Portable boards can be moved with the student back into the main study space after tutoring session.

Flexible Learning Environment

- A rail system throughout all adjacent spaces hosts portable white boards which can be used for individual study or tutoring and are easily relocated to changing student locations.
- A variety of learning styles can be accommodated by configurations including:
  - Office-like work stations via desking system with supply storage, large work surfaces and cable management to support desktop computer stations.
  - Small-group café style collaborative space (upholstered furnishings with shared casual workspace including standing-height or tall stool workspace.
  - Conversational groupings with write-on collaboration tables to support individual or very small group study or discussion areas.
  - Study-bar work areas with standing height counters (tall stools provided) to allow individual paper-based or laptop study with few distractions. Room can alternatively be used with interactive media board for small-group seminars or to provide audio/visual background environment such as news programs or whitenoise ambiance with accompanying visuals.
  - Conference room can be used for small-group seminars and dining with the bistro height bar seating a number of students who may choose to interact with students in the smaller booth-style grouping. The mobile table may be moved to accommodate a more traditional presentation environment.



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GAMING STUDIO

Presentation & Seminar Use

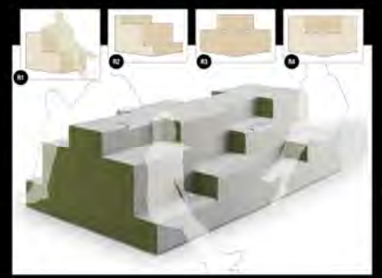
- Risers will comfortably seat 20 students during a presentation.
- Mobile computer tables have embedded laptop safes which can be closed so that equipment is does not project above 29" desktop surface. Tables can be easily moved if necessary to clear floor space.
- Riser seating (uncompressed) and table seating would provide presentation accomodation of 40 students with mobile furnishings re-configured to face the large wall.

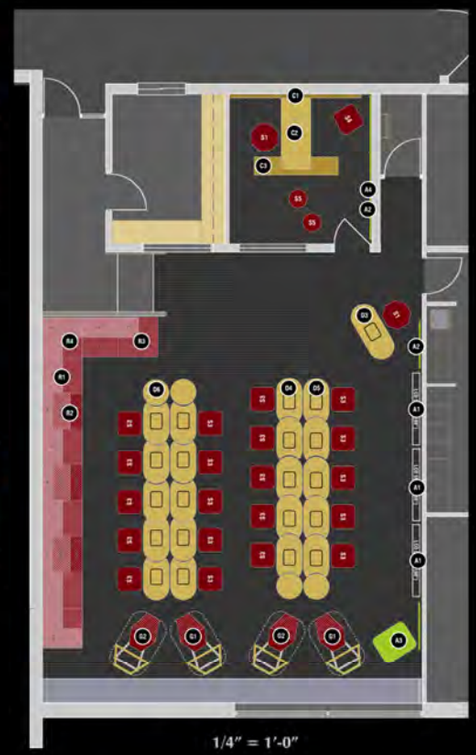
Technology Classroom Use

- Mobile computer tables can seat 20 students.
- Risers may be used as student seating and workspace for less conventional software development ergonomics.
- Mobile printer stations conform to computer table shapes and can house paper and printer supplies. Printer stations may be used for other shared electronics equipment and can be stationed throughout the space or near the perimeter to allow easier reconfiguration of student desks.
- Should additional monitors be desired for greater computing display, monitor arms could be attached to the desk via clamps. Computer tables include power strips.
- Gaming cockpits have adjustable automotive seat positioning and will support three monitors up to 32" each. Cockpit stations will support foot-pedals, keyboards and other accessories with either steering wheel or flightstick control support. This will allow immersive testing of simulation and gaming programs.

Humanities Classroom Use

- Mobile computer tables have embedded laptop safes which can be closed so that desktops are completely cleared of equipment and accessories. This allows tables to be used for paper-based testing, note-taking, sketching, etc. for non-computer-based learning.
- Concave end student tables allow for configuration into creative, non-linear collaborative space.
- Riser seating around room perimeter can be reconfigured to create islands, facing bleachers and other flexible seating configurations to support collaborative and non-traditional learning styles.





1/4" = 1'-0"

Indiana Area High School

Indiana Area High School

Windber Area Middle/High School

Case Study

Windber Area Middle/High School

Built in 1919 with additions in the 1950s.

The Issue: Steep decline in student enrollment resulted in a facility that is oversized and inefficient.

Grades 6-8 & 9-12 560 Students

Windber Area Middle/High School – Ground Floor

- CORRIDOR / CIRCULATION
- COMMONS
- ADMIN. / GUIDANCE / HEALTH / FACULTY
- GENERAL CLASSROOM HIGH SCHOOL
- GENERAL CLASSROOM MIDDLE SCHOOL
- RESOURCE ROOM / CONFERENCE
- SCIENCE
- MUSIC
- ART
- TECHNOLOGY EDUCATION
- GYMNASIUM / FITNESS ATHLETIC SUPPORT
- KITCHEN / SERVING
- SUPPORT SPACE

Windber Area Middle/High School – Upper Floor

- CORRIDOR / CIRCULATION
- COMMONS
- ADMIN. / GUIDANCE / HEALTH / FACULTY
- GENERAL CLASSROOM HIGH SCHOOL
- GENERAL CLASSROOM MIDDLE SCHOOL
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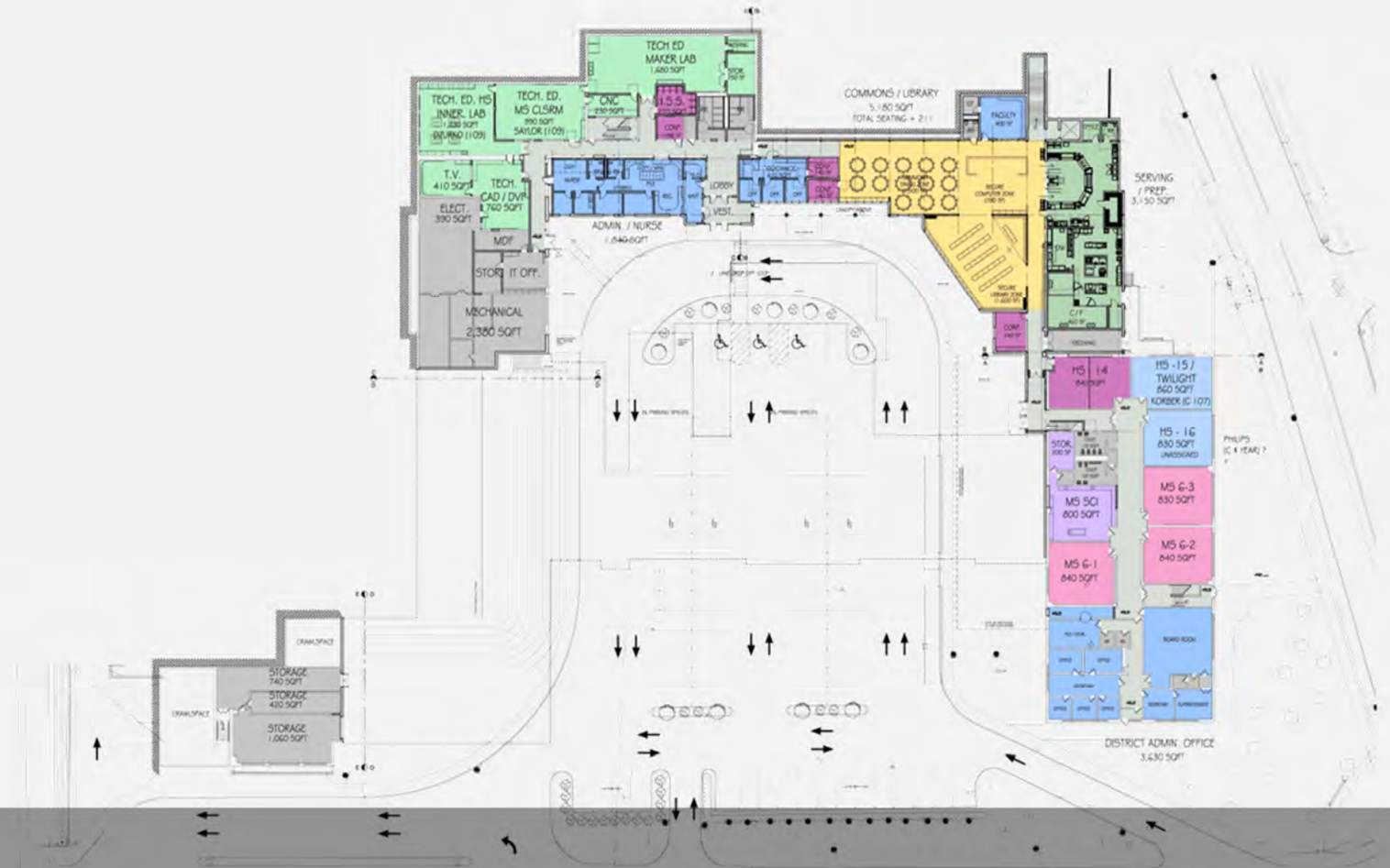
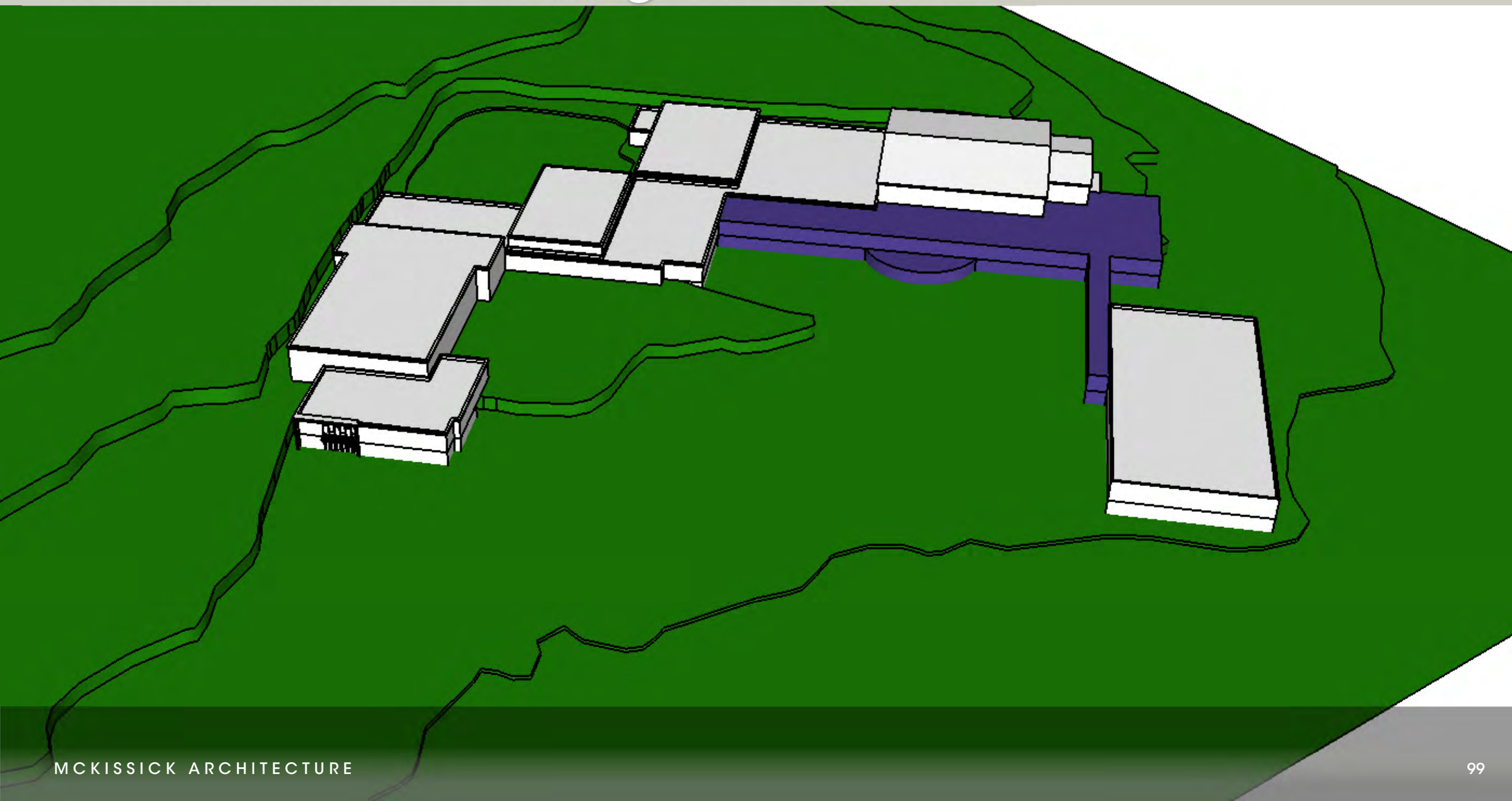


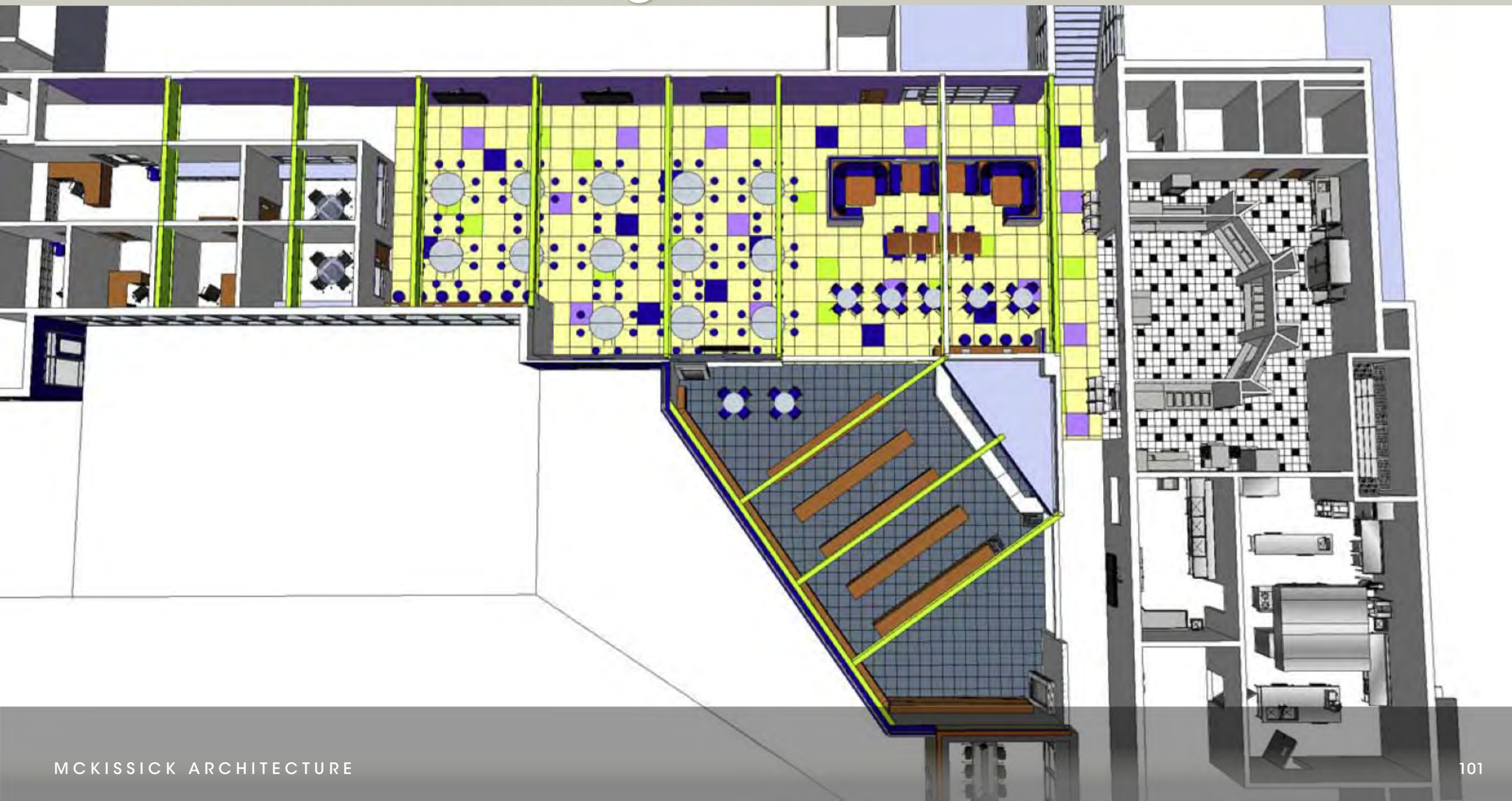
Windber Area Middle/High School - Before

Windber Area Middle/High School - After



Windber Area Middle/High School

Windber Area Middle/High School



Windber Area Middle/High School

Before

Windber Area Middle/High School

Before

Windber Area Middle/High School

Before

Windber Area Middle/High School

Windber Area Middle/High School

Windber Area Middle/High School

Windber Area Middle/High School

Windber Area Middle/High School

Windber Area Middle/High School

Before

Windber Area Middle/High School – Former Cafeteria

Windber Area Middle/High School – Former Locker Room

Windber Area Middle/High School – Former Locker Rooms

Windber Area Middle/High School – Former Shop

Windber Area Middle/High School

Windber Area Middle/High School – Former Administration

Granite Falls Middle School

Case Study

Granite Falls Middle School

Built in 1935 next to an oak tree that had been growing on the hilltop since 1768.

The Issue: Historic school in an aging facility which couldn't meet the rigorous 21st Century educational standards.

Grades 6-8 680 Students

Granite Falls Middle School

Rooted in the center of the community…

Drone video shows relationship of tree to school to town.

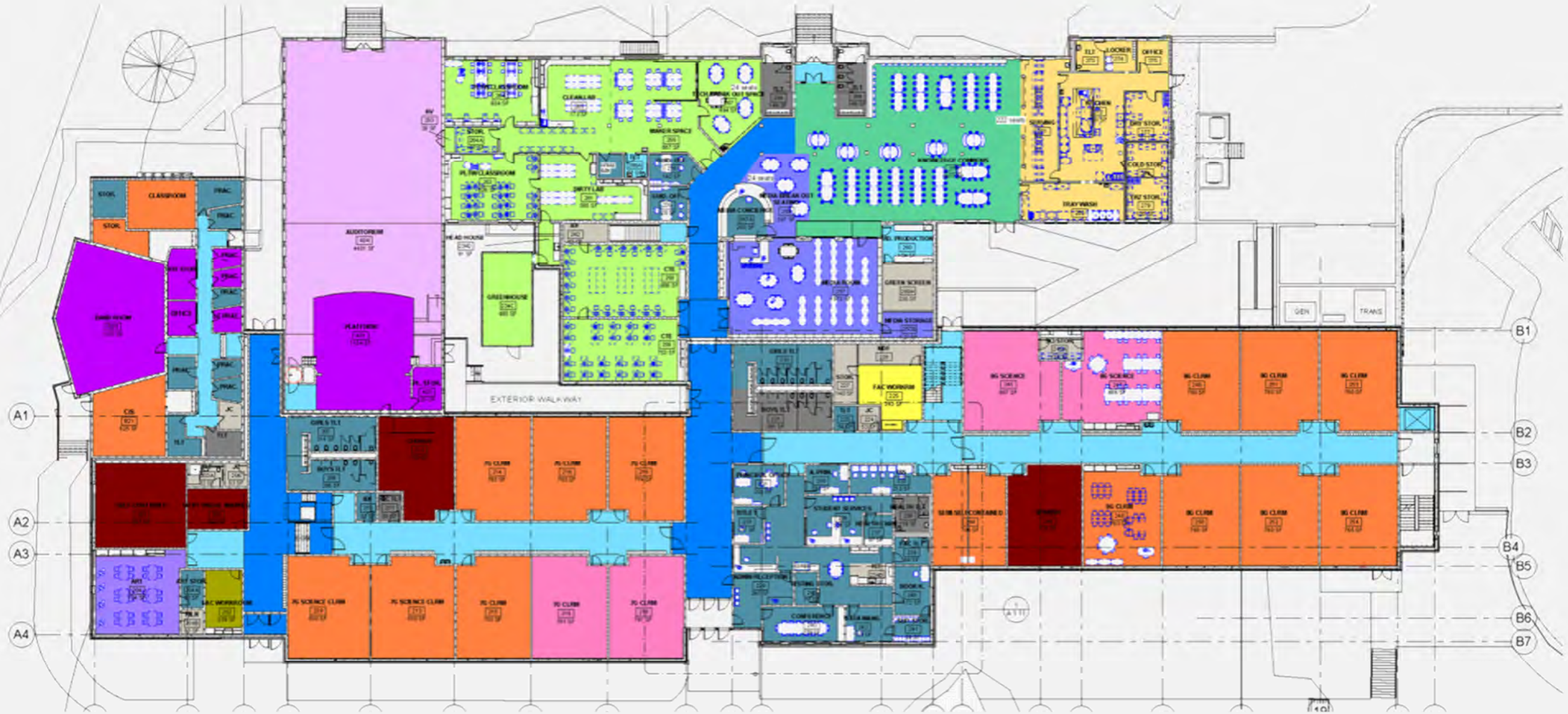
Schoolhouse on the Hill

Granite Falls Middle School

Granite Falls Middle School

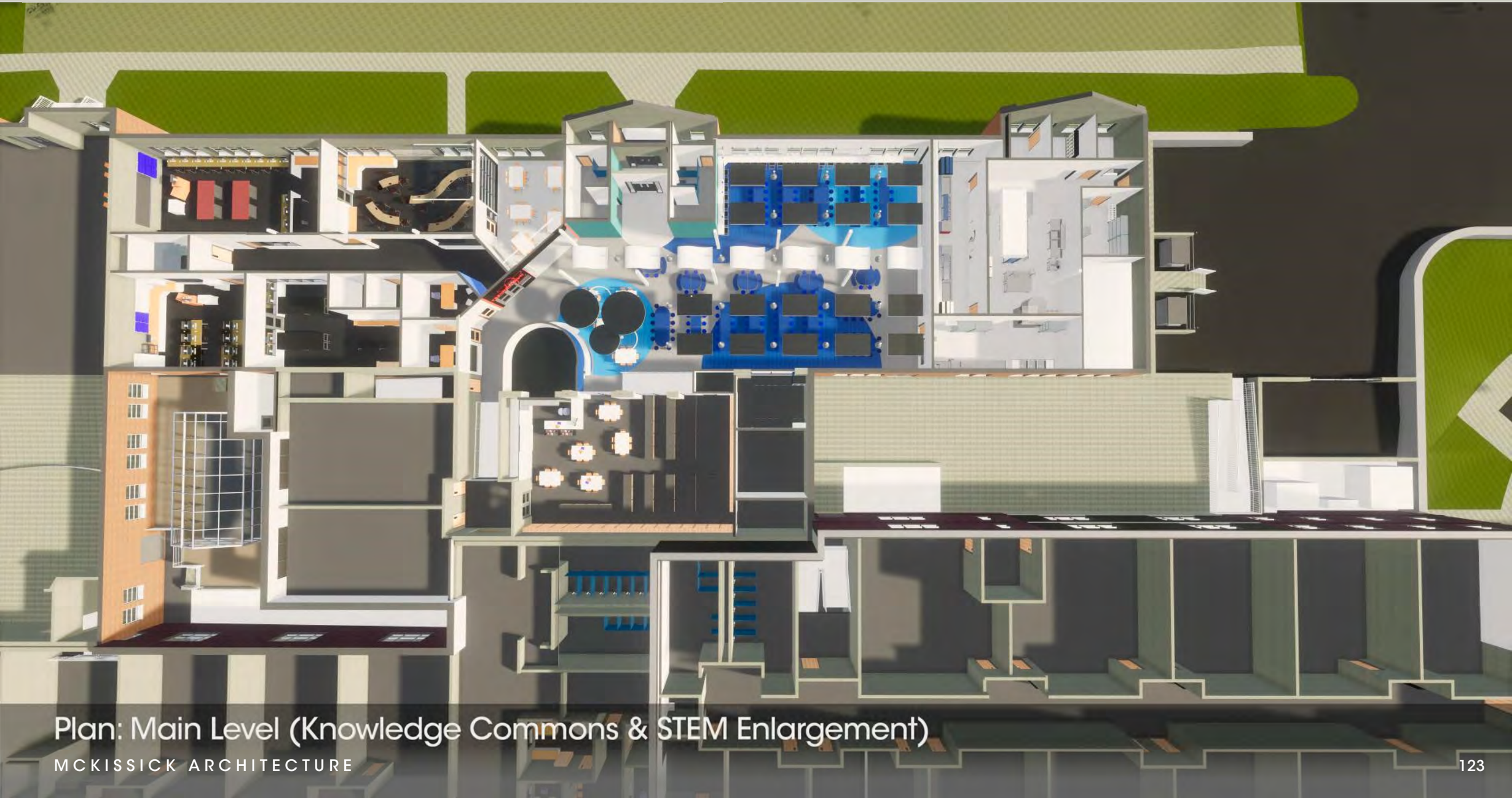
Parent Driver Arrival Entrance (Staff Parking at Forefront)

Granite Falls Middle School



Plan: First Floor

Granite Falls Middle School



Plan: Main Level (Knowledge Commons & STEM Enlargement)

Granite Falls Middle School

1935 Building

MCKISSICK ARCHITECTURE

Granite Falls Middle School

1935 Building: Knowledge Commons

MCKISSICK ARCHITECTURE

Granite Falls Middle School

Knowledge Commons

MCKISSICK ARCHITECTURE

Granite Falls Middle School

Knowledge Commons

Granite Falls Middle School

Knowledge Commons

MCKISSICK ARCHITECTURE

Granite Falls Middle School

Knowledge Commons

MCKISSICK ARCHITECTURE

Renovated Facilities Create Unique Opportunities

The static resource portion of this library will be located several feet higher than the main floor in existing space

- supervision of multiple areas by limited faculty allows more access with the same instructional cost
- the “monitor" is also positioned as a resource so that oversight is non-threatening

Granite Falls Middle School

1935 Building: STEM Center - Technotorium & Project Lead the Way

Granite Falls Middle School

1935 Building: Configuration As it is Today…

Granite Falls Middle School

1935 Building: STEM Center - Technotorium & Project Lead the Way

Granite Falls Middle School

Knowledge Commons

MCKISSICK ARCHITECTURE

Granite Falls Middle School

MAKER SPACE (Looking into Knowledge Commons)

Granite Falls Middle School

STEM Center

MCKISSICK ARCHITECTURE

Granite Falls Middle School

STEM Center

MCKISSICK ARCHITECTURE

Granite Falls Middle School

Renovated Area	21,966 SF
Cost per SF	$ 147.22 /SF
Renovation Cost	$ 3,233,840
Equivalent New Cost	$ 4,173,540

Questions?

ASSOCIATION FOR LEARNING ENVIRONMENTS
Enhancing the Educational Experience

Thank You!

ASSOCIATION FOR
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ENVIRONMENTS

Enhancing the Educational Experience

2019 North Carolina Conference