# Minnesota State Colleges and Universities

## New Directions in Learning Spaces: Active Learning, Maker Spaces, and the Learning Commons

## *Creating Learning Spaces for the Future*

As MnSCU colleges and universities look toward the future, they seek to better serve the needs of their students by adapting existing academic spaces—classrooms, libraries, and lab spaces—to new trends in teaching and learning. These new learning spaces are built to encourage collaboration, group learning, and student engagement, leading to greater student success.

## *SCALE-UP/ALC/TILE/TEAL: Making Sense of the Active Learning Alphabet Soup*

### Where we are

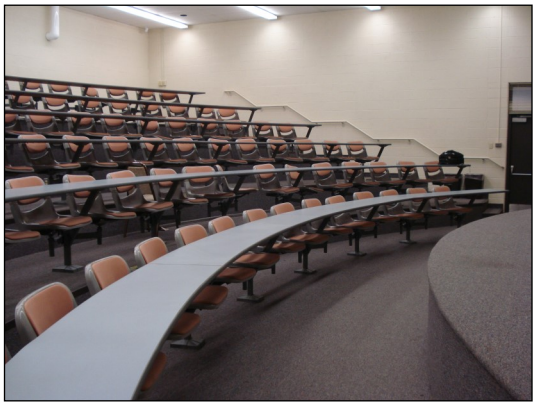
Currently, a typical classroom on a MnSCU campus will likely be one of two types:

1. A flat-floored classroom with desks/tables (fixed or movable) or tablet-arm chairs, arranged in rows facing the front of the room;

2. A tiered or ramped fixed-seat lecture hall/auditorium.

*Typical flat-floored classroom*

These types of classrooms best suit a traditional style of teaching where the instructor stands at the front of the room and lectures for most of the class period. While movable furnishings in these classrooms may allow some collaboration among students, the furnishings and equipment do not generally encourage or support alternative teaching methods that use collaborative or hands-on learning.



*Typical tiered lecture hall*

Until recently, lecture-based teaching was regarded as the optimal method for non-technical classes (especially large-scale undergraduate classes), and typical classrooms reflect that. However, growing pressure to reduce operating costs and increase student success has led colleges and universities across the country to study new methods of teaching as well as new strategies for using classrooms. The end goal of this research is to find ways to maximize the use of existing classroom space while also maximizing student success.

### What's changing

Recent research has led to the development of a new teaching style known broadly as Active Learning, which encourages learning through hands-on activities, collaborative work, or simulations of real-world activities.

Traditional teaching methods, where the instructor transfers knowledge to students through lectures, are considered "passive" because students are not required to actively engage with the material; instead, the

student acts as a "scribe", writing down what the instructor says. Active Learning, by contrast, supports the idea that students acquire a deeper, longer-lasting understanding of the course material when they actively construct knowledge through hands-on activities and real-world problems. An Active Learning environment supports knowledge construction by providing opportunities for rehearsal, feedback, and application of skills and knowledge. Students who have taken classes in Active Learning classrooms have been found to display enhanced conceptual understanding of the course material, moving beyond simply memorizing facts and formulas.

Research about Active Learning has also led educators to realize the importance of community in learning: learning, they have found, is a social process, and students benefit from group learning activities and preparation in working collaboratively with others as they will in the working world. Active Learning classrooms encourage this collaboration by giving students the resources to learn from, and with, one another in technology-rich environments.

## What's out there: classrooms

Nationwide, a number of colleges and universities have created their own programs to adapt classrooms and courses to Active Learning. Though the principles behind the programs are similar, each institution's program has its own distinct ideas about how to implement Active Learning.

*SCALE-UP Classroom, North Carolina State University*

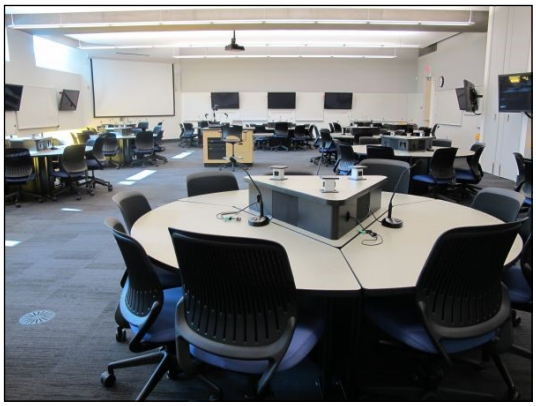
SCALE-UP: *Student-Centered Active Learning Environment with Upside-Down Pedagogies*; was originally *Student-Centered Activities for Large Enrollment Undergraduate Programs* (North Carolina State University). NCSU's SCALE-UP program was one of the pioneers in exploring Active Learning environments. Classrooms include abundant whiteboard space, round tables, chairs with wheels, laptop computers, projectors and monitors, an audio system designed to allow the students to both hear the instructor and to respond (e.g., by having microphones located at the tables), and lighting that can be adjusted depending on the task. These classrooms have no "front"; a podium at the center of the room allows the instructor to control audio and video components. Instead of lecturing from a fixed position, instructors move around the room, talking with groups of students and checking on their progress.

Nine students typically sit in groups of three around tables that are seven feet in diameter; this size was found to be optimal for encouraging collaboration. Too much classroom density (not enough space between seats) was found to lower student achievement, but too much space between groups prevents students from moving easily from group to group. Two to four feet between seated students was found to be the most effective spacing.

NCSU has studied the effects of the SCALE-UP classrooms and found that students benefit from these classrooms in numerous ways:

- Better retention and understanding of concepts
- Better class attendance
- Lower class failure rates

- Higher student satisfaction with the learning process overall.



*Active Learning Classroom, University of Minnesota—Twin Cities*

ALC: *Active Learning Classrooms* (University of Minnesota, Twin Cities). Based on SCALE-UP, the ALCs were first used for large-scale undergraduate introductory science courses. Campus researchers evaluated the success of ALCs by analyzing student outcomes in ALC classes vs. traditional, lecture-based classes. Students in the ALC classes were significantly more successful than students in the traditional classes, and retained critical concepts longer.

TILE: *Transform, Interact, Learn, Engage* (University of Iowa). Also adapted from SCALE-UP, TILE environments encourage collaborative learning, peer instruction, and activities that benefit from access to computers/technology. Faculty are given training in how to use the TILE classrooms and adapt their courses to active learning. A special unit within the university reviews faculty requests to teach within TILE spaces and ensures that courses within the spaces will make maximum use of the TILE environment.

*Remodeled TILE Classroom, University of Iowa*

TEAL: *Technology Enabled Active Learning* (MIT). TEAL uses an Active Learning approach for undergraduate science or engineering courses, encouraging hands-on projects in a collaborative environment. MIT has found that student learning gains in undergraduate physics classes are almost double when Active Learning is involved. The TEAL approach applies state-of-the-art visualization technologies to transform the main topics of introductory science courses from abstract to concrete, increasing student understanding.

*Maker space, University of Texas*

*Maker Spaces:* Though not truly an Active Learning environment, a Maker Space enables multi-disciplinary learning and collaborative work. These types of spaces may include a variety of DIY tools and technologies such as 3D printers, software, electronics, craft and hardware supplies and tools, and more. Classes might be taught in the Maker Space, or it could be more of an open-lab type space open to any student.

## Where we're headed: classrooms

Though most MnSCU colleges and universities do not currently have Active Learning classrooms, a number of upcoming projects will create these classrooms within new or existing buildings:

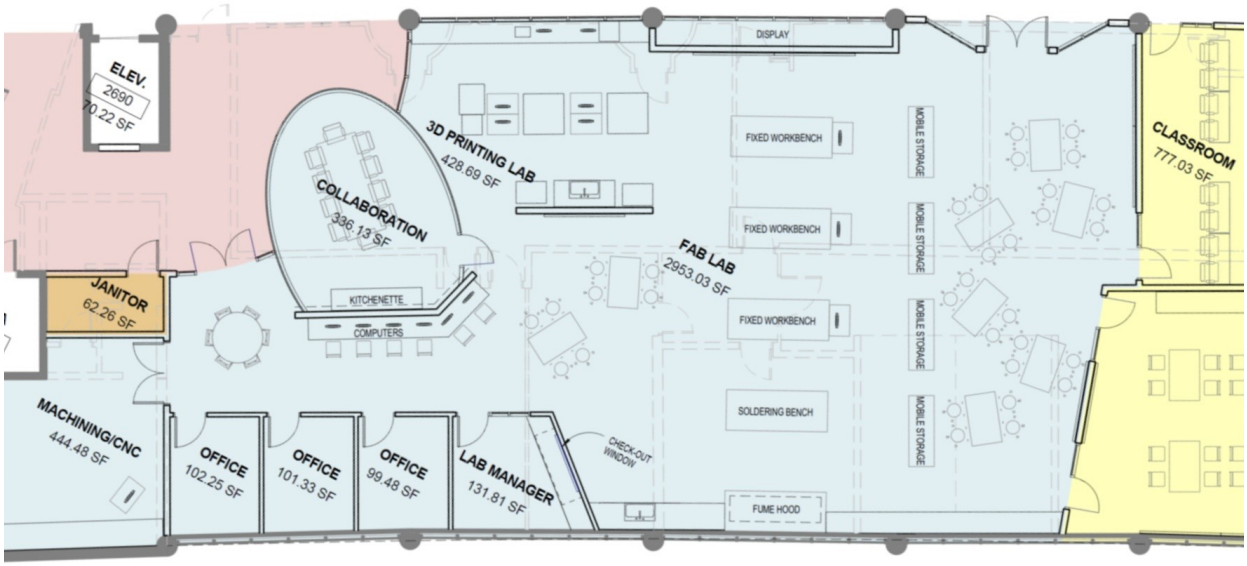
**Bemidji State University, Academic Learning Center** (new building): This new academic building, which will consist primarily of classrooms and a large lecture auditorium, will include two Active Learning classrooms.

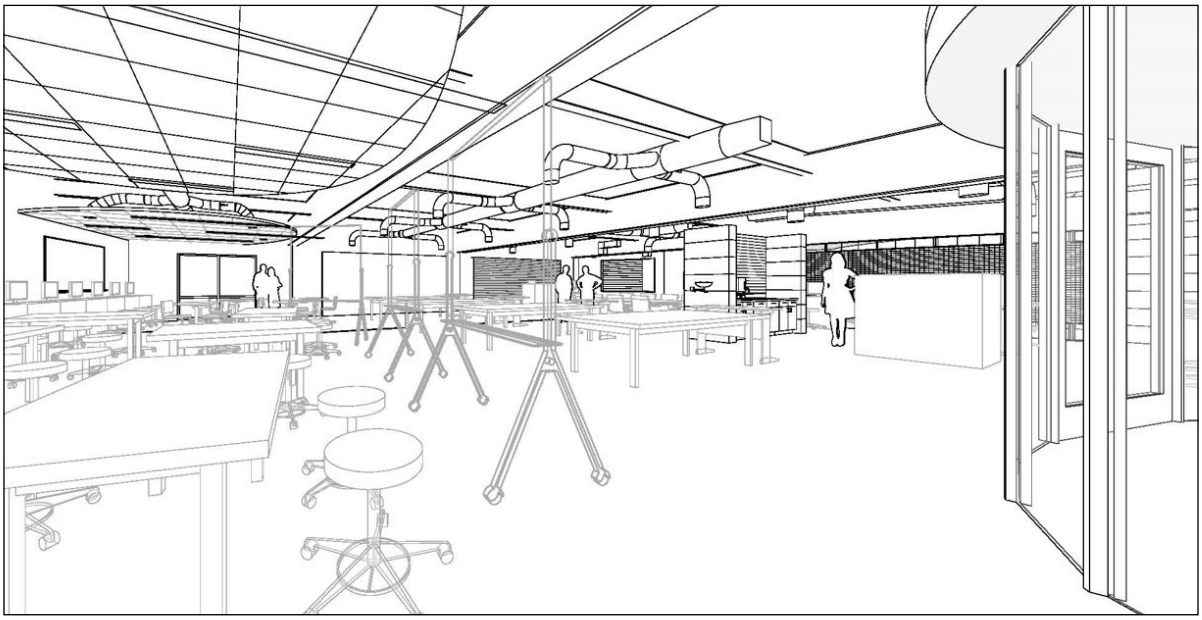
**Metropolitan State University, Science Education Center** (new building): New science labs and classrooms will have mobile furnishings, where possible, to provide flexibility and the ability to adapt the rooms to Active

Learning methods. Group study areas will provide space for students to work collaboratively outside the classroom.

**Winona State University, Education Village Phase 2** (renovation): This project remodels three existing buildings to create new spaces for the College of Education. It will include Active Learning environments as well as group learning/collaborative study spaces.

**Century College, Fab Lab** (renovation): This new maker space/fabrication lab contains areas for 3D printing, digital fabrication, and hands-on learning. Two nearby classrooms open directly into the lab, allowing students to easily translate classroom concepts into real-world designs.



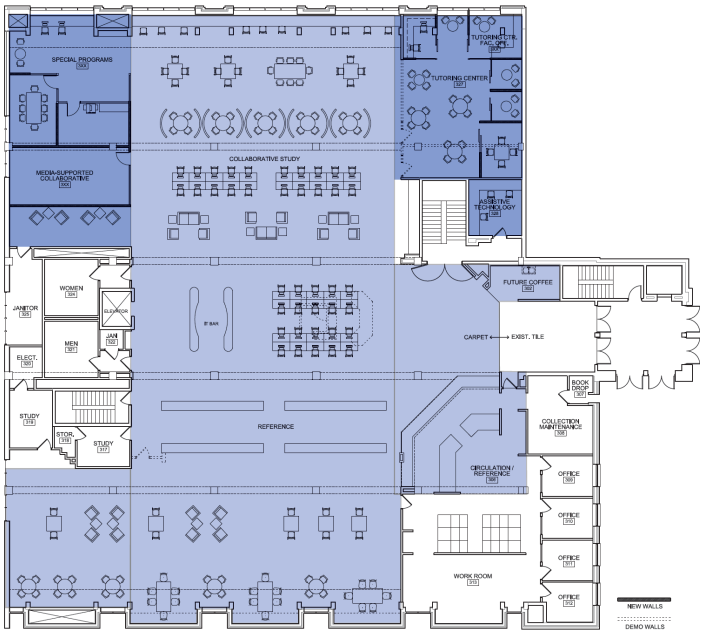
*Century College: Floor plan (top) and concept model (bottom) for the new Fab Lab, collaboration space, and adjacent classrooms*

## *Where we're headed: libraries*

In recognition of the transition to group-based collaborative learning, colleges and universities have begun to reshape their non-classroom spaces — especially libraries — to reflect a more collaborative approach to learning. The quiet, book-filled library of years past is being replaced with the Learning Commons, where students gather to work in groups and to access a wide range of digital and print resources. These Commons areas often contain both traditional quiet study spaces and new technology-enhanced enclosures for small group work. The Learning Commons concept is making its way to MnSCU campuses, as illustrated below.

*A typical traditional library: long rows of book stacks and study carrels.*

*MSU Moorhead's Livingston Lord Library remodel created a Learning Commons space with a variety of seating options.*




*Bemidji State University: Proposed renovation of A.C. Clark Library. 3rd floor plan (left) and conceptual model (right).*

## *Appendix: Active Learning Research and Resources*

### The SCALE-UP Project: A Student-Centered Active Learning Environment for Undergraduate Programs

*http://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_072628.pdf*

North Carolina State University, the home of the original SCALE-UP classrooms, studied active learning physics classes at Florida State, Penn State-Erie, and Florida International University. This research looked at students' improvements on the FCI (Force Concept Inventory), a test of basic physics understanding that is given at the beginning and end of physics courses. Though students in introductory physics courses would normally experience a 23% increase in FCI score during their physics course, students in the SCALE-UP classes experienced an average 50% score gain. Female students at Penn State, who typically came into physics courses with lower SAT math and science scores, achieved course grades equal to those of the males.

Florida International found that active learning classes experience a drop/fail/withdraw rate that is only 25% that of traditional classes, and failure rates for the active learning classes are greatly reduced. NCSU researchers also studied Clemson University, where the drop/fail/withdraw rate for introductory calculus classes was 44%, but dropped to 22% with the introduction of active learning classes.

### Learning Spaces Research: University of Minnesota

*http://www1.umn.edu/ohr//teachlearn/alc/umnresearch/index.html*

*http://er.educause.edu/articles/2011/12/pedagogy-and-space-empirical-research-on-new-learning-environments*

In 2009, the University of Minnesota and Stanford University studied how active learning affected student outcomes in an introductory biology course. Two sections of the course were studied: The first section was taught in a newly-remodeled active learning classroom and was composed of students who had a lower composite ACT score. Because of their lower average score, the students in this section were expected to earn slightly lower grades in the course than their counterparts in the other section. This second section of the course was taught in a traditional classroom but also used active learning teaching methods. The students in this section had a higher average ACT score than those in the first section, and were thus expected to earn higher grades in the course. Both sections of the course were taught by the same instructor. Researchers found that students in the active learning classroom, despite their lower ACT scores, achieved grades that were equal to those of the students in the traditional-classroom section of the course.

### Using the PAIR-up Model to Evaluate Active Learning Spaces

*http://er.educause.edu/articles/2009/3/using-the-pairup-model-to-evaluate-active-learning-spaces*

Before studying the effects of active learning on student outcomes, the University of Minnesota had studied students' and instructors' reactions to active learning classrooms. In 2007-2008, researchers surveyed students and instructors who had experienced active learning courses.

- Faculty felt that the active learning environment created a deeper student-instructor relationship, and shifted the instructor's role to that of a "learning coach" or facilitator.
- Instructors appreciated that the active learning classrooms were designed for collaboration, which decreased instructors' class preparation time and allowed them to focus more on the course content.
- Perceptions of the active learning classrooms were favorable overall, with students feeling that the classrooms helped them to feel more active and talkative in class.
- Teamwork and collaborative projects especially benefited from the active learning environment.
- Some instructors even felt that the most important "technology" in the active learning rooms was the round tables, which encouraged student interaction and collaboration.
- One instructor did note an issue with accessibility: Students with physical sensitivities or special needs sometimes found the active learning classrooms too "visually busy" and had difficulty dealing with the increased amount of cognitive load from the many sources of visual stimuli.

### Active learning increases student performance in science, engineering, and mathematics

*http://www.pnas.org/content/111/23/8410.full.pdf*

A 2014 study by researchers at the University of Washington and the University of Maine found that active learning techniques improved average exam scores in STEM courses by about 6%. Students in traditional lecture classes were about 1.5 times more likely to fail a course compared to students in active learning classes. This study found that active learning had the greatest impact on higher-level cognitive skills (deep understanding of course content) versus lower-level skills (solving quantitative problems).

### New challenges to active learning initiatives

*http://er.educause.edu/articles/2016/1/new-challenges-to-active-learning-initiatives*

Researchers at Case Western Reserve University studied active learning courses over two years and surveyed students for their views on active learning environments.

- Students in the active learning courses reported engaging in greater amounts of active group work, group projects, and collaborative learning with peers as compared to traditional classes.
- Greater enthusiasm for the courses and positive effects on learning were also noted by the students.
- However, students in larger classes (more than 50 students) were far less likely to recommend that the course be taught in an active learning classroom again; many indicated that the active learning techniques were less effective in larger classes because the instructors were not able to be as involved with the students.
- The researchers found that some of the instructors for these larger classes were not well-prepared to teach in an active learning environment; instructors with more experience in active learning tended to see greater student success regardless of class size.
- This suggests that faculty education and preparation is critical to achieving student success with active learning, especially for larger class sections.

## Additional research:

- **Investigating teaching and learning at technology-infused TILE classrooms at the University of Iowa**
  *http://www.educause.edu/sites/default/files/library/presentations/ELI12/SESS14/ELI_PPT_ForWeb.pdf*

- **Can flipped classrooms transform STEM courses?**
  *http://www.academicimpressions.com/news/can-flipped-classrooms-transform-stem-courses?mkt_tok=3RkMMJWWfF9wsRonu6nPdO%2FhmjTEU5z17eguWqC%2BlMI%2F0ER3fOvrPUfGjI4EScprI%2BSLDwEYGJlv6SgFS7jFMaxzzLgLXBM%3D*

- **How does technology-enabled active learning affect undergraduate students' understanding of electromagnetism concepts?**
  *http://web.mit.edu/edtech/casestudies/pdf/teal1.pdf*

- **Technology for active learning**
  *http://web.mit.edu/edtech/casestudies/pdf/teal2.pdf*