

Cornell University College of Human Ecology

## **DEVELOPING A TRANSFORMABLE CLASSROOM**

# AN ACADEMIC AND ADMINISTRATIVE PROJECT WITH STUDENT LED DESIGN

PROCESS WHITE PAPER

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This white paper describes the process Cornell University, College of Human Ecology employed to convert two existing lecture classrooms into transformable instructional environments with student design professionals through an academic course and administrative construction project.

#### PREFACE

### WHAT THIS DOCUMENT IS

This white paper describes the process Cornell University, College of Human Ecology employed to convert two existing lecture classrooms into transformable instructional environments as a joint academic course project and administration construction project where undergraduate students with a major in Design and Environmental Analysis (DEA) were engaged as the primary designers for the space and charged with the development of innovative ideas and would be involved in the project from design to construction.

Their goal was to develop classrooms which could readily transition between lecture, collaborative lecture and active learning in small groups. In addition to outlining the method and approach in developing these classrooms, this paper also describes the spatial and technological solutions implemented, and the efforts to raise community awareness of these new classrooms.

#### WHAT THIS DOCUMENT IS NOT

This document neither analyzes the strengths of different pedagogical methods, nor prescribes specific design solutions (such as lighting, acoustics, sightlines, network connectivity, electric distribution) or technology standards for learning environments (AV system design, assistive listening needs, computer selection or support, etc).

#### **EXECUTIVE SUMMARY**

In the fall of 2013, the College leadership launched a living learning lab project intended to address the evolving needs of the built environment to respond to the pedagogical flip of instruction. Our intention was not only to address this needs but to develop and share a model which could be readily integrated into any number of facilities for any number of programs institution-wide.

The vision of this project is to de-couple the technology/equipment from the learning space construction, reducing cost and lack of post-construction scalability – often the key limiting factors for developing active learning spaces. The goal of the project as charged to a junior studio of Design and Environmental Analysis students was:

to create designs and specifications for mobile, modular student workspaces that can transform a traditional classroom into an active learning room on demand.

The development of these classrooms was executed in two phases: the first was a "Concept Competition"; the second we termed "Administrative Advancement." A third and final survey/feedback loop phase will be initiated once these spaces are in use. Outreach and communication about the essential components of transformable classrooms was determined as integral to successfully addressing the pedagogical needs of active learning. By marketing the spaces as "coming soon" and training the faculty and students, the pedagogical benefits of the new spaces were realized earlier and the user experience has been maximized.

Our transformable classrooms aim to address the high level of demand for different flexible and adaptable instructional settings while providing relief for resource constraints, specifically:

SPACE CONSTRAINTS: generating higher space utilization

FISCAL CONSTRAINTS: reducing overall capital expenditures and reduces staff support time

INSTRUCTIONAL INEFFICIENCY: reducing loss of time or engagement in courses during transition between multiple instructional styles in a single session.

Three main teaching styles were considered in planning for these classroom modifications: traditional

lecture, collaborative lecture, and active learning in small groups. Based on the spatial considerations of the

three styles, three key objectives for a transformable space were identified: to provide a flexible facility, to develop an interactive platform, and to create a comfortable and enticing space. A subsequent solutions search for each of the project goals noted above generated a product inventory of furniture and technology equipment which provided:

A FLEXIBLE FACILITY: Modular and mobile furniture plays a fundamental roll in making a space a suitable transformative classroom. As a result of frequent reconfiguration, durability becomes a main logistical consideration.

AN INTERACTIVE PLATFORM: Technology is fundamental in creating an interactive platform. All technology should facilitate collaboration, be easy to use, be interactive, and align with and support the classroom learning goals. These characteristics can be found in a variety of low and high technology solutions

A COMFORTABLE AND ENTICING SPACE: Material and finishes are integral to making a flexible and interactive environment comfortable and enticing for users. Considerations should be made to spatial ergonomic elements (day lighting and acoustics), natural materials, circulation and storage.

Through our experience, we propose a list of furniture and technology product to serve as representative of examples of equipment which can provide a transformable classrooms for a total cost of ~\$3000 per student for a classroom of 26 students. These items can be readily procured and installed in any number of classroom settings to address the increasing desire for more active and engaged instructional space.

#### INTRODUCTION

The College of Human Ecology is one in transition from both and staffing and facilities perspective: our professorial new hire rate exceeds 30% over the past 5 years, and we are in the midst of total renovation of our 1930s home facility. Many new Assistant Professors arrive to the College with previous experience in engaged/active instructional pedagogy which is then reinforced by the orientation provided by Center for Teaching Excellence. With capital dollars allocated to renovate the inventory of instructional spaces we have in the College, we are well positioned to respond to the desire to develop an active learning curriculum across the College, for traditional lecture courses beyond the specialty labs and design studios.

In 2012, the College responded to an SUNY ITTG grant notice with a proposal to develop a readily reproducible model to entice movement from traditional lecture style to active learning. While we did not receive this grant, it was from this effort that the current project was spawned.

In the fall of 2013, the College leadership partnered with a junior studio course in Design and Environmental Analysis to launch a living learning lab project intended to address the evolving needs of the built environment to respond to the pedagogical flip of instruction. Our intention was not only to address this needs but to develop and share a model which could be readily integrated into any number of facilities for any number of programs institution-wide.

The goal of the project as charged to the junior students was: to create designs and specifications for mobile, modular student workspaces that can transform a traditional classroom into an active learning room on demand. The vision of this project is to de-couple the technology/equipment from the learning space construction, reducing cost and lack of post-construction scalability – often the key limiting factors for developing active learning spaces.

Space influences learning by influencing behavior. Arrangement of furniture and educational tools in a space encourage level of engagement, types of activity, and direction of dialogue. In turn, spatial influences naturally lead to alignment of particular functions with particular spaces.

In a resource rich environment it is easy to optimize space for single, specialized uses. However, in most instructional environments, the demand for classroom space far exceeds availability and thus most spaces must fulfill multiple needs. The desire to create readily transformable spaces arises from a high level of demand for different types of educational settings in a resource constrained environment. A transformable classroom would provide relief for:

SPACE CONSTRAINTS: Supporting multiple pedagogical styles leads to higher space utilization, reinforces pedagogical practices in team settings, and provides team spaces for academic work outside class.

FISCAL CONSTRAINTS: Developing spaces where furnishing and equipment can address multiple needs reduces overall capital expenditures and reduces staff support time.

INSTRUCTIONAL INEFFICIENCY: Easy self-service space transformation provides for changing activities without significant loss of time or engagement in courses that employ multiple instructional styles in a single session.

#### LEARNING STYLES AND TRANSFORMABLE SPACES

In response to a pedagogical push to flip the traditional lecture course thereby receiving more active participation by students in the learning process, this project examined various teaching styles and compatible classroom layouts.

Three main teaching styles were considered in planning for these classroom modifications: traditional lecture, collaborative lecture, and active learning in small groups. Each has different spatial needs and instructional support materials.

*TRADITIONAL LECTURE:* This environment is used to convey critical information, history, background, theories and equations. Usually the lecturer will stand at the front of the room and recite information relevant to the lecture's content. Student engagement is primarily to listen, and absorb information. This style works especially well in auditoriums or tiered classrooms. In this relatively static setting, there is one main focal point in the room: a traditional front of room, and fixed instruction station to support the activities. The layout most conducive to traditional lecture includes rows of seating that are parallel to the front of room and concentric such that students face the front of room.



Room in a Traditional Lecture layout

*COLLABORATIVE LECTURE:* The collaborative lecture functions predominantly like a lecture setting, with the occasional break in presentation to allow students to discuss and analyze the information they just received. This style works especially well in flat floored classrooms. Collaborative lecture requires a traditional front of room with one instructional focal point. However, the room layout is

modified from a traditional lecture style with tables in rows perpendicular to the front of room that position students face to face and are clustered to allow small group discussion.



Room in a Collaborative Lecture layout

ACTIVE LEARNING IN SMALL GROUPS: In this paper, active learning in small groups is defined as a teaching/learning style where students discuss, read, write, and engage in many activities to analyze the information they are presented. Active learning works especially well in a seminar and/or studio environment. As such, active learning requires flexible room layouts, which are readily transformable, and multiple surfaces for the presentation and analysis of information (i.e., digital displays, white boards, flip charts, etc.). A classroom optimized for active learning requires mobile furniture to be grouped with desks and tables facing each other. Often, it also implies that the teacher's station may be mobile as well, to eliminate the traditional front of room, and put focus on the groups of students, rather than on a point of information distribution.



Room in an Active Learning in Small Groups layout

#### GOALS OF A TRANSORMABLE SPACE "ONE ROOM FITS MOST"

Based on the spatial considerations of the main learning styles, three key objectives for a transformable space are: to provide a flexible facility, to develop an interactive platform, and to create a comfortable and enticing space. These goals aim to enhance the learning experience for students and provide an efficient, thoughtful space that includes all services an instructor would need to accomplish a wide array of instructional objective.

A FLEXIBILE FACILITY: A flexible facility emphasizes modularity and mobility, user control, and dispersed seating. This characteristic addresses the need to rearrange the classroom to suit the various learning objectives. The room can be aligned in rows for traditional lecture and arranged in a variety of group sizes for collaborative lecture or active learning. Instructional tools in the room such as mobile whiteboards and other low and high-tech instructional support items can readily move for access by students in any classroom setup.

*AN INTERACTIVE PLATFORM:* An interactive space provides both low and high-tech tools, multiple focal points, and positive distractions. The variation in collaboration tools should account for

different students' comfort levels with technology: students can share ideas and execute activities in a way that works well for them, personally. Similarly, when lecturing, an instructor may choose the type of technology that suits the subject matter and teaching style. The classroom should provide the opportunity to post informational material around the room, on either tack boards, magnetic boards, or multiple digital displays. Having multiple focal points displaying the same information in the room accommodates varying layouts and resulting sightline challenges.

A COMFORTABLE AND ENTICING SPACE: An environment that appeals to and attracts faculty and students also encourages them to 'settle in' and develop a sense of ownership and increased engagement and focus on the instruction. The classroom should address personal needs such as space for belongings, ergonomics, and universal accessibility. Intuitive, effective, and well-integrated technology and support materials provide an environment that allows for optimal instructional opportunities. Providing multiple opportunities for the front of room improves the classroom experience and minimizes barriers, providing a more equal experience for all students. Lastly, access to natural daylight, incorporation of natural materials, as well as controlled room acoustics and environmental condition significantly contribute to comfort in the space.

#### METHOD AND APPROACHOUR PROCESS

This project was based on and inspired by the academic framework of the College and University. Once the project was established, the development of these classrooms was executed in two phases: the first was a "Concept Competition"; the second we termed "Administrative Advancement." A third and final survey/feedback loop phase will be initiated once these spaces are in use.

ACADEMIC FRAMEWORK: Two academic contexts framed the notion of developing a transformable space to accommodate variety of activities. Human Ecology has identified eight pedagogical learning outcomes which direct the instructional program of the College:

- Comprehend disciplines and fields;
- Think critically;
- Apply multi-disciplinary perspectives;
- Innovate in research, design, or practice;
- Write/speak/use visual communications effectively;
- Work effectively with others;
- Display commitment to ethical principles;
- Direct own learning.

Because these outcomes are best achieved in a variety of learning environments, they served as a guide for the design of a transformable classroom that would be able to meet most if not all of these objectives.

The Center for Teaching Excellence (CTE), the center that promotes the advancement of teaching and learning at Cornell University, is guiding a university-wide initiative to drive instruction towards a higher position on Bloom's Taxonomy of instructional activities.



While they suggest a variety of strategies for instructors to engage students, they acknowledge that advancement of the instructional paradigm is most readily achieved in smaller classes, and note that the activities of the classrooms should be aligned with the learning goals of the class.

*CONCEPT COMPETITION:* The concept phase of the project began as a Design and Environmental Analysis (DEA) junior studio assignment. DEA awards degrees in Design Strategy, Sustainable Futures and Health and Well-Being. Multiple teams of students were given the prompt to explore active learning and provide the college with designs of transformable functionality to inspire future classroom renovations. [See Appendix A] The studio had the opportunity to interview fellow students and several functional or subject matter experts throughout Cornell to gain a broad and thorough understanding of how each member of the classroom is affected by their environment. Each team submitted a concept which met both the academic requirement of the course and provided the College with the beginnings of a solution to the newly identified need.

Ultimately, two concepts advanced to the College for consideration. These concepts were 'The Learning Game' and 'Building on Basics.'

THE LEARNING GAME: The Learning Game team likened active learning to a game show, and designed a dynamic classroom that would elicit the same excitement and focus found in a game show environment.



### The Learning Game presentation poster

*BUILDING ON BASICS*: The Building on Basics team realized active learning is inherent in primary school classroom environments, and designed a transformable space that couples basic features found there with innovative technologies.



The Building on Basics presentation poster

Throughout the term, the teams received guidance from both academic and administrative leadership in the College: the studio professor and support personnel in Facilities and Information Technology. This important collaboration between faculty and administrators allowed for a holistic perspective which supported student led design development to meet the needs of a wide range of University stakeholders.

ADMINISTRATIVE ADVANCEMENT: The College of Human Ecology believes in supplementing the classroom learning of its Interior Design students through living learning lab projects which provide hands on experience in a project beyond the design concept phase through to construction. After the studio submitted their final recommendations for each concept, the College worked to advance

these projects through final design and construction to use and assessment. During the administrative phase, interested design students from the concept competition phase were taken on as employees of the college to develop the design from conceptual ideas into buildable solutions. The students received mentorship from two professors that are experts in the fields of interior design and ergonomics/user experience. A professional design firm was engaged to review the design and to provide the final, stamped set of construction documentation and specifications. The students had the opportunity to witness the modifications required to the design drawings, furthering their understanding of the level of detail and consistency that is required by construction level documentation. This stage also included the creation of an accompanying faculty/student support website, a full set of computer-generated interior perspectives a set of instructor and student feedback surveys, as well as posters and promotional materials for the project

*SURVEY FEEDBACK LOOP:* Active learning classrooms and transformable instructional environments are new trends in pedagogy, and the classroom discussed in this paper is meant to serve as a test environment to determine the best practices in responding to the shift of instructional styles. Thus, feedback is a necessary part of the design process. We determined surveys as the most effective means to secure feedback from both faculty and students. The student design team had the opportunity to meet with advising experts from the Cornell Survey Research Institute to gain the skills and insight required to develop and administer effective surveys. In this project, six types of surveys have been drafted. Our surveys are tailored specifically to each user group, adjusted to draw information from their point of view and their unique experience. Each survey shall be administered at the beginning, middle, and end of the semester.

BASELINE SURVEYS: Two baseline surveys, one intended for the general body of CHE instructors and one for all CHE students, are to be administered at the beginning of the semester. These surveys will ask both parties general questions with the aim of establishing

a baseline of data for use in analysis of later feedback. These surveys endeavor to gauge whether faculty and students have heard of the classroom, have explored the classroom, or used the room after hours or for activities outside of scheduled classes. The focus of these surveys is to understand the baseline impression of active learning environments and expectations of use.

DESIGN SUCCESS/FAILURE SURVEYS: Also during the start of the semester, and again in the middle of the term, a second set of surveys will be exclusively administered to those faculty and students that are scheduled to use the room. This round of surveys will vary from teacher to student, as well as from classroom to classroom, in order to gain specific information about the successes and failures of each specific concept. These questions are essential to testing and discovering the effectiveness of the specific components of the classroom: whether it is being used, whether any difficulties have been encountered, or whether it is so successful that it overshadows a need for a different component of the room.

*NEW CLIMATE SURVEY*: Finally, at the end of the semester, the same baseline and classroom-specific surveys from the beginning of the semester are to be re-administered. This is to gauge if any changes have taken place in the awareness of, and the impressions of usability and functionality of the space. For example, to note negative changes such as components breaking or becoming unusable, or positive changes such as students growing accustom to the furniture and technology and can now use it more efficiently and effectively.

#### SOLUTIONS SEARCHASPECT OF OUR OVERALL PROJECT

Converting a traditional classroom to become transformable required identification of solutions for each of the project goals noted above: to provide a flexible facility, to develop an interactive platform, and to create a comfortable and enticing space.

A FLEXIBLE FACILITY: Modular and mobile furniture plays a fundamental roll in making a space a suitable transformative classroom. As a result of frequent reconfiguration, durability becomes a main logistical consideration.

Modularity is the ability of the furniture to fit together in multiple ways to support various room layouts. This is important for collaboration in a transformable space because it physically brings students together and provides flexibility to use the room in a variety of ways.

Modularity was achieved by the selection of trapezoidal tables, which can be arranged in rows, or as circles, by connecting their non-perpendicular sides.



Mobility is how quickly and easily the furniture can be moved. It can either encourage or discourage use of the furniture's modularity. By adding casters to the tables and chairs, they can be promptly and conveniently relocated in the room.

Durability is necessary to support the required mobility of the layout. The furniture must be durable and high quality to withstand the repeated frequent reconfiguration and account for any rough handling or bumping of the furniture.

AN INTERACTIVE PLATFORM: Technology is fundamental in creating an interactive platform. All technology should facilitate collaboration, be easy to use, be interactive, and align with and support

the classroom learning goals. These characteristics can be found in a variety of low and high technology solutions. Logistically, spaces with high tech solutions must distribute adequate power to support these technologies, and flexible facilities must also account for the reconfiguration of these technologies throughout the space.

We found low tech solutions equally as important as high tech solutions to achieve balanced engagement of students given varied comfort levels. Low-tech solutions like mobile whiteboards with markers and extra-large paper pads facilitate student brainstorming and collaborating on one shared surface.

We found that the power of packaged high tech solutions resides in the integration and coupling of solutions together with other low tech and high tech options. In our spaces independent solutions are integrated with a PC, projector, and projection surface – often doubling as a whiteboard – and coupled with a second solution to achieve the maximum opportunity for team interaction and collaboration. Our high tech solutions include: Clickshare, Team-spot, and eBeam.

*CLICKSHARE BY BARCO*: This is a hardware-based technology that provides a dongle that plugs in to a computer to project that participant's screen. Up to four participants can project their personal displays simultaneously, and the dongle can be quickly past around for different participants to share. We chose magnetic white boards as the projection surface which provides the possibility for it to be mobile and multi-use. For example, projecting on a magnetic whiteboard allows students to write with markers on the projected material without altering the digital copy and post hard copies of reference or supporting material directly on the board.

TEAMSPOT BY TIDEBREAK: This is a software-based video sharing system that allows students and instructors to simultaneously work in a shared digital workspace using their personal devices as keyboard and mouse control. Team-spot provides a shared workspace Page | 13 where all participants can advance an original document through digitally edit the same material at the same time, and then retrieve a new version from the shared workspace. Independent student groups work in a Team-spot workspace. Multiple Team-spots then come together to form the instructor led Class-spot.

*EBEAM BY LUIDIA*: This is a digital notation program that digitally records and saves the path created by the eBeam marker or capture pack. Either with or without ink, paired with a projector or used on a tradition white board surface, the eBeam digitally traces and captures the path of the marker, making it possible to share the collaboration notes digitally.

In a high-tech instructional setting with furniture that is frequently rearranged, power needs to be very evenly distributed and made readily available for the students as well as the instructor(s). We identified two approaches to accommodate the needs of instructional technology tools as well as students' devices: floor boxes distributed in a nine-foot (9') grid, and Wiremold with outlets evenly spaced around the perimeter of a room.

A COMFORTABLE AND ENTICING SPACE: Because of the specific characteristics of the rooms preselected for this project, we were not required to pursue solutions for the identical set of considerations for each room. The location of the rooms along the western exposure of the facility provided us with the desire natural day lighting. One room was benefited with an extensive amount of natural material (wood flooring and trim) but is known to have serious acoustic challenges. The other room was absent of any natural materials but was absent of acoustic challenges. The resulting FFE and interiors finishes packages provided acoustic solutions for one space and natural materials for the other.

We found two shared logistical considerations across the rooms which are integral to making a flexible and interactive environment comfortable and enticing for users: circulation and storage.

To support the ready reconfiguration of the furniture, we identified the importance of extra space allocation to circulation. In fixed rows, the furniture is easy to predict, and circulation space can be accounted for more precisely. When furniture is grouped and with mobile whiteboards and other instructional tools moving around the room, space is used less efficiently and required circulation space is less predictable and harder to account for in a generic way. As a result, we chose to calculate circulation space to be comfortable in the collaborative layout, which resulted in approximately twenty percent (20%) more space allocated to circulation than would have been in the traditional lecture layout.

For students to collaborate well in groups, move around the room freely, and reconfigure the room efficiently, we found personal storage to be an important consideration. Cubbies, shelves, and coat hooks are conveniently located within each room but away from the student work area. This allows for students to put their belongings aside yet close enough to keep an eye on them. To support the ready transition between lecture and collaborative activities, we determine the student chairs as another solution to address this need. The student chairs are equipped with large storage baskets between the casters to provide space nearby to stash student devices, and/or miscellaneous learning support materials when desk top surface is required.

A sample budget of the proposed equipment and furniture solutions from above is provided below for reference. Prices reflect the 2014 Cornell buy price (not manufacturing list price).

Solution	Product	Budget	Per	
Student Chair	Node Chair	\$220	Student (x25)	\$5,500
Student Desk	Arc-8 Desk – Smith System Or	\$200	Student (x25)	\$8,300
	Wavelink Transition Desk – Versteel	\$469		
Instructor Chair	Liberty Chair	\$555	Room	\$555
Instructor Desk		\$430	Room	\$430
Low-Tech Collaboration Tool	Egan V-Series	\$1,250	Pair of students (x12)	\$15,000
High-Tech Collaboration Tool, support	Projector with Base Laptop	\$1,000 + \$1,400	Team (x5) + 1 for room	\$14,400
High-Tech Collaboration Tool, support	Egan V-Series	\$1,250	Team (x5)	\$6,250
High-Tech Collaboration Tool Option 1	ClickShare	\$3,450	Team (x5) + 1 for room	\$20,000
Tool Option 2	Team-Spot	\$3,334		
High-Tech Collaboration Tool 3	eBeam	\$1,000	Team (x5) + 1 for room	\$6,000
			Total per room	\$76,435
			Cost/student	\$3,057

## COMMUNITY INVESTMENTOUTREACH AND COMMUNICATION

Outreach and communication about the essential components of transformable classrooms is an integral part of successfully addressing the pedagogical needs of active learning. By informing the faculty and students of the opportunities these elements present, the benefits are realized earlier and the user

experience is maximized. Spreading awareness was done in a variety of ways: direct communication with faculty, development of a support website, installation of informative displays in the public corridors, as well as a training program of faculty/students.

ACTIVE LEARNING WEBSITE (<u>http://activelearning.human.cornell.edu</u>): Because it is always available to the students, faculty, and general community an informative and intuitive website is an excellent tool for spreading awareness about the existence of the new classrooms. The website provides in depth information about the specifics aspects of each room, provide reference links for additional information on products, outline the process by which the rooms were transformed, and offers contact information for those that were involved in the project for further dialogue.

*INFORMATIVE DISPLAYS:* Placing informative posters and displays in the building where the classrooms are located is a very basic and useful tool to generate excitement and awareness of classrooms while they are in development. An eye-catching display in an area with high traffic can encourage passers-by to explore the rooms while they are in the building.

*COMMUNICATING TO FACULTY:* Direct, one on one communication with faculty, coupled with a room tour, is one of the most effective ways to spread awareness and generate positive user experiences. This provides an opportunity to engage future users of the classroom, as well as to receive feedback from faculty that currently use the room, and improves future classroom projects.

FACULTY/STUDENT TRAINING: A strong training program is great opportunity to educate faculty and students about the characteristics of the room that set it apart from a traditional classroom. This effort includes demonstrations with the room-specific technologies, furniture, and other features so that the users are more comfortable with the space, and can take full advantage of what the space has to offer.

#### **PROJECT TAKE-AWAYS** FUTURE IMPLICATION

Our development of a transformable classroom was driven by the need to provide a cost-effective space that would allow instructors more options in how they teach course material. The project turned out to be about much more. Defining the <u>what</u> of the project and having students designers framing the <u>how</u>, changed the outcomes in ways we didn't expect; varying tables and chairs in the same space, expanding the use of low tech collaboration devices in a space that's also technologically modern, including natural lighting, materials, and positive distractions. The student designers were able to reach demographics, such as other students and faculty, in a very different and more intimate way than achieved by design professionals and administrative team and the resulting design solutions reflect that heightened awareness of user needs. We would encourage anyone developing classrooms to include students, not as 'just another stakeholder', but as a design partner to develop truly thoughtful and successful space.

While the technology and white board solution we chose were off the shelf purchases, combining them to create mobile technology stations required some custom manufacturing. At this time mounts and brackets for this purpose were not identified in the market place. We developed projector mounts that hang from the marker trays and stringers / hangers for laptops or other equipment that thread into the marker board rails. To minimize the visual impact and to respect the aesthesis of the design, heavy duty clear acrylic was laser cut and glued together to create these custom accessories.

Timelines, as always, become both compressed and exaggerated in a project that includes many stakeholders and requires a variety of sign-offs. Add into the typical project considerations that of a student learning opportunity and schedule falls victim to more mission driven goals. However, it is our experience that the benefits outweigh the costs of schedule delays.

As of the writing of this paper, one room using the *Building on Basics* concept has been built and is currently being used for instruction. The room identified for the *Learning Game* will be constructed over the winter break. The initial cycle of survey and feedback has been completed; mid-term surveys have yet Page | 18

to be completed to determine the strengths/weaknesses or effectiveness of the designs we have chosen to test. However, survey results will be available before we start the design process for the third phase of renovation, intended to include a new classroom wing and greatly inform that process.

## Appendix A

## **DEA Junior Studio Project**

## Building the Transformable Classroom

The goal of this project is to create designs and specifications for mobile, modular student workspaces that can transform a traditional classroom into an active learning room on demand. By developing this form of innovation, we will benefit by being able to de-couple the technology/equipment from the learning space construction, reducing cost and lack of post-construction scalability -- the key limiting factors for developing active learning spaces, and produce classrooms of any size by replicating the workspaces for the needs of the space. As many schools use or are developing active learning approaches, this project will provide readily available models to immediately integrate into design and construction projects.

The requirements will come from interviews with project stakeholders including Cornell faculty, staff specializing in instruction, IT, AV, and facilities and also from professional consultants in the IT, AV, and furniture industries. In this project, you and your peers are also stakeholders in the project and this will allow for a user-centered approach by including your own first-hand experiences and expectations.

The initial conceptualization for the mobile student workspaces is that these will be a combination of furniture (e.g. desktops and seats), IT (e.g. hardware and software), and AV (e.g. monitors and electronic chalkboards) to enable 5-9 students to work individually and together in class sessions. Students will use their personal computers and shared IT and AV equipment as they access and analyze class materials, discuss class content, create solutions to problems, and report to each other and the larger class. The instructor has IT and AV support to move around the room to work with individual groups, address the whole group, and display group work to the whole class. This initial conceptualization results in a preliminary list of foundational design elements and strategies for the workplace design in this project (Table 1). These will be revised and elaborated upon through the input from the various stakeholders in the design process.

Table 1: Preliminary Foundational Design Elements and Strategies of Workspace Design			
Sustainability	Provide for sustainable, renewable or recycled materials		
Economy	Use off-the-shelf furnishings and equipment		
Transparency	Create for an intuitive academic environment and practical maintenance		
Accessibility	Provide for access regardless of disability, ergonomic, simple physicality		
Scalability	Can be deployed independently, or replicated for larger installations		
Engagement	Provide for peer-to-peer, group-to-group learning		
Fluidity	Allow freedom of movement for the instructor; enabling quick assessment		
Mobility	Capable of relocation; self-contained, allowing for setup in any space		
Supportability	Easy configuration, modification or replacement		
Flexibility	Support quick transitions of teaching modes: lecture, team project, discussion		
Modularity	Capable of changing technology to support various academic instruction tasks		

This project will conclude with the assessment of the designs and the communication of the specifications to appropriate audiences as described previously in this plan. Project stakeholders will assess each project team's design vision, innovation, delivery, and understanding of the criteria from this document and input gained earlier in the design process in interviews with academic and functional key stakeholders. As this phase does not include a physical deliverable, some criteria, such as ease of use, cannot be tested.

The possible criteria evaluated in this phase include:

Area	Criteria	
Academic and Usability	Compliance with ADA, ergonomic and accessibility needs Match to	
	programmatic needs	
	Options for technology modularity Provisions for intuitive usage, signage	
Administrative and	Ability for deploy independently or synergy in multiple installations	
Technological	Completely self-contained	
	Provisions for sustainable, renewable or recycled materials and energy	
	efficient equipment	
	Possibility of breakdown/setup and movement	
	Reasonable assumption of easy access for equipment maintenance	

It is possible for the outcome of this assessment to be multiple successful designs suitable for adoption. This would be a positive outcome as it would allow for individual preferences in form, function, and design aspects from among the workspace designs that integrate with the academic, support and architectural style best. This design assessment will be the conclusion of the academic project.

## <u>Students interested in continuing with the development of these designs after the academic project</u> <u>finishes are welcome.</u>

As follow-on to the academic project, the college will continue to develop and refine designs that appear promising. After refinement, suitable candidates will be built and tested for physical and programmatic fit in the college. These physical constructs will be made fully functional with the inclusion of AV and IT equipment and be placed in the college for further review and assessment by interested academics.

Designs that pass this phase will be deployed in the college's newest classrooms.