



Classroom of the Future

Amanda Fay

Director of Instructional
Technology



Amy LaDue

Associate Superintendent for
Instruction



Mike Dronen

Executive Director of Technology



Classroom Teaching and Learning Technology





Learning Science > Instructional Practice > Classroom Technology

Learning Science

Dazhi Yang
Department of Educational Technology
Boise State University
Boise, United States

Abstract—This work in progress reports the design and initial implementation of a complete online statistics course. It focuses on applications and adaptations of effective instructional strategies based on current research and best practice of teaching quantitative oriented courses (math, statistics, and engineering) online. The online statistics course was an introductory course and covered common statistical concepts and their applications in educational research for graduate students in educational technology. The course was equivalent to an undergraduate level statistics class for students majoring in science, technology, math, and engineering (STEM). Thus the implications of this project in terms of effective instructional strategies and online course design are relevant to a broad audience including course designers, instructors, and students in science and engineering.

Keywords—teaching online; statistics; instructional strategies

I. INTRODUCTION

Online courses continue to grow unprecedentedly in higher education. According to the tenth annual survey released by the Sloan Consortium, more than 6.7 million students took at least one online course during the fall of 2011 [1]. In addition, thirty-two percent of postsecondary students took at least one course online in 2011. In practice, more instructors are teaching or will teach online courses. However, teaching online is fundamentally different from teaching in a face-to-face setting [2], [3]. Instructors teaching online find it more difficult and time-consuming to teach. It is even more difficult to teach science and other quantitative oriented courses completely online because these courses usually require more hands-on activities and live demonstrations [4]. Meanwhile more educators agree that quantitative oriented courses such as math and statistics can be effectively taught online despite of their application-based nature [4], [5]. However, little has been done in developing effective instructional strategies for teaching such courses online [4]. The research aspect of this project in addition to the design and implementation of an online course was to investigate student's feedback and perspectives on the effectiveness of the instructional strategies and activities adopted in a complete online statistics course.

This work in progress reports the design and initial implementation of a full online statistics course, focusing on

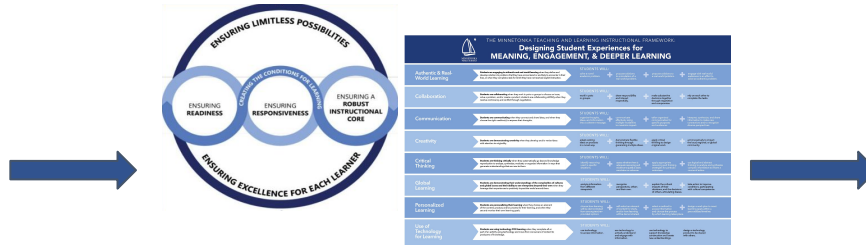
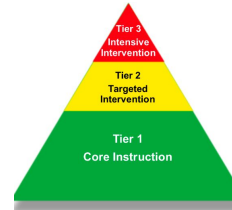
applications and adaptations of effective instructional strategies based on current research and best practice of teaching quantitative oriented courses online. The statistics course was intended for graduate students who were pursuing their masters' degrees in the field of educational technology. The course covered common statistical concepts and their applications in educational research. It was equivalent to an undergraduate level statistics course for students majoring in STEM fields.

II. INSTRUCTIONAL STRATEGIES ADOPTED

There were not many studies on effective instructional strategies for teaching science online. Thus the author extended the literature review on effective instructional strategies and best practice for teaching science online to quantitative oriented courses which include math, statistics and engineering. Four main strategies are most frequently adopted and implemented: (1) promoting interactivity through asynchronous and synchronous communications or delivery [7]–[8], [2], (2) facilitating the applications of concepts using strategies such as problem-based learning [10], [12], (3) using video demonstrations (such as screencasts for demonstrating tools and programs) [13], [14], and (4) conveying a strong social presence or a sense of belonging to a learning community [17]–[18].

Main instructional strategies adopted in this online statistics course included: online discussion forum, video demonstrations of statistical tests and procedures in SPSS, case studies of published research articles, mini projects, learning module reflections. The course used Moodle (a learning management system) to host all the course content. Table 1 briefly summarizes the literature review and instructional strategies adopted in the course.

Interaction can be promoted through either synchronous or asynchronous communication modes. Synchronous communication involves real-time interaction such as instant messaging, chat rooms, and online office hours. They address concerns immediately [8] and are believed to be more effective than asynchronous delivery mode [9]. However, they are often not practical for students that have difficulty meeting at fixed times. Asynchronous communication allows students to have more flexibility and work at their own pace [8], [11]. A drawback to this approach is a delayed time response and difficulty in collaboration. Regardless of delivery modes, conveying a strong social presence is essential to connecting with students in online



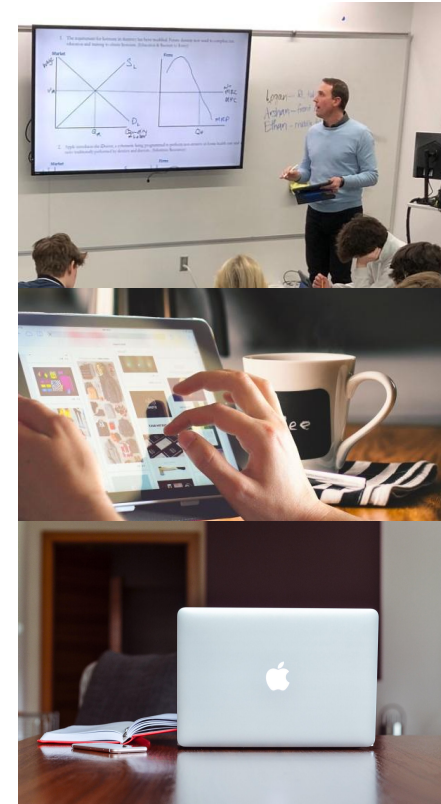
Minnetonka Instructional Technology Beliefs

Technology is a powerful catalyst that serves as a core tool to accelerate learning, promote innovative mindsets and strengthen student success.

Technology is a means that adds value by:

- increasing engagement
- enhancing student-centered learning
- promoting deeper learning by empowering students to know and access tools and resources
- encouraging students to gain, transfer, adapt, and apply understanding to new and existing situations
- increasing efficiency and effectiveness in practices and processes
- providing each student unique opportunities that promote voice and choice
- encouraging individuals to approach problems more creatively, think more critically, collaborate more skillfully and communicate more effectively
- providing access to tools and resources as a means to support each individual student's needs

Summary: Technology is not static; it will continue to evolve. Students must be taught and supported to use technology in healthy, balanced, ethical, responsible and safe ways.





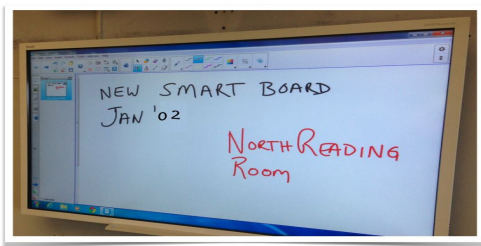
A Brief History of Classroom Technology

- 1890: The Chalkboard
- 1920: On Air Classes via Radio
- 1925: Film and the filmstrip
- 1951 Video Tapes
- 1957: B. F. Skinner's Teaching Machine
- 1955: Ditto Machine/Spirit Duplicator
- 1959: Photocopier
- 1960: The Modern Overhead Projector
- 1972: Scantrons
- 1972: Handheld Calculators
- 1977: Desktop Computers
- 1978: Apple II and MECC
- 1983: First popular Word Processors: MacWrite and MS Word
- 1991: Publicly Available Internet
- 1991: Smart Board
- 1991: Gopher
- 1993: First "easy to use" web browser, Netscape
- 1996: Liquid crystal panel
- **1999-2000: "Web 2.0"**
- 2002: Moodle (K12 ~ 2007)
- **2002-2003: Smart Board software for training/instruction released**
- 2003-2005: Social Media, i.e. MySpace, YouTube, Facebook, etc.
- 2003: Common Sense Media formed
- 2005: Classroom Clickers
- 2007: Google Apps for Education
- 2008: Apple's App Store (500 apps)
- 2010: First generation iPad
- 2011: Blended Learning
- **2012: Second generation LMS's**
- 2012: Software integrations
- 2012: Growing view that EdTech PD is essential
- 2013-14 Marked improvement Ed Tech application functionality and stability
- 2014: Improved learning cycle workflows



Minnetonka's Innovative Instructional Technology Eras

1.



3.



2.



4.





This Next Period for Classroom Technology

- Advanced software (i.e AI)
- High performance devices for all students
- High definition large displays
- Student and teacher mobility
- Post COVID conditions ripe for innovation



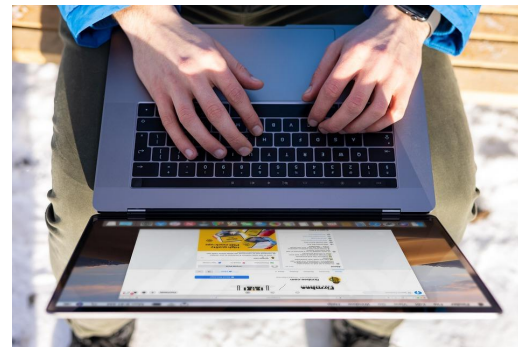
Evaluation, Research, and Findings

- **2019-2020**
 - Teachers surveyed on classroom technology usage
 - District innovation and technology leadership presented to all buildings around the history of classroom technology overall and specifically in Minnetonka Public Schools
 - Themes and big ideas from the teacher survey were also shared.
 - COVID happened and evaluation work was put on hold
- **2021- 2022**
 - Revising Minnetonka Instructional Technology Beliefs



Evaluation, Research, and Findings

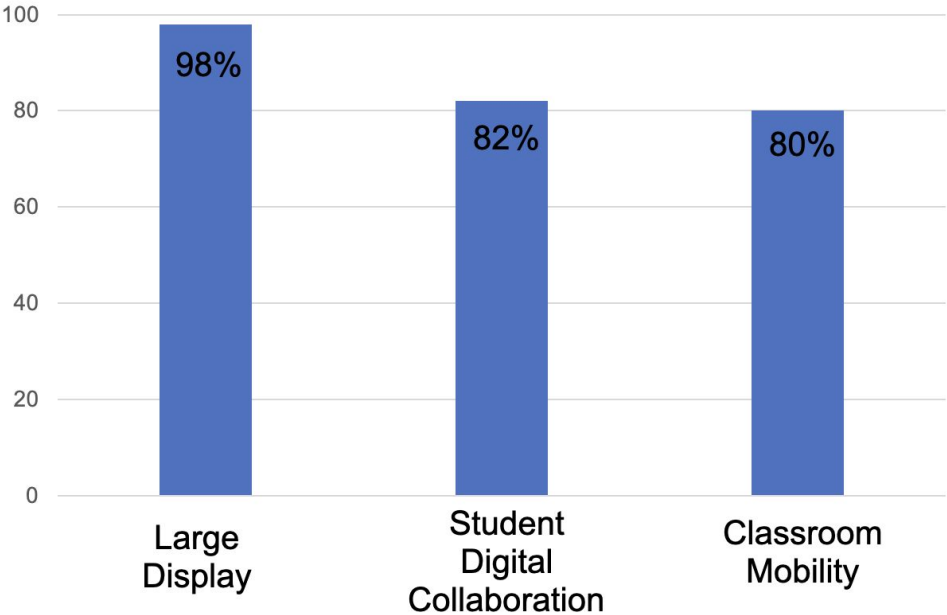
- **2022 - 2023:**
 - “Lessons learned” from the pandemic
 - Stakeholder Feedback: Teacher Google Form Survey, Student and T&L Advisory Focus Groups, PTO/PTA Leaders Feedback
 - Initial Updated K-5 Technology Expectations Shared
 - High School Instructional Technology Pilot
 - Future Classrooms Surveys and Focus Groups
 - Visits to Metro High Performing School
 - Education Technology Vendor Product Showcases





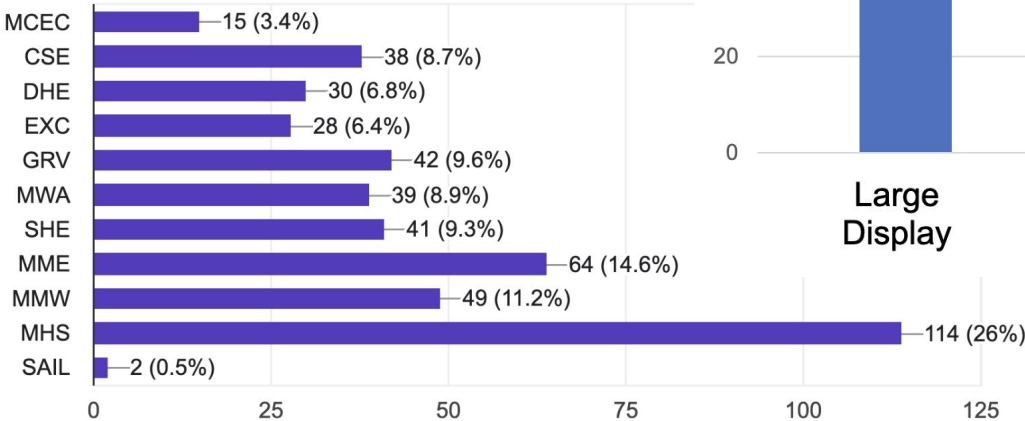
Classroom of the Future Survey - Nov 22

Leading Themes: Teachers



What building(s) are you in?

439 responses





22-23 All Future Classrooms Focus Group Themes

- **1:1 for students** is pivotal
- Currently provided **technology and tools for teachers** provides mobility and flexibility (Apple Pencils, Macbooks, Apple Tv Airplay, PearDeck...)
- **Apple classroom to curate the student experience**, monitor, and showcase their work is very helpful
- Opportunity for **more whiteboard space**
- Opportunity for more **flexible furniture and spaces**
- Opportunity for more **consistent classroom teaching and learning technology** in all spaces



Minnetonka's Classroom of the Future





Classroom of the Future Priorities

- **Visible**
 - consistent, reliable, equitable, modern, ease of use, bright and clear classroom display technology
- **Mobile**
 - responsive, productive & efficient workflows with the tools to support teachers and students both in and out of the classroom
- **Flexible**
 - physically and digitally adaptable based on individual or collective student or teacher needs
- **Collaborative**
 - every student and teacher engaged in the learning



Classroom of the Future Implemented Priorities

Timeline	Implementation Steps
2020	- High School Laptop Implementation
2021, 2022	- High School Apple TV Airplay Implementation
Summer 2022	- High School Instructional Technology Pilot - Desktop Removal
2022-2023	- Middle School Apple TV Airplay Pilots - Elementary Updated Guidelines for Instructional Technology - K-3 Devices Reconfigured and Kept at School
2023-2024	- Elementary HD Display and Apple TV Airplay Pilots - Middle School Apple TV Airplay Implementation - Middle School Teacher Laptops Implementation - 4-5 Devices Reconfigured and Kept at School



Elementary Classroom Pilot

(Visible, Mobile, Flexible, Collaborative)

- 15 Teachers piloting at a variety of grade levels and areas
- Instructional Technology Coach Strong Support
- Focus on Classroom of the Future priorities
- Continuous informal feedback
- Formal feedback focus groups, March-April



Elementary Classroom Pilot Feedback

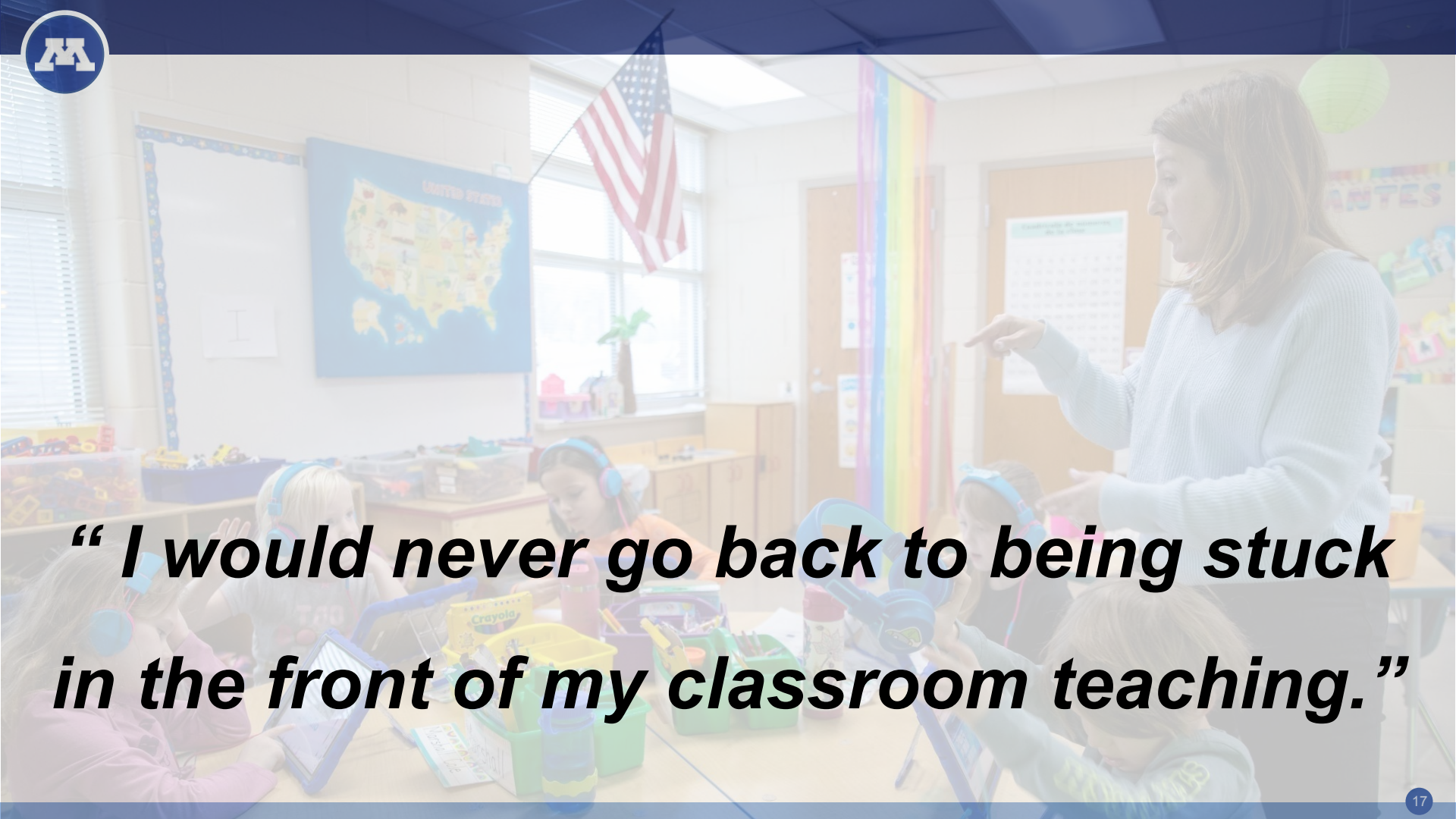
(Visible, Mobile, Flexible, Collaborative)

- **Bright and crisp picture quality**
- **No shadows in front of the screen**
- **Flexibility to be next to, behind, and with students while still interacting with the screen**
- **A whole different way of teaching- including not being tied to the front of the room**



**In a dream world, what else might
you need or want?**

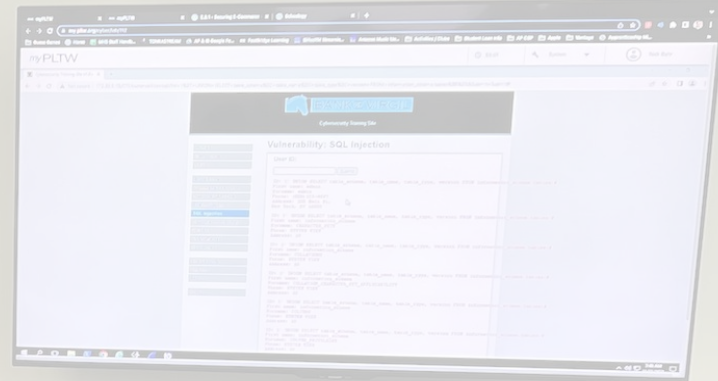
***“I’m good! I’m really happy with
the display and the visibility.”***

A teacher with long brown hair, wearing a light blue sweater, stands in a classroom pointing towards a whiteboard. Several young students are seated at a table in the foreground, wearing blue headphones and looking at tablets. The classroom is decorated with an American flag, a rainbow streamer, a map of the United States, and a whiteboard with the letter 'I'. There are also various classroom supplies like crayons and water bottles on the table.

“I would never go back to being stuck in the front of my classroom teaching.”



“When I look at the room next door, I really notice how much better my new display is over projector and smart board.”





Middle Schools

(Visible, Mobile, Flexible, Collaborative)

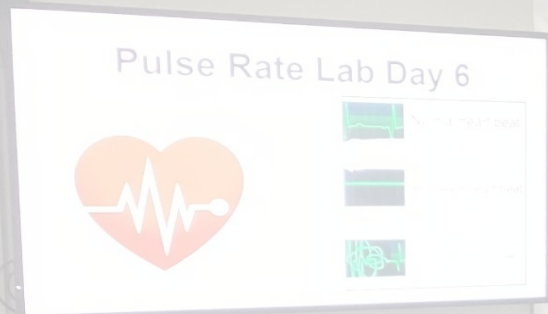
- **Apple TV Airplay** installed in all classrooms
- **Macbooks** deployed to all MME and MMW teachers
- **Classroom Desktops** to be removed summer of 2025
- **Smart Notebook** phase out, end of 2024-25 school year
- **HD Displays** piloted with 100% positive feedback



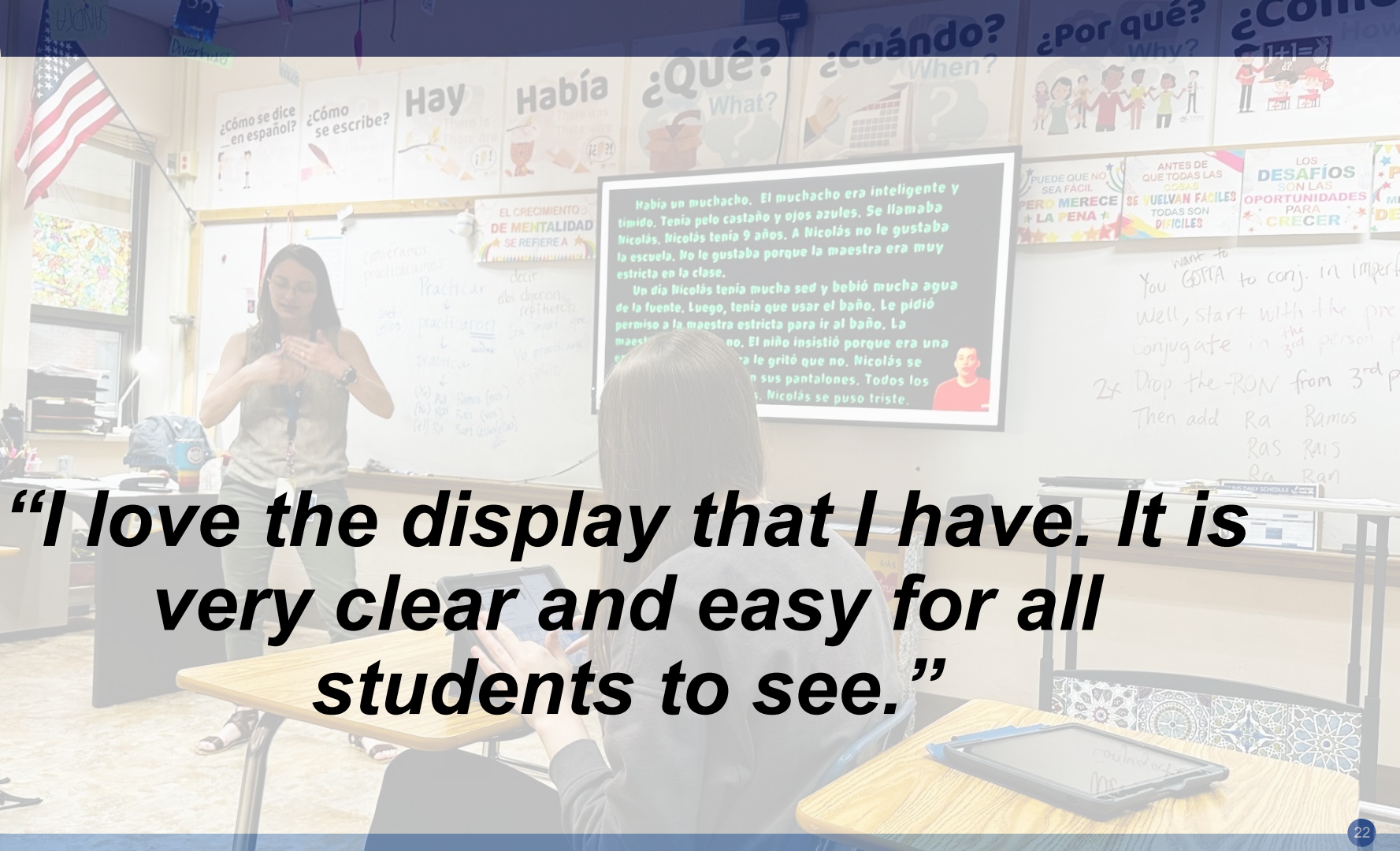
High School

(Visible, Mobile, Flexible, Collaborative)

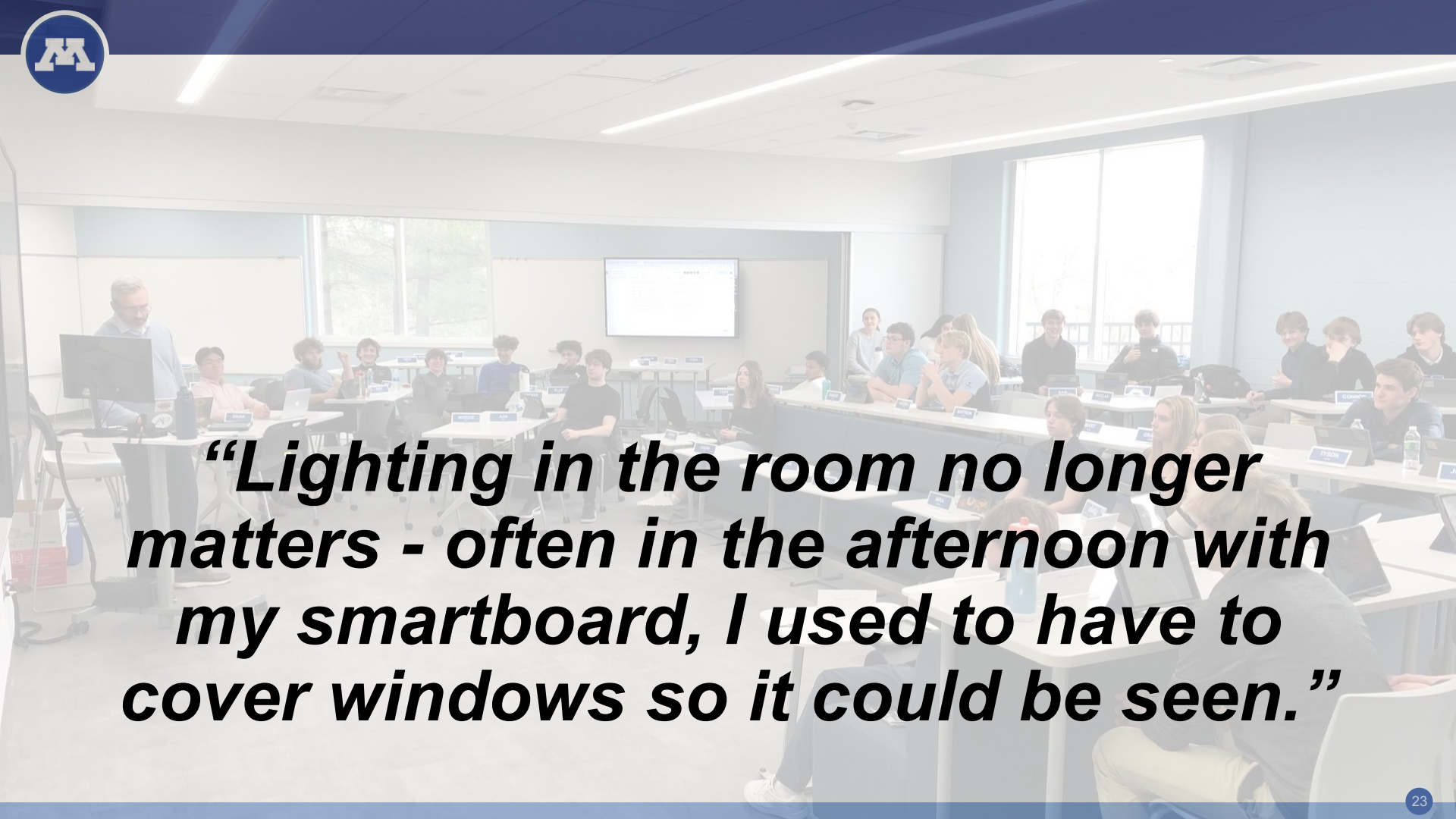
- Macbooks & Apple Tv Airplay strong impact
- HD Displays at Vantage and pilot high school classrooms
- T&L Student Advisory (focus group) repeated with common themes



“The display has really changed my classroom... it is way more clear and I have drastically less students saying that they can't see the board.”



“I love the display that I have. It is very clear and easy for all students to see.”

A photograph of a modern classroom with students seated at long tables, facing a smartboard and a teacher. The room has large windows and a bright, airy feel. The text is overlaid on the image.

“Lighting in the room no longer matters - often in the afternoon with my smartboard, I used to have to cover windows so it could be seen.”



The new **VANTAGE/MOMENTUM** building serves as a model of future classrooms and the environment for all students.





Our Future Work - Consistent Experience

- Updating **all classrooms** with smart, **clear display** technology for an **equitable visual experience** for all students
- Supporting teachers with ongoing access to **mobile, flexible devices**
- Designing classroom environments to align with **best practices for learning**
- Updating **sound enhancement** to provide **equitable audio**
- Designing purposeful and **flexible classroom** layouts, including furniture

