

THE SEXTANT GROUP
AN NYS COMPANY

Facilities Design for Future Technologies

A Framework for Transformation

John Cook
February 2020

1

Credit(s) earned on completion of this course will be reported to American Institute of Architects (AIA) Continuing Education Session (CES) for AIA members.

Certificates of Completion for both AIA members and non-AIA members are available upon request.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

2

Course Summary

Campuses are shifting to new and exciting learning space models that provide opportunities for design innovation.

This course will explore a framework for planning this new breed of Higher Education facilities to support emerging practices in pedagogy and new enabling technologies.

3

Learning Objectives

- At the completion of the course, participants will be able to:
- Describe how student demographics and new technologies have changed expectations for higher education facilities
 - Apply a framework to planning innovative campus environments
 - Identify how emerging technologies impact the design of forward-thinking educational facilities
 - Describe how to adapt architectural and interior design to meet new pedagogical options



4

Agenda: Framework for Transformation

- Discuss & Apply each step of the model



5

*Five years from now you'll be able to find the best lectures in the world on the Web for free...
So... place-based learning will be five times less important than it is today.*

Bill Gates
2010

6

“
 We always overestimate the change that will occur
 in the next two years and underestimate the change
 that will occur in the next ten.
 ”

Bill Gates

7

Don't be this guy!



8

Shared Vision for your assignment ...

- “As we seek to establish ourselves as leaders in the transformational area of personal air travel, we will establish a *Flying Cars Institute of Excellence* on campus. The Institute will be considered a world-class facility, supporting the finest collection of faculty, researchers, students and support staff.”
 - The President of your institution




Workhouse Surefly Aeromobil

9



10

Project Vision Example

The 108,000 NASF / 200,000 GSF building will contain office, instructional and research space, including state-of-the-art hacker space and maker space in which students, faculty, and industrial and community partners share knowledge and ideas via workshops, presentations and lectures, and work on projects individually or in collaboration. ~~It~~ brings together faculty from a variety of disciplines that use powerful computing tools to address some of today's most pressing scientific and societal challenges in areas such as national defense, precision medicine, big data, cybersecurity and language and culture. This building will enhance their ability to collaborate with industrial and community partners and secure sponsored research grants.

- Usually handed to you and others
 - May be beautifully articulated
- Must be central to all project efforts
- Continual touch-base with Shared Vision

11

Shared Vision: supporting data

- Internal Context
 - Directives from President / Provost / Board
 - Institution Vision Statement
 - Institution Mission Statement
 - Campus Master Plan
 - Academic Plan
 - Utilization Study
 - Strategic Technology Plan
- External Context
 - Larger Higher Education context

12

Framework for Transformation

As we seek to establish ourselves as leaders in the transformational area of personal air travel, we will establish a Flying Cars Institute of Excellence on campus. The Institute will be considered a world-class facility, supporting the finest collection of faculty, researchers, students and support staff.

13

Framework for Transformation

14

“
If the ladder is not leaning against the right wall, every step we take just gets us to the wrong place faster.
 ”

Stephen R. Covey

15

STUDENT LEARNING OUTCOMES

Upon graduation the student will:

- Incorporate knowledge from arts, humanities and sciences in the planning and provision of professional nursing care.
- Demonstrate personal effectiveness as evidenced by progressing from awareness to knowledge to proficiency in the following competencies: Clinical/professional judgment, professional valuing/caring and professional role development.
- Demonstrate interpersonal effectiveness as evidenced by progressing from awareness to knowledge to proficiency in the following competencies: Communication, teaching/learning and technology utilization.
- Demonstrate effectiveness in human health outcomes as evidenced by progressing from awareness to knowledge to proficiency in the following competencies: Health promotion and disease prevention and evidence-based care.
- Demonstrate effectiveness within complex health systems as evidenced by progressing from awareness to knowledge to proficiency in the following competencies: Leadership/management, global perspectives and health care systems and policy.

16

From Strategic Plan: Key Goals and Initiatives

Prepare students for the 21st century

- Develop expertise in at least one field
- Acquire familiarity with other disciplines
- Encourage lifelong habits that lead to understanding
- Inspire students
- Prepare for engaged, thoughtful participation in all aspects of life
- Teach students to acquire, evaluate, and apply knowledge
- Active and experiential learning
- Emphasize innovation and excellence in teaching and mentoring

17

Defining the Outcomes

- What will make this project a success?
- Attributes of the project ...
 - Facility on Day 1
 - Facility in Year 5
 - Facility in Year 10
- "A Day in the Life" of ... in 2025
 - a student ...
 - a Faculty Member ...
 - the facility itself ...



18

What skills do employers prioritize?

- Creativity
- Emotional Intelligence (EI)
- Analytical / critical thinking
- Active learning with global mindset
- Judgement and decision making
- Interpersonal communication skills
- Leadership skills
- Diversity and cultural intelligence
- Technology skills
- Agility / flexibility to change



Forbes.com

19

The "T-SHAPED Student"

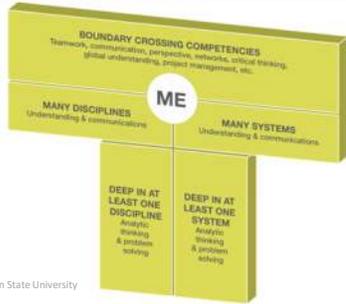


Image courtesy: Michigan State University

20

Apply this step ..

- How would you define the **OUTCOMES**?
- What techniques, tools, people, or other resources would be needed?
- How would you capture, document and present the info?



21



22



23

- Learning Theories ... a partial listing
- **CONSTRUCTIVIST, SOCIAL AND SITUATIONAL THEORIES**
 - [Anchored Instruction \(Bransford\)](#)
 - [Cognitive Apprenticeship \(Collins et al.\)](#)
 - [Cognitive Dissonance \(Festinger\)](#)
 - [Communities of Practice \(Lave and Wenger\)](#)
 - [Connectivism \(Siemens, Downes\)](#)
 - [Discovery Learning \(Bruner\)](#)
 - [Ecological Theory of Development \(Bronfenbrenner\)](#)
 - [Multiliteracies \(New London Group\)](#)
 - [Semiotics \(deSaussure, Barthes, Bakhtin\)](#)
 - [Social Development Theory \(Vygotsky\)](#)
 - [Problem-Based Learning \(PBL\)](#)
 - [Situating Learning \(Lave\)](#)
 - **DESCRIPTIVE & META THEORIES**
 - [Activity Theory \(Vygotsky, Leont'ev, Luria, Engstrom, etc.\)](#)
 - [Actor-Network Theory \(Latour, Callon\)](#)
 - [Bloom's Taxonomy \(Bloom\)](#)
 - [Distributed Cognition \(Hutchins\)](#)
 - [Social Network Analysis \(Scott, Prell\)](#)
 - **COGNITIVIST THEORIES**
 - [Attribution Theory \(Weiner\)](#)
 - [Cognitive Load Theory \(Sweller\)](#)
 - [Cognitive Theory of Multimedia Learning \(Mayer\)](#)
 - [Elaboration Theory \(Reigeluth\)](#)
 - [Expertise Theory \(Ericsson, Gladwell\)](#)
 - [Functional Context Theory \(Slicht\)](#)
 - [Gestalt Theory \(von Ehrenfels\)](#)
 - [Information Processing Theory](#)
 - [Metacognition \(Flavell\)](#)
 - [Situating Cognition \(Brown, Collins & Duguid\)](#)
 - [Stage Theory of Cognitive Development \(Piaget\)](#)
 - [Theory of Mind, Empathy, Mindblindness \(Premack, Woodruff, Perner, Wimmer\)](#)

24

Learning Theories ... a partial listing

- **BEHAVIORIST THEORIES**
 - Classical Conditioning (Pavlov)
 - GOMS Model (Card, Moran, and Newell)
 - Operant Conditioning (Skinner)
 - Psychological Behaviorism (Staats)
 - Social Learning Theory (Albert Bandura)
- **MOTIVATION & HUMANIST THEORIES**
 - ARCS Model of Motivational Design (Keller)
 - Emotional Intelligence (Goleman)
 - Experiential Learning (Kolb)
 - Flow (Csikszentmihalyi)
 - Grit (Duckworth, Matthews, Kelly, Peterson)
 - Intrinsically Motivating Instruction (Malone)
 - PERMA Theory (Seligman)
 - Self-Determination Theory (Deci and Ryan)
- **IDENTITY THEORIES**
 - Erikson's Stages of Development (Erik Erikson)
 - Identity Status Theory (Marcia)
 - Mindset: Fixed vs. Growth Mindset (Dweck)
 - Narcissism (Kernberg)
 - Self-Perception Theory (Bem)
 - Self-Theories: Entity and Incremental Theory (Dweck)
 - Social Identity Theory (Tajfel, Turner)
 - Stereotype Threat (Steele)
- **MISCELLANEOUS LEARNING THEORIES & MODELS**
 - Affordance Theory (Gibson)
 - Andragogy – Adult Learning Theory (Knowles)
 - Flipped Classrooms
 - Model of Hierarchical Complexity
 - Multiple Intelligences Theory (Gardner)
 - Systems Thinking
 - 21st Century Skills (P21 and Others)

25

The Learning Pyramid – Be Careful !

26

Quick Workshop ideas ...

What experiences do our students need to develop those skills?

Our students learn best when ...

Our researchers are most effective when ...

Our library staff is most effective when ...

What will faculty and staff need to do in order to bring the Shared Vision to life?

27

Our students learn best when ...

- They work collaboratively, wrestle with the content – and articulate it to others – during class
- They are encouraged to use technology tools to help with assignments – tech as enabler not a distraction
- They are given the freedom to ask questions
- Individuality and creativity are encouraged
- The room – lighting, temperature, acoustics - does not get in the way of learning
- They have access to course materials 24x7
- They have a mix of lively, engaging collaboration spaces and quiet isolated spaces for critical thinking and studying tasks
- They are encouraged to take risks, make mistakes and learn from those mistakes, producing a far better outcome than just playing it safe
- They are held to high and clear expectations – and receive personalized and timely feedback about their work
- See and hear clearly – but only what should be seen and heard
- Learning environments include meaningful and realistic problem-based activities
- They are involved in the learning process
- Environment is free from distractions
- Are allowed to work cooperatively, with hands-on activities and access to tech for groupwork
- There are plenty of visual aids and graphics; multiple modes of instruction

28

Sample Question ... Audience Response System "Clickers"

For my classes, the following percentage of class time is spent on traditional lecture:

Category	Percentage
1. Less than 20%	8%
2. 20% - 40%	25%
3. 40% - 60%	42%
4. 60% - 80%	25%
5. More than 80%	0%

29

Pedagogical Analysis Exercise

Learning Activities	Lecture Hall (150 – 200)	Large Classroom (60 – 75)	Active Learning (36 – 48)	Seminar Room (20 – 25)
Lecture / Didactic Instruction	90%	60%	5%	20%
Whole Group Discussion	5%	25%	25%	25%
Small Group Activities with Technology	0%	0%	40%	25%
Small Group Activities <i>without</i> Technology	5%	10%	20%	10%
Self-directed Learning / Individual Web-based Research or Visualization	0%	0%	0%	5%
Student Delivered Presentations / Demonstrations	0%	5%	10%	15%

30

Framework for Transformation

- How would you define the *EXPERIENCES*?
- What techniques, tools, people, or other resources would be needed?
- How would you capture, document and present the info?

31

Framework for Transformation

32

It is tough to make predictions, especially about the future.
– Yogi Berra

Prediction is very difficult, especially about the future.
– Niels Bohr
Physicist
Nobel Prize Winner

33

There is no reason anyone would want a computer in their home.
– Ken Olson
President of Digital Equipment Corp., 1977

Nuclear-powered vacuum cleaners will probably be a reality in 10 years.
– Alex Lewyt
President, Lewyt Vacuum Company, 1955

34

Quick Workshop ...

Develop a profile of the students that will use this building in the year 2025 ...

35

Student of the future

- Always on, connected
- Active, social and visual learners
- Expect full and immediate access to personalized media, information and course materials
- Reckless with technology
- Create *and* consume
- Visual, multi-sensory
- Connect living & learning
- Learning any time, any place
- Value the on-grounds, campus experience
- Environmentally conscious
- Consumer orientation towards their educational experiences
- Impatience with inefficiencies
- Want to collaborate
- Want alone time – for study and personal creativity
- Prefer practical applications, authentic experiences
- Global thinkers; want to connect globally
- “Design” thinkers
- Gamers
- Blend their social and academic lives
- Participation and Personalization

36

Quick Workshop ...

Develop a profile of the _____ of this building in the year 2025 ...
 (students, faculty, staff, researchers, librarians, corporate partners, coaches ...)

Think-Pair-Share
Whole group discussion
Paper & pencil exercises
Info gathering tools: surveys, intranet, wiki, "clickers", etc.

Do not expect 100% alignment !!!



37

Technology Visioning

The Solution After Next

So what?



38

Virtual Benchmarking – example of gaming areas



39

Design Directions ... examples

- Prioritize network-based solutions; any source to any destination
- Invest in automation to minimize tech support staff
- Invest in data gathering around tech / room usage to inform future projects
- Plan for 4K but not 8K (other than Viz Wall, which will be ready for 8K)
- Move towards a single supplier of AV Control System Software for all systems, campus-wide; standardize with this project
- Use voice-based AV Control Systems for Seminar Rooms (assume passes Pilot Test)
- Lecture Capture for all classrooms (plus Seminar Rooms as budget allows)
- Retire in classrooms: DVD players, cable TV, chalkboards, doc cams (except labs)
- Black Box Classroom – ceiling pipe grid, raised floor, adjacent AV Control Room
- Active Learning – student groups of 7, tables, hybrid lecture/ALC, flat panel per student group, non-interactive, analog writing surfaces

40

Framework for Transformation

- How would you define the *FUTURE CONTEXT*?
- What techniques, tools, people, or other resources would be needed?
- How would you capture, document and present the info?



41

Framework for Transformation



42

Quick Workshop ... ideas

- What challenges will we face to realize the Project Vision?
- Related to *pedagogy*, the biggest challenges will be
- Related to *technology*, the biggest challenges will be



43

Statement of Challenges

- Some faculty will be resistant to recording class sessions.
- Tech support is minimal.
- We will need to redesign our courses to support the flipped classroom concept.
- We can't afford what we want on Day 1, let alone have funding for technology replacement/refresh.
- Systems must be bullet-proof.
- Technology changes too rapidly. We can't plan for it.
- We can't always get cooperation from Central AV/IT staff if we deviate from their standard.
- At home, my VHS deck still blinks 12:00.
- The last time we tried _____, it was an epic fail.
- Chalk always works.

44

Framework for Transformation

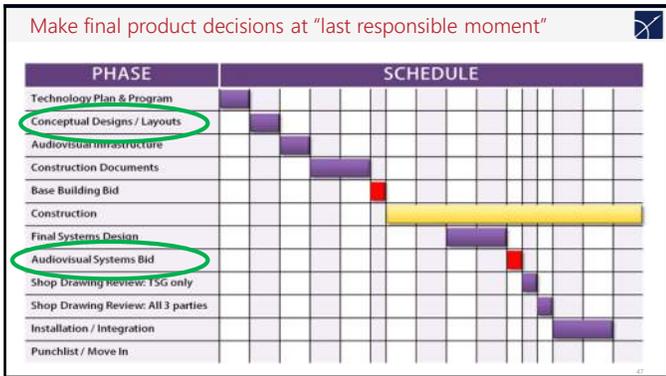
- How would you define the *CHALLENGES*?
- What techniques, tools, people, or other resources would be needed?
- How would you capture, document and present the info?



45



46



47

Technology & This Project ... 3 Rs

What should we *RETAIN*?

What should we *RETIRE*?

What should we *RE-IMAGINE*?

48

Remember the Design Directions (examples)

- Prefer network-based solutions; any source to any destination
- Invest in automation to minimize tech support staff and accelerate user adoption
- Invest in data gathering around tech / room usage to inform future projects
- Plan for 4K but not 8K (other than Viz Wall, which will be ready for 8K)
- Move towards a single supplier of AV Control System Software for all systems, campus-wide; standardize with this project
- Use voice-based AV Control Systems (assuming successful Pilot Test)
- Lecture Capture for all classrooms (plus Seminar Rooms as budget allows)
- Retire in classrooms: DVD players, cable TV, chalkboards, doc cams (except labs)
- Black Box Classroom – ceiling pipe grid, raised floor, adjacent AV Control Room
- Active Learning – student groups of 7, tables, hybrid lecture/ALC, flat panel per student group, non-interactive, analog writing surfaces

49

Our students learn best when ...

- | | |
|---|---|
| <ul style="list-style-type: none"> • They work collaboratively, wrestle with the content – and articulate it to others – during class ✓ They are encouraged to use technology tools to help with assignments – tech as enabler not a distraction ✓ They are given the freedom to ask questions • Individuality and creativity are encouraged • The room – lighting, temperature, acoustics - does not get in the way of learning ✓ They have access to course materials 24x7 • They have a mix of lively, engaging collaboration spaces and quiet isolated spaces for critical thinking and studying tasks | <ul style="list-style-type: none"> • They are encouraged to take risks, make mistakes and learn from those mistakes, producing a far better outcome than just playing it safe ✓ They are held to high and clear expectations – and receive personalized and timely feedback about their work ✓ See and hear clearly – but only what should be seen and heard • Learning environments include meaningful and realistic problem-based activities • They are involved in the learning process • Environment is free from distractions ✓ Are allowed to work cooperatively, with hands-on activities and access to tech for groupwork ✓ There are plenty of visual aids and graphics; multiple modes of instruction |
|---|---|

50

Statement of Challenges

- Some faculty will be resistant to recording class sessions.
- Tech support is minimal.
- We will need to redesign our courses to support the flipped classroom concept.
- We can't afford what we want on Day 1, let alone have funding for technology replacement/refresh.
- Systems must be bullet-proof.
- Technology changes too rapidly. We can't plan for it.
- We can't always get cooperation from Central AV/IT staff if we deviate from their standard.
- At home, my VHS deck still blinks 12:00.
- The last time we tried _____, it was an epic fail.
- Chalk always works.

51

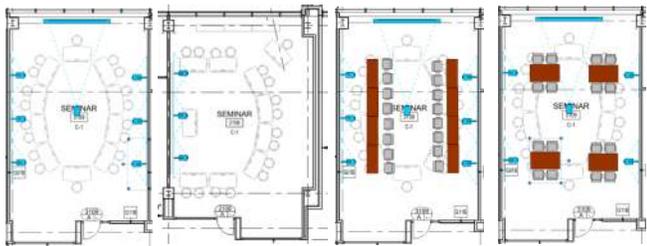
Systems Design Process



- Create a Technology Program report defining the "Full Program"
 - Aspirational, beyond the budget and the basis of a roadmap for the future
 - Do not simply default to the "campus classroom standard"
- Focus on agreement on the Full Program
 - Day 1 budget is enormously important – but not let it limit the vision for the future
 - Delay the tough decision on priorities until later
- Get the building right !
 - Ceiling heights, column spacing, room geometries, acoustics, lighting, cable pathways, etc.
- Do not lock onto a single manufacturer / single solution
 - "Manufacturer independent infrastructure"
- Make it graphical for the end users

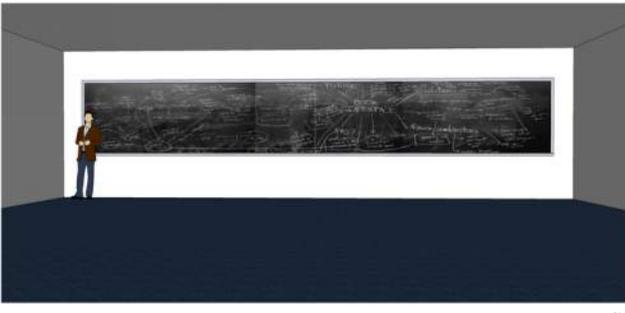
52

Equipment Plans make it graphical !



53

Attention Wall



54



55

Systems Design: Concept Design (early), Detailed Design (late)

- Do the solutions ...
 - Align with the Shared Vision?
 - Help faculty and students achieve the desired outcomes?
 - Enhance how students learn best?
 - Follow the trends and emerging technologies that were identified as relevant to this project?
 - Follow the Design Directions?
 - Address the Challenges that were identified?
 - Adhere to the Day 1 budget, while also providing a roadmap for future growth?

56

Framework for Transformation

- How would you define the *SOLUTIONS*?
- What techniques, tools, people, or other resources would be needed?
- How would you capture, document and present the info?

57



58

- Our students learn best when ...
- They work collaboratively, wrestle with the content – and articulate it to others – during class
 - They are encouraged to use technology tools to help with assignments – tech as enabler not a distraction
 - They are given the freedom to ask questions
 - Individuality and creativity are encouraged
 - ✓ The room – lighting, temperature, acoustics - does not get in the way of learning
 - They have access to course materials 24x7
 - ✓ They have a mix of lively, engaging collaboration spaces and quiet isolated spaces for critical thinking and studying tasks
 - They are encouraged to take risks, make mistakes and learn from those mistakes, producing a far better outcome than just playing it safe
 - They are held to high and clear expectations – and receive personalized and timely feedback about their work
 - ✓ See and hear clearly – but only what should be seen and heard
 - Learning environments include meaningful and realistic problem-based activities
 - They are involved in the learning process
 - ✓ Environment is free from distractions
 - ✓ Are allowed to work cooperatively, with hands-on activities and access to tech for groupwork
 - There are plenty of visual aids and graphics; multiple modes of instruction

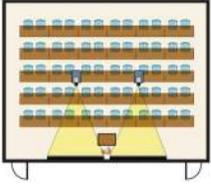
59



60

Classroom Study

Lecture Mode
60 Seats



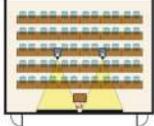
Active Learning
45 Seats



61

Classroom Study

1350 SF Classroom



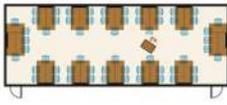
FIXED LECTURE
60 seats

- can be reconfigured to active format (by semester)
- 22.5 SF / student



FIXED ACTIVE
45 seats

- can be reconfigured to lecture format (by semester)
- 30 SF / student



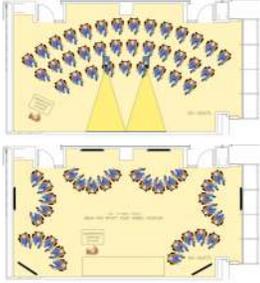
FIXED ACTIVE
60 seats

- unusual proportion
- not reconfigurable
- most efficient layout for active learning
- 22.5 SF / student

62

Active Learning Decisions

- Number of students per group
- Define the flexibility needed
- Define the adaptability needed
- Students at tables, armchairs or hybrid
- Size / shape / configuration of furnishings
- Space for instructor at each student group
- Campus-provided tools per student group
- Writing surfaces per student group
- Role of lecture component
- Location of instructor "home base"
- Role of Teaching Assistants



63



64



65



66

Active Learning in a large space



67



68



69



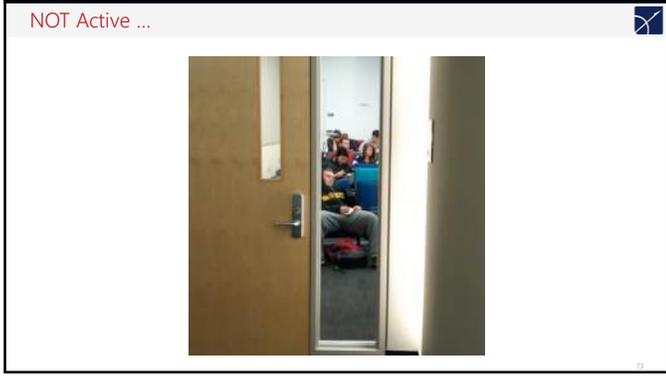
70



71



72







Framework for Transformation

- How would you define the SPACES?
- What techniques, tools, people, or other resources would be needed?
- How would you capture, document and present the info?

76

Summary ... and some personal biases

1. Start planning *NOW* for the people side of change that might accompany new learning spaces, new workflows, etc.
2. Put as much time and energy into planning the people, policies and procedures as the wires and widgets.
3. Use the project as a catalyst for improvement, as building projects are often the largest, most impactful chance to strengthen or change the culture.
4. Do not simply default to "campus standards." The rigid application of technology standards shuts down discovery, exploration and scholarship on the topic of how technology can improve teaching, learning, research, workflow, efficiency, etc.
5. Think long-term and in the future tense – resist "this is what we do now" thinking. Substitute "this is what we would like to do ..." or "wish we could do ..."
6. Focus on the future student. Picture the middle school student in your neighborhood ...

77

Summary ... and some personal biases

7. Use tech to build *Collaboration, Communication & Community*.
8. Prototype new concepts prior to widespread deployment. Create a Black Box Classroom or Sandbox to promote exploration. Used lessons learned to inform future projects.
9. Be willing to experiment and accept some failures.
10. Recognize that no institution can afford all technology desired. Control expectations of Day One capabilities.
11. Prioritize getting the building right, realizing the infrastructure is much more than just conduit and power and junction boxes.
12. Make final tech systems decisions at the "Last Responsible Moment."
13. For learning space projects, think Pedagogy first. Let Pedagogy drive the bus. Use tech to increase the quality, quantity and effectiveness of teachable moments.

78

Summary ... and some personal biases



- 14. Assume all processes will become more tech-dependent. There may be some pushback or a pendulum swing, but tech eventually wins if it offers an improvement.
- 15. Focus on employer skills and desires. Use tech to teach applied skills rather than simply knowing information.
- 16. Think Total Cost of Ownership.
- 17. Plan for technology refresh cycles.
- 18. Attach timelines to terms such as "Adaptable" and "Flexible" to have more productive conversations. Define nebulous terms such as "state-of-the-art."
- 19. Consider technology as an enabler not simply an expense.
- 20. Consider smart phones to be the greatest portable knowledge machine – not the greatest distraction - in the history of the world. A professor in their pocket.

79

Summary ... and some personal biases



- 21. Design with dual focus: the individual user experience and an enterprise-wide perspective. Consider access, usability, supportability, scalability and enterprise-wide standardization.
- 22. Plan all devices to be connected to the network. Plan/build the virtual world alongside the physical world.
- 23. Think platforms not products. Think of ecosystems not islands. Sharing of data, interoperability, open standards, open APIs – all bring more benefits than proprietary anything. Don't focus on just this building but on how it fits into the enterprise context and how these systems/spaces interrelate.
- 24. Gather actionable real data about the facility and the tech systems.
- 25. For learning spaces, don't think F2F or on-line. Think both and.
- 26. Use high tech to enhance high touch.

80

Summary ... and some personal biases



- 27. Align all tech decisions to corporate strategy / institutional mission.
- 28. Prioritize compatibility with long-term strategic tech direction over custom integration for a specific use.
- 29. Prioritize flexibility over optimization.
- 30. Prioritize evolutionary refinement over pursuit of initial perfection.
- 31. Don't fight against progress ... embrace the tech and the changes that accompany it.
- 32. Establish tech planning process, communicate the process and follow the process.



81

This concludes The American Institute of Architects Continuing Education Systems Course

AIA Continuing Education Provider

82

82

Questions?
APPA 548

John A. Cook
Vice President
Sextant Group / NV5 Engineering & Technology
jcook@thesextantgroup.com
412.301.4208



83

83