CORGAN

# Adaptive Learning

## *for Entrepreneurs, Experimenters and Creatives*

**SEM - 202**

**October 6, 2022**

learningSCAPES 2022
A CALL TO ACTION

# Introductions

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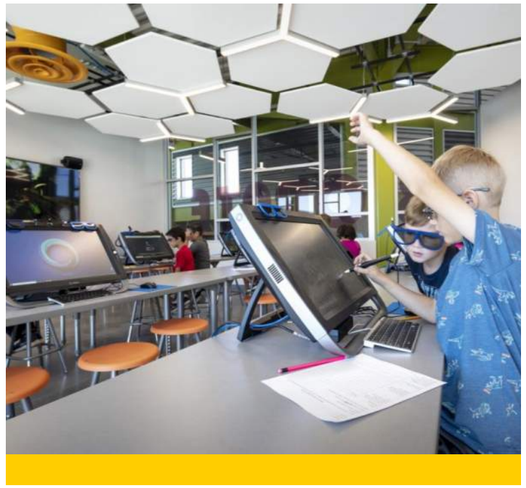
# Learning Objectives



## 1 — Understand Adaptive Learning

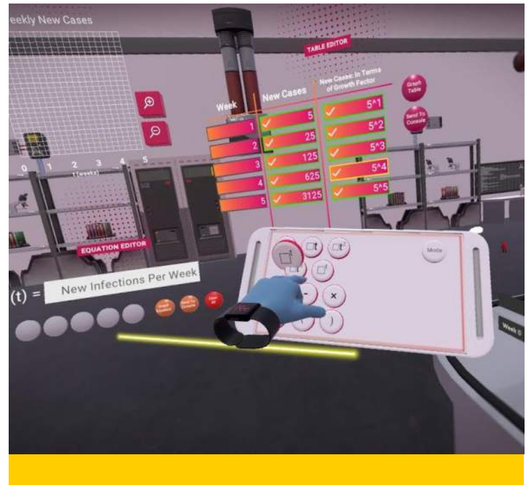
Gain a thorough understanding of the definition of adaptive learning and how it can be implemented to accelerate educational outcomes


## 2 — Leveraging Digital Tools

Learn how to leverage digital assessments, analytics, and robust learning management systems to achieve deeper learning insights into student needs

## 3 — Redefine the Learning Environment

Take a deeper dive into redefining physical and virtual places of learning to facilitate adaptive learning methodologies




## 4 — Explore Sample Learning Modules

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# Imagine you are an educator tasked with reaching *every unique student* in your class


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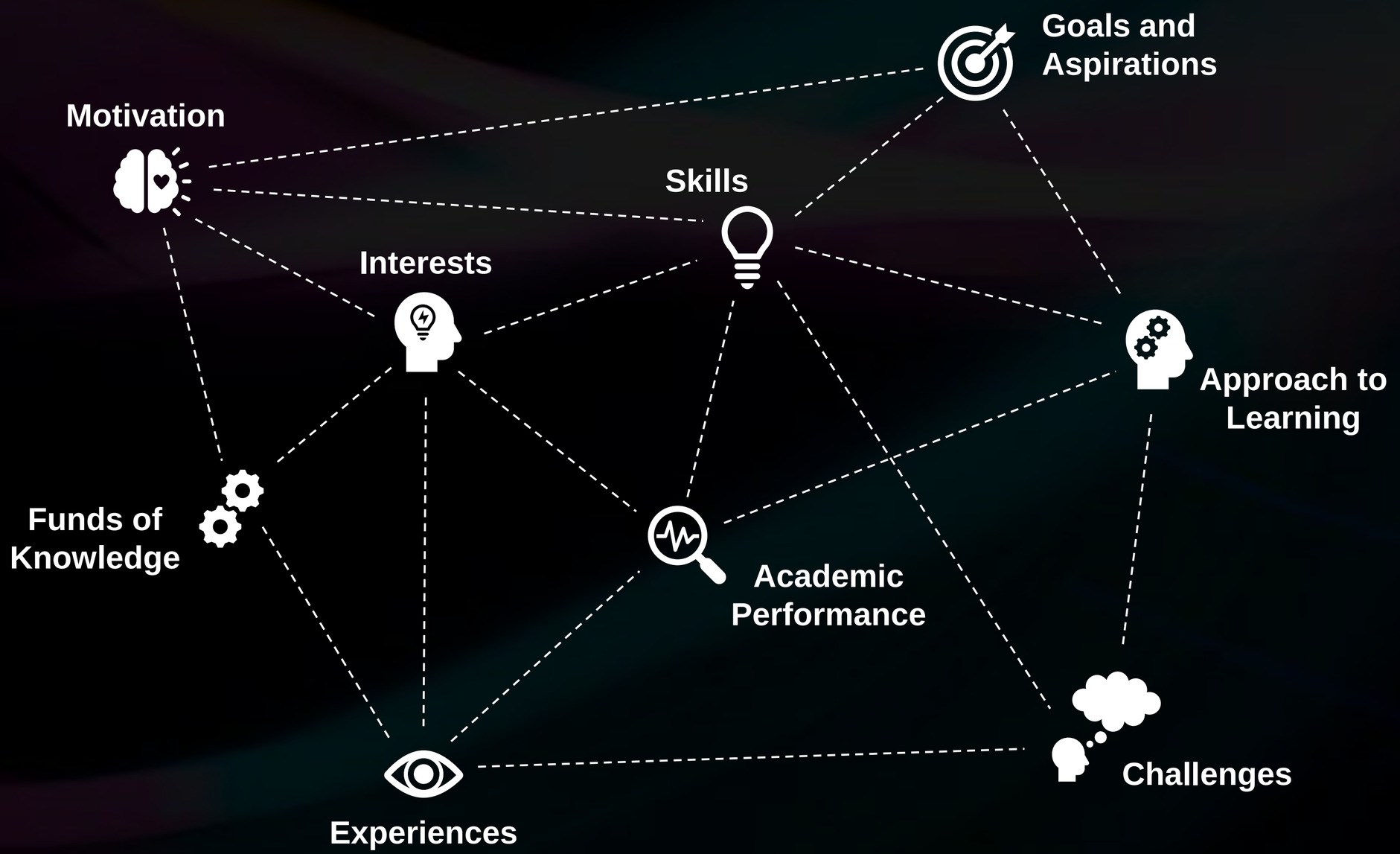

Goals and Aspirations
Motivation
Skills
Interests
Approach to Learning
Funds of Knowledge
Academic Performance
Challenges
Experiences


# Learning at a Personal Scale

- 1-to-1 interaction
- Adapt to learner cues and comprehension in real-time
- Instruction tailored to student needs and interests
- Individualized approach
- Able to assess learner progress

NEWSPAPER
1605

TELEVISION
1927

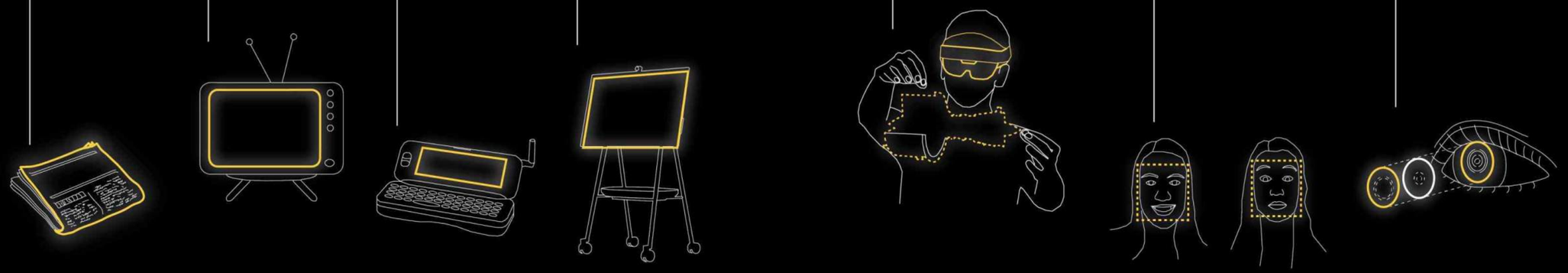
CELL PHONE
1983

MOBILE IN-TERACTIVE WHITEBOARD
2001

AUGMENTED REALITY WORKFLOWS
2013

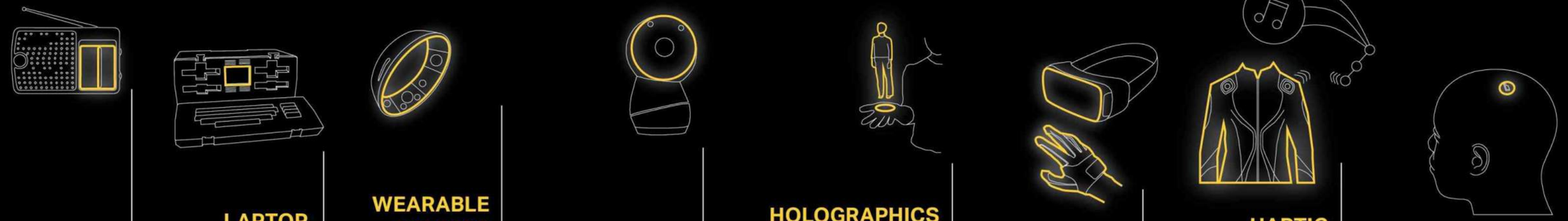
AFFECTIVE COMPUTING
2016

INVISIBLE COMPUTING
2020



1900 | 1950 | 2000 | 2015 | 2020

Static | Mobile | Dematerialized | Immersive



RADIO
1920

LAPTOP
1981

WEARABLE DEVICES
2000

SOCIALLY INTELLIGENT ROBOTS
2004

HOLOGRAPHICS
2015

VIRTUAL REALITY
2016

HAPTIC WEARABLE DEVICES
2020

BRAIN-COMPUTER INTERFACES
2021

## Carnegie Learning Mathia Application Video

https://www.youtube.com/watch?v=6ldlQtAhQY8&ab_channel=CarnegieLearning

# Learning in a Changing World

CONSIDERATIONS FOR 21ST CENTURY LEARNERS

# Understanding Generation Alpha

## Born 2010 to 2025

- First generation born entirely in the **21st century** and first to live decidedly into the **22nd century**
- Technologically literate
- Skilled creators of **products and services of value**
- Meaningful and relevant **skills-based experiences**

[Zmuda et al, 2017; Hughes, 2020; McCrindle, 2020]


# *Teaching Generation Alpha*

- Shift from content mastery to **meaningful and relevant skill-building experiences**
- Align with Alpha's natural drive for **innovation, entrepreneurship, and knowledge-sharing**
  - High-Fidelity Learning Environments
  - Industry Partnerships
- **Personalized learning**
- **Technology**
  - Active Use of **Extended Reality (XR) Technologies**
  - The Future of EdTech: Anticipating the **Metaverse**
  - **A Balanced Approach**

> They will be **lifelong learners**, holding multiple jobs across multiple careers. They will also need to be **adaptive, constantly upskilling and retraining to remain relevant** to the changes anticipated as they move through their working life
>
> ***McCrindle***

[McCrindle, 2020; Hughes, 2020]

# Passive Learning

Focuses on the cognitive experience of internalizing new information presented by a teacher or expert.

Students listen, but are not physically engaged, experimenting, or exploring as they learn.

Passive Learning creates **weaker, more limited neural connections.**

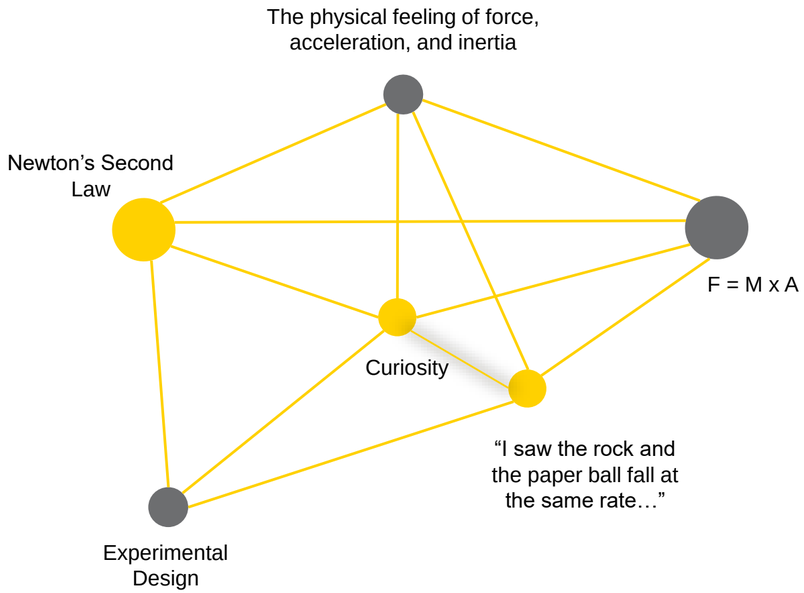

*[Hoogendoorn, 2015; Herold, 2019]*

# Active Learning

Encourages students to engage their mind, their body, and their environment as they learn.

Student-led, hands-on, inquiry-based experiences.

Active learning forms more deeply embedded and more easily retrievable memories and **more effective learning outcomes.**



# Connectivism

A learning theory for the digital age

- **Knowledge is a network**
- Learning involves both **accessing and creating** knowledge using digital tools
- Self-directed **knowledge-seeking**
- Collaborative, **global** interactions
- Focuses on **building connections**

*[Goldie, 2016; Mattar, 2018]*

# Concept Introductions

1

### ADAPTIVE LEARNING

Changing part of the instruction to respond to learner characteristics

2

### INDIVIDUALIZED LEARNING

Responding to student's knowledge base, academic performance, and learning

3

### PERSONALIZED LEARNING

Adapting to student interests and background to connect learning to the real world

4

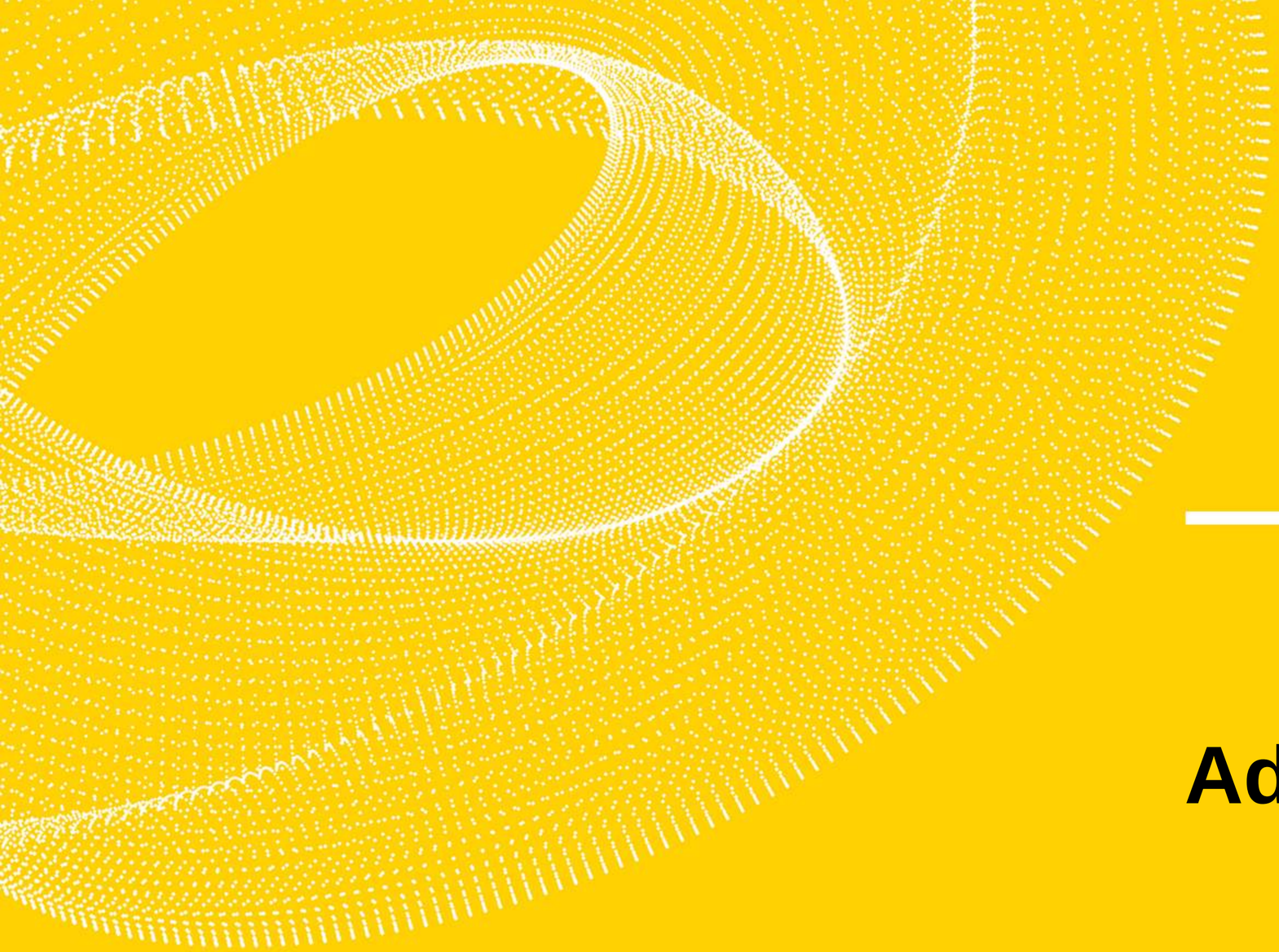
### EXTENDED REALITY

Spectrum of technologies ranging from real-world to fully immersive

5

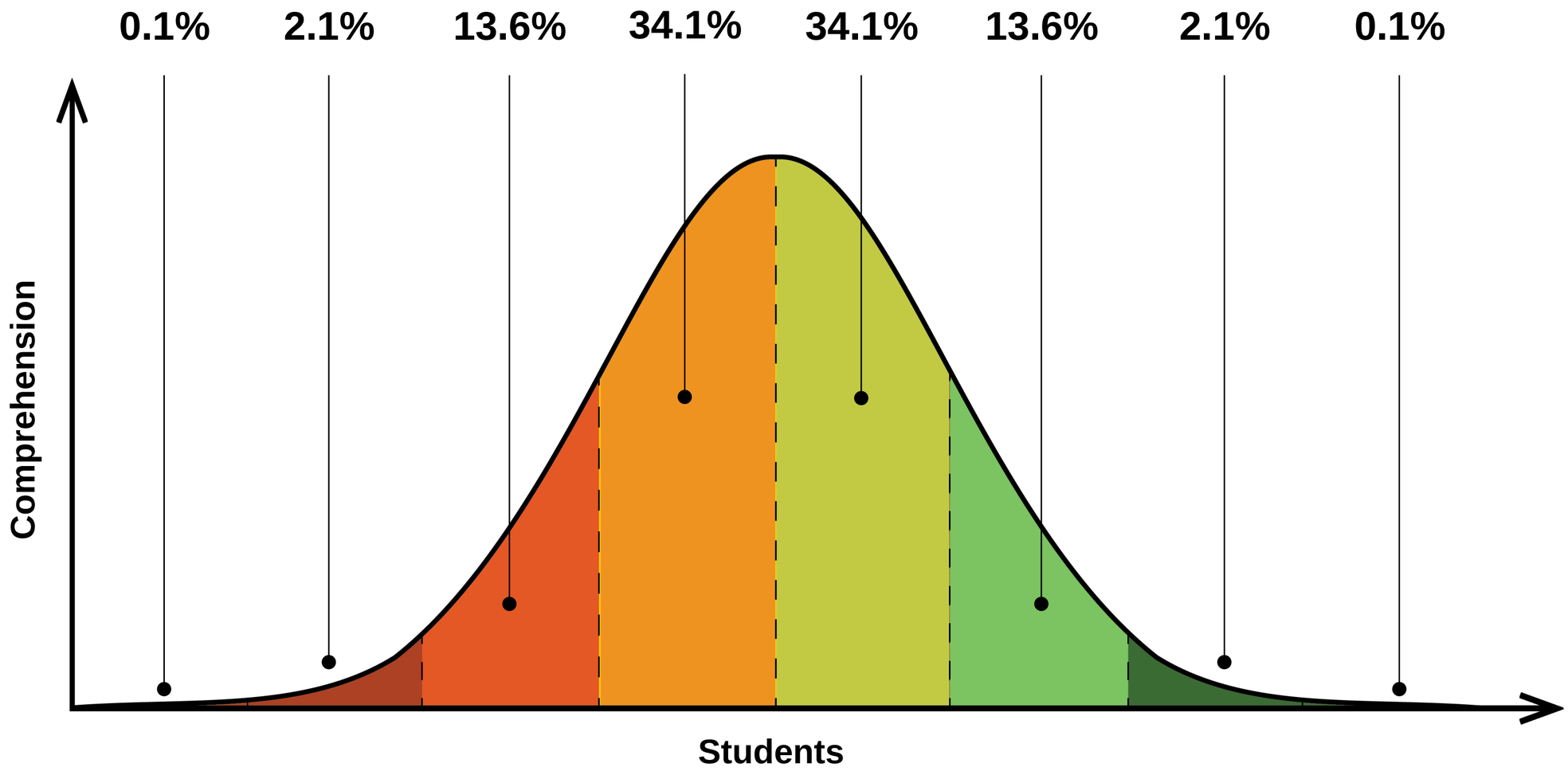
### METAVERSE

A material and digital hybrid future



# Adaptive Learning

# The Fallacy of “Teaching to the Middle”



# Content Mastery for Every Student


By ensuring that students reach **mastery** before moving on, ***adaptive learning avoids "teaching to the middle"…***

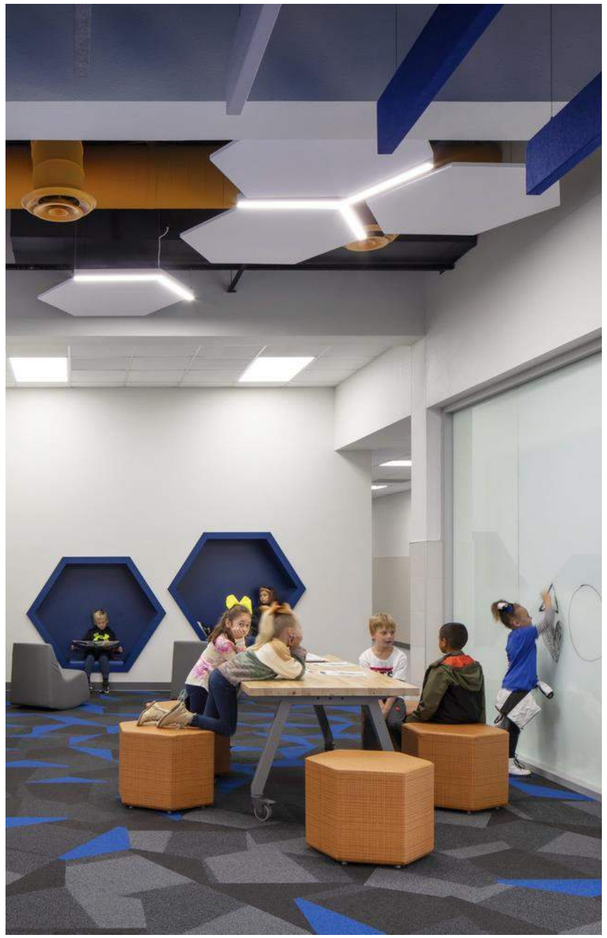
*[Moskal et al., 2017]*

# **Adaptive Learning**
## Definition and Goals

- **Data-driven** systems that deliver instruction and remediation
  - Utilize **algorithms**, assessment, and student feedback
  - Can employ a **non-linear approach**
- **Adaptive Learning systems dynamically adjust instruction to respond to learner characteristics, student interaction, and performance levels**
- Choose important characteristics backed by research:
  - **Individualization**
  - **Personalization**
- Can be implemented within the framework of traditional instruction
- Connections with **Extended Reality** technologies to ground learning through movement and immersive experiences

*[Dr. Candace Walkington; Feldstein et al., 2015; Moskal et al., 2017; Plass, 2016]*

# Individualization vs. Personalization



## Individualization

- Responding to student's knowledge base, academic performance, and learning
- Metrics-oriented
- More research-backing

## Personalization

- Adapting to student interests and background to increase engagement and motivation
    - Career goals, hobbies, pop-culture, prior knowledge and experiences
- **"Utility Value":** help students see the value of learning by connecting the topic to the real world (effective and authentic motivation)
- Difficult to scale and implement

> ***Adaptivity*** is an approach to the design of a learning system in which **each learner is provided with the kind of experience they need** at any given time **in order to be successful** in reaching the intended learning outcome

— *Dr. Jan Plass, NYU*

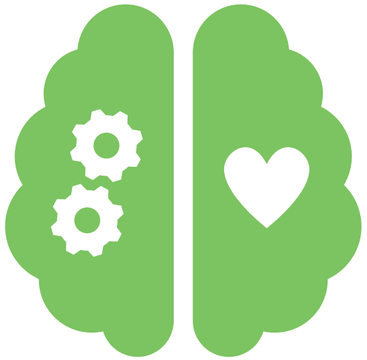
# What Could Adaptive Learning Systems *Adapt For?*

## Cognitive Variables

Current knowledge and skills
Developmental level
Cognitive abilities
Self-regulation
Cognitive load

## Motivational Variables

Interests
Orientation with goals
Self-efficacy
Stereotype threat
Persistence



## Affective Variables

Emotional state
Appraisal
Emotion regulation
Attitude

## Socio-Cultural Variables

Social and cultural context
Identity and self-perception
Relatedness
Social agency

*[Plass, 2016]*

# System Types

## Closed

- Existing, off-the-shelf course content
- Rapid implementation
- Limited customization

## Open

- Control all configuration and content decisions
- Time and resource-intensive to implement
- Entirely customizable

## Hybrid

- Allows for limited configuration
- Provides a balance between time/effort and customization
- Educators can select modules and upload their own course content

*[Moskal et al., 2017]*


# *Benefits for Students*

1 **Respects Prior Knowledge**

2 **Responsive to Learning Needs**

3 **Reduces Gaps in Understanding**

*[Feldstein et al., 2015; Moskal et al., 2017]*

# *Benefits for Educators*

1 **Monitor Student Progress**

2 **Measure Performance**

3 **Maximize Learning Outcomes**

*[Feldstein et al., 2015; Moskal et al., 2017]*

# Considerations for Implementing Adaptive Learning

1

### LIMITED DATA

Lack of independent research data to validate learning benefits and guide the use of these systems

2

### COST AND TIME

Resources and effort are needed to configure and implement adaptive learning systems

3

### SUBJECT APPLICABILITY

Best suited for introductory-level, procedural, and factual content rather than higher-order thinking

4

### PRIVACY AND TRANSPARENCY

Concerns about data being shared across platforms and limited understanding of proprietary algorithms

5

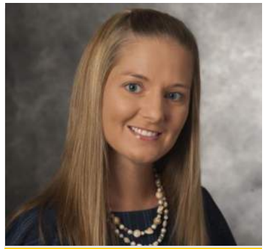
### METACOGNITION

Relying on learning systems could impact students' ability to understand how they learn and how to adapt their learning experiences to their needs

6

### EDUCATOR TRAINING

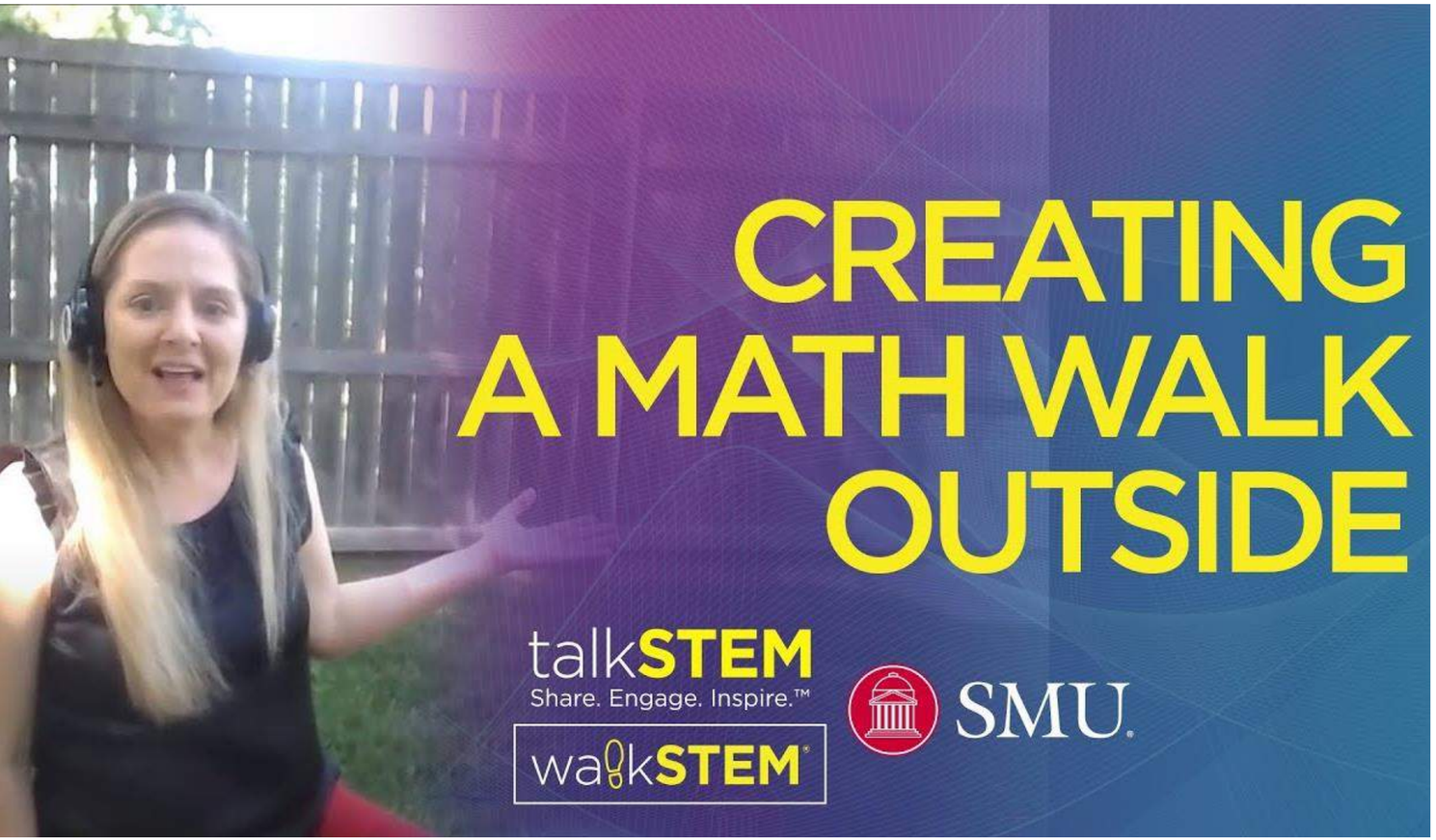
Additional training is needed to help teachers navigate the adaptive learning system as an asset that supports their role



Researcher Spotlight:

## Dr. Candace Walkington

*SMU Department of Teaching and Learning*



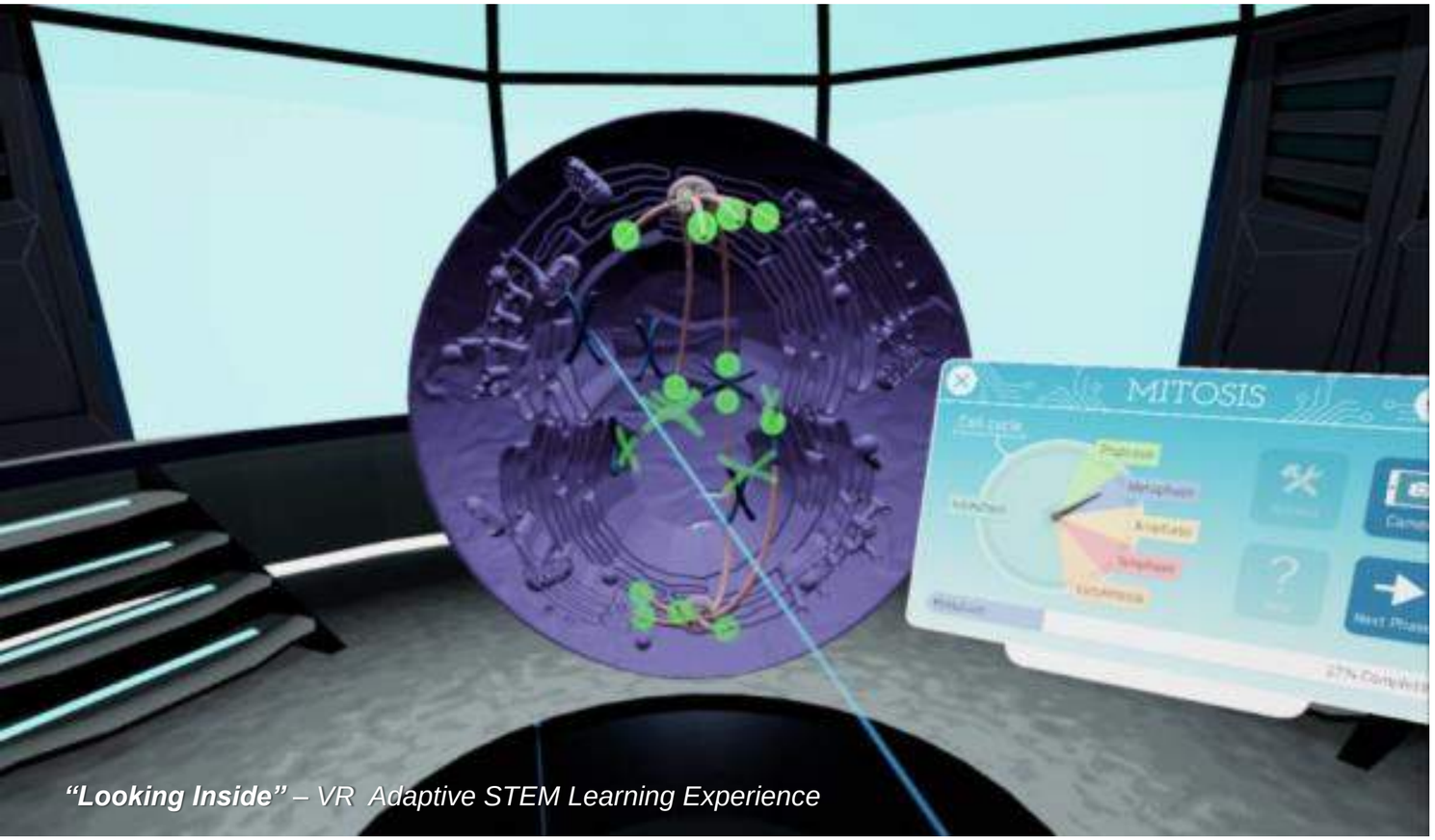

**RESEARCH AREAS AND CONTRIBUTIONS**

- Math instruction, personalization, adaptive learning, augmented reality (AR), and place-based learning
- Connecting math concepts to everyday life through personalization and embodied experiences
- Focus on motivational variables
- Collaboration with Dallas-area non-profit, **talkSTEM** to develop guided “math walks” in the DFW area
- Grant from the NSF to develop an AR math learning app called **“Mathfinder”**
  - Place-based AR game for math learning in informal environments

Researcher Spotlight:

# Dr. Jan Plass

*NYU Digital Media and Learning Sciences*




***"Looking Inside"** – VR Adaptive STEM Learning Experience*

## RESEARCH AREAS AND CONTRIBUTIONS

- Founding director of **CREATE** – Consortium for Research and Evaluation of Advanced Technology in Education
  - Learning simulations and cognitive skills training games
- Co-director of the **Games for Learning Institute (G4LI)**
  - "G4LI is dedicated to advancing the design, use, and evaluation of digital games in formal and informal educational settings."
- Investigates cognitive, social, and emotional design patterns for effective **simulations, games, and XR experience-based tools for learning**

# Adaptive Learning Systems

CARNEGIE LEARNING

GeoGebra
Dynamic Mathematics for Everyone

prisms

Pearson

Khan Academy

Mc Graw Hill Education

SMART SPARROW

acrobatiq by VitalSource

CENGAGE Learning

Realize it®

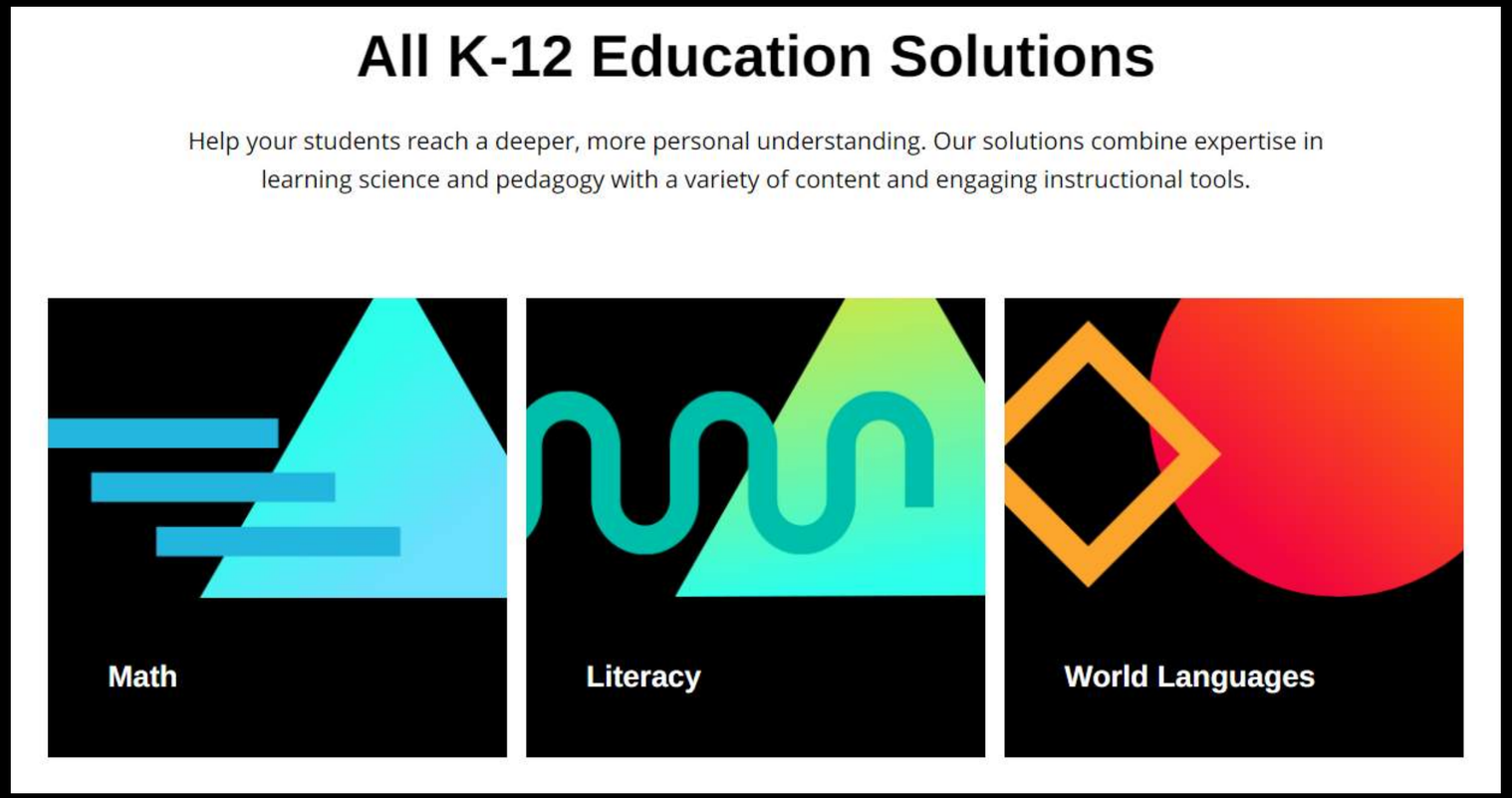
CogBooks™ Adaptive Learning

Cerego

*(EDUCAUSE, 2017; Dr. C. Walkington, personal communication, 2022)*

Adaptive Learning for Entrepreneurs, Experimenters and Creatives

CARNEGIE LEARNING




*Help your students reach a deeper, more personal understanding. Our solutions combine expertise in learning science and pedagogy with a variety of content and engaging instructional tools.*

- K-12 and Higher Education
- Math, literacy, world languages, tutoring, and professional learning services
- **TEA-approved Texas Math Solution**

CARNEGIE LEARNING

## Fast ForWord

- Reading intervention program
- PreK-12
- Reading and learning difficulties

## More Carnegie Learning Solutions

- MATHia
- Zorbit’s Math
- Zulama Coding
- Mirrors and Windows
- Bookshop Phonics
- World Languages

Adaptive Learning for Entrepreneurs, Experimenters and Creatives

prisms

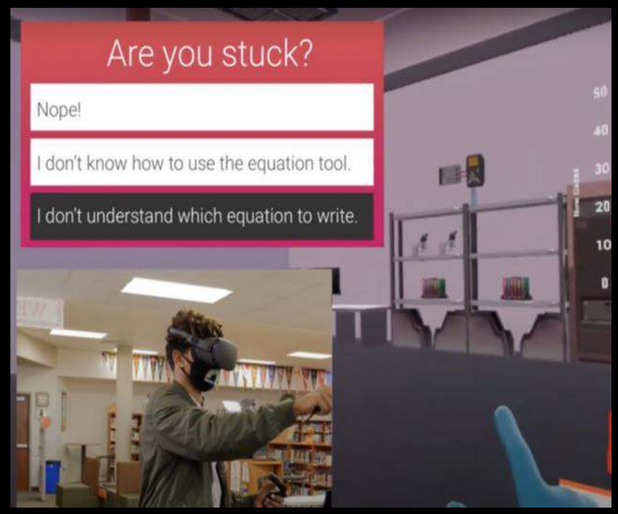
## Prisms VR

*The new paradigm for math education. Learn math through movement, experience, and meaningful discovery*

- Our brains are wired to learn through **experience**
- **Core math proficiencies** – spatial reasoning and abstracting from physicality
  - Connect 3D, 2D, and 1D
  - Algebra, Geometry, STEM
  - Real-world problem solving (Algebra learning app - “Pandemic”)

prisms






## Prisms VR

Personalized learning with just-in-time feedback

Utilizes student ***thinking*** **data,** not just performance data

Provides educators with real-time learning insights and post-session reports

# Looking to Higher Education
# **Arizona State University** – School of Life Sciences


Developed ***world's first adaptive learning biology degree***

- Shift from mass production to mass personalization
- **BioSpine** Adaptive Learning Platform
- Flips high-enrollment gen ed courses to facilitate active learning

Co-created, scaffolded content with ASU and CogBooks

Dreamscape Learn

- Biology degrees of the future
- Integrated XR technologies

*[EDUCAUSE, 2017; Leander, 2019]*

# Educational Technology and the Future of Learning

# Extended Reality (XR)

Active Technologies and the Future of Learning


**Active use** of technology ***shifts learning*** from passive consumption of digital media to **active creation, interaction, and problem-solving.**

*[Herold, 2019]*

# Pedagogical Applications for XR Technologies

1

## REINFORCE CONCEPTS

XR expands the range of topics that can be learned as skills, rather than as abstract knowledge.

2

## ACTIVE TECHNOLOGY

Encourages students to meaningfully engage with their learning through creative problem-solving, embodied experiences, and building connections.

3

## LEARNING GAINS

Cognitive, psychomotor, and affective learning.

4

## EXPERIENTIAL LEARNING

Providing students access to artifacts, resources, experiences, and situations that may not be accessible otherwise.

[Pomerantz, 2018; Pomerantz, 2019; Herold, 2019; Hoogendoorn, 2015; Lindgren et al, 2016]

# A Foot in Each Universe:

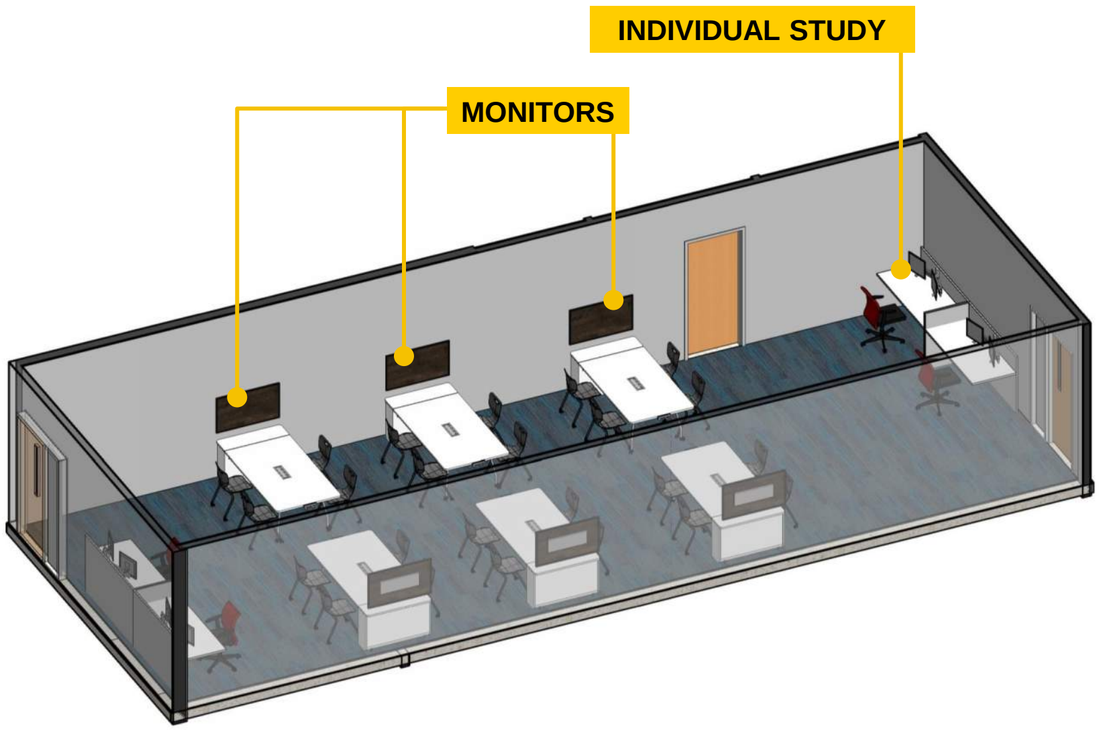
## Striking a Balance in the Metaverse

- Prioritize **live, socially interactive, connected, collaborative experiences** between real people (not avatars)
- **Balance** technology-driven opportunities and grounded experiences
- Focus on how children learn: **playful learning and exploration**
- Engage educators, researchers, and designers to develop data-driven ***educational*** tools and experiences
- Consider how **digital overlays can enhance the real world**
- **Integrate teachers** as an active “guide on the side” to facilitate learning, not merely a supervisor

[Hirsh-Pasek et al, 2022; Roth et al, 2017; Golinkoff et al, 2016]

# Emerging Learning Environment Typologies

# Design Application:
# XR Lab




# Future-Focused Space Typology:
# Simulation Lab

# Future-Focused Space Typology:
# Immersion Room

# Future-Focused Space Typology:
# Immersion Workroom

# Future-Focused Space Typology:
# Immersion Theater

# Future-Focused Learner Profiles

## Entrepreneurs

**Interests**

Business types and trades

**Skills**

Visioning, strategizing, and marketing
Leadership and problem-solving
Resilience and grit

**Motivations**

Independent, self-starter
Project and business-based curriculum

## Experimenters

**Interests**

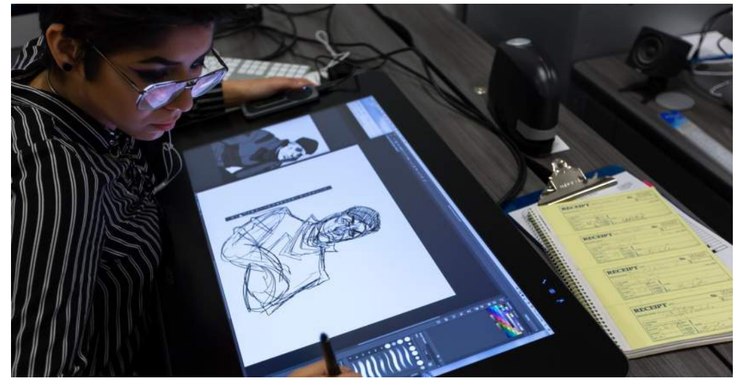
Technology and emerging innovations
Science and exploration

**Skills**

Research, planning, and analysis
Spirit of curiosity, ingenuity, and inquiry

**Motivations**

Problem-solving with a purpose
Ideating, creating, and developing



## Creatives

**Interests**

Fine arts, writing, and design
Creative and personal expression

**Skills**

Honing a craft through technical skill
Expressing ideas and emotions

**Motivations**

Authenticity and self-discovery
Expression as a means of connection

# Jobs of Tomorrow?

1

### VIRTUAL STORE SHERPA

Focus on customer satisfaction through virtually advising customers using the knowledge of the product line

2

### PERSONAL DATA BROKER

Ensure consumers receive revenue from their data. The broker will establish prices and execute trades.

3

### PERSONAL MEMORY CURATOR

Consult with patients and stakeholders to generate specifications for virtual reality experiences.

4

### AR JOURNEY BUILDER

Collaborate with talented engineers and technical artists to develop vital elements for clients.

5

### BODY PART MAKER

Will create living body parts for athletes and soldiers

6

### NANO-MEDIC

Will transform healthcare

[simplelearn.com, 2022]

# Designing for Adaptive Learning

*Emerging Environments for Future-Focused Learning*

**Learning Commons**

**Technology & Innovation Hub**

**Exploration Lab**

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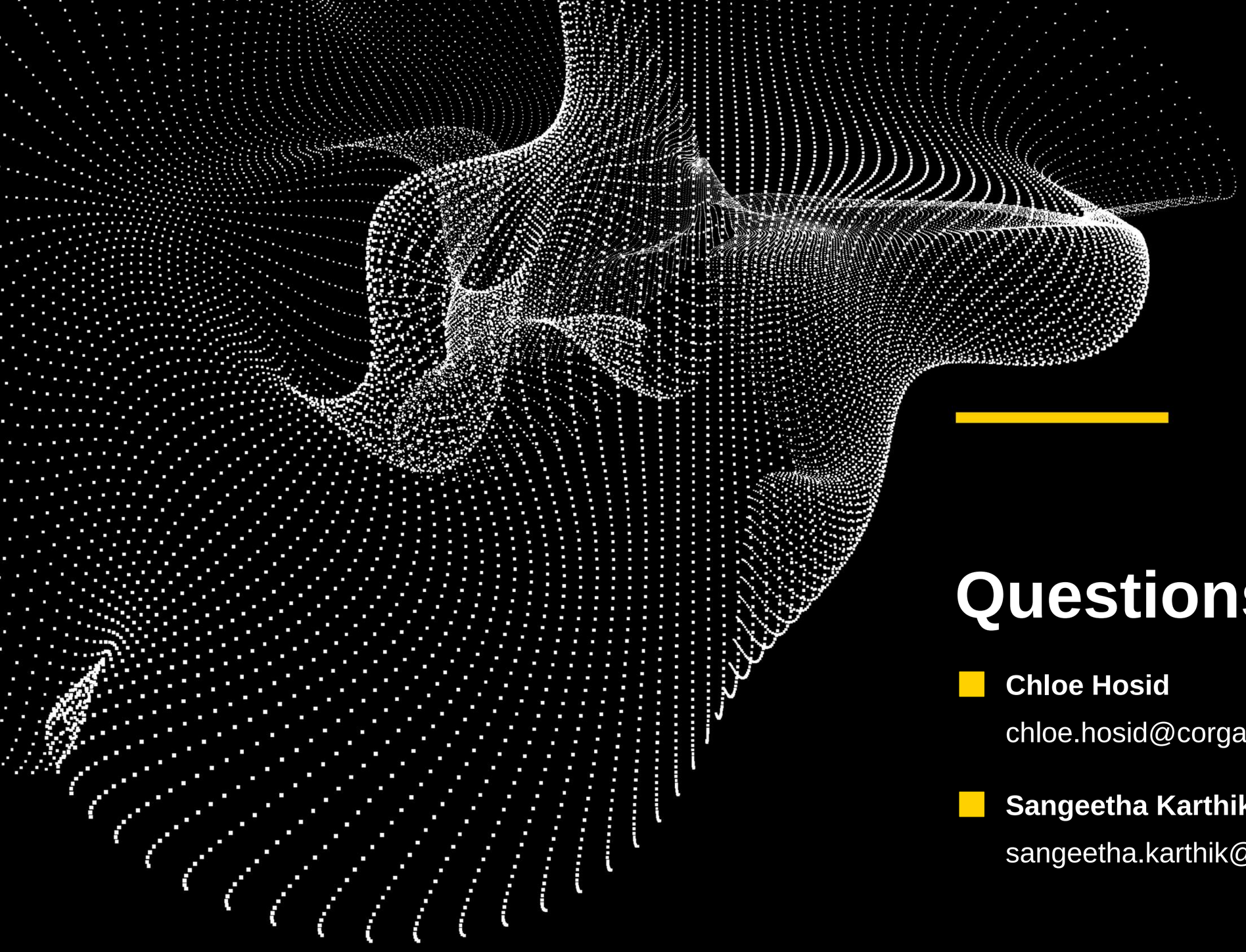

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# Questions?


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