UMass Adventure:
Towards Building a Metaverse for Education Analytics

Recognizing the Value of Digitalized Education Records

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Background

- "Forced" transition to remote teaching since COVID-19
- Potential of continuing **education digitalization** beyond the pandemic
  - Complement, not replace

Q4 - After the pandemic, do you want more courses to be offered in face-to-face, purely remote, or BeaconFlex hybrid modality?
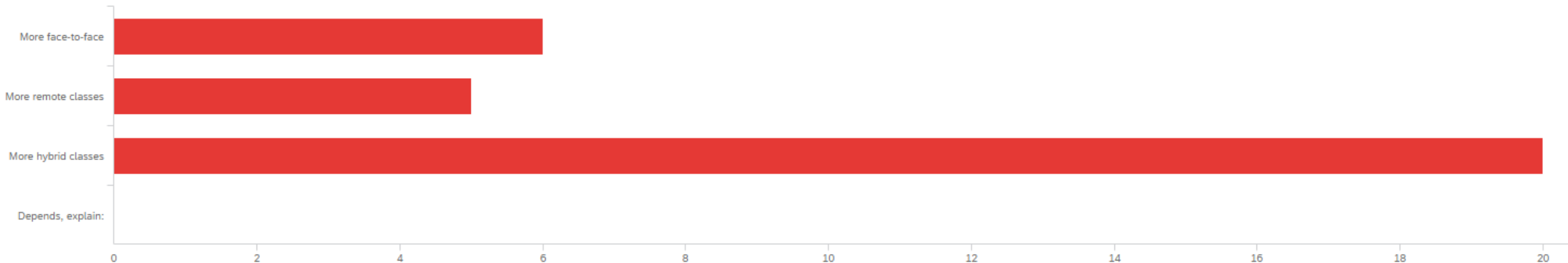
Figure 1 Results of a survey conducted in a BeaconFlex course

An Outcome of Education Digitalization

- Digitalized Education Records (DERs)
  - e.g., Lecture videos, attendance records, Zoom chats, "Last access" time in Blackboard …
  - Think about Electronic Medical Records (EMRs)
  - ≠ Digitalized Student Records

- **DERs are valuable, efficient, and everywhere, yet not fully utilized**
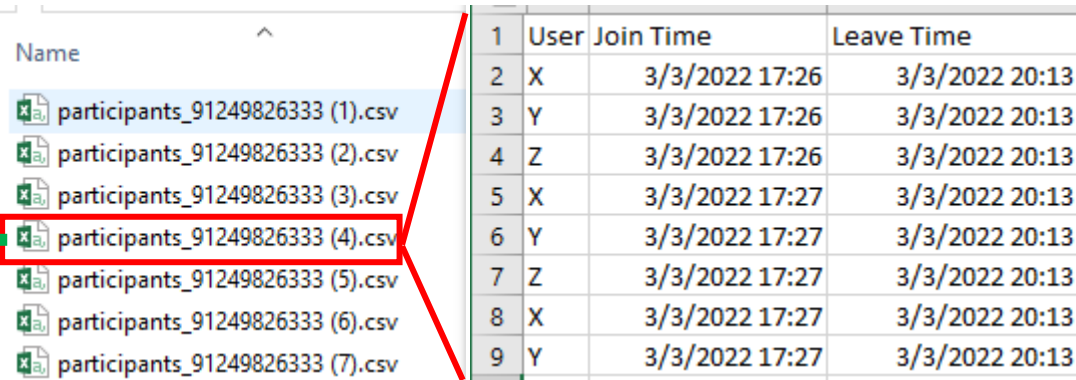 - Several examples to follow

DERs are Everywhere
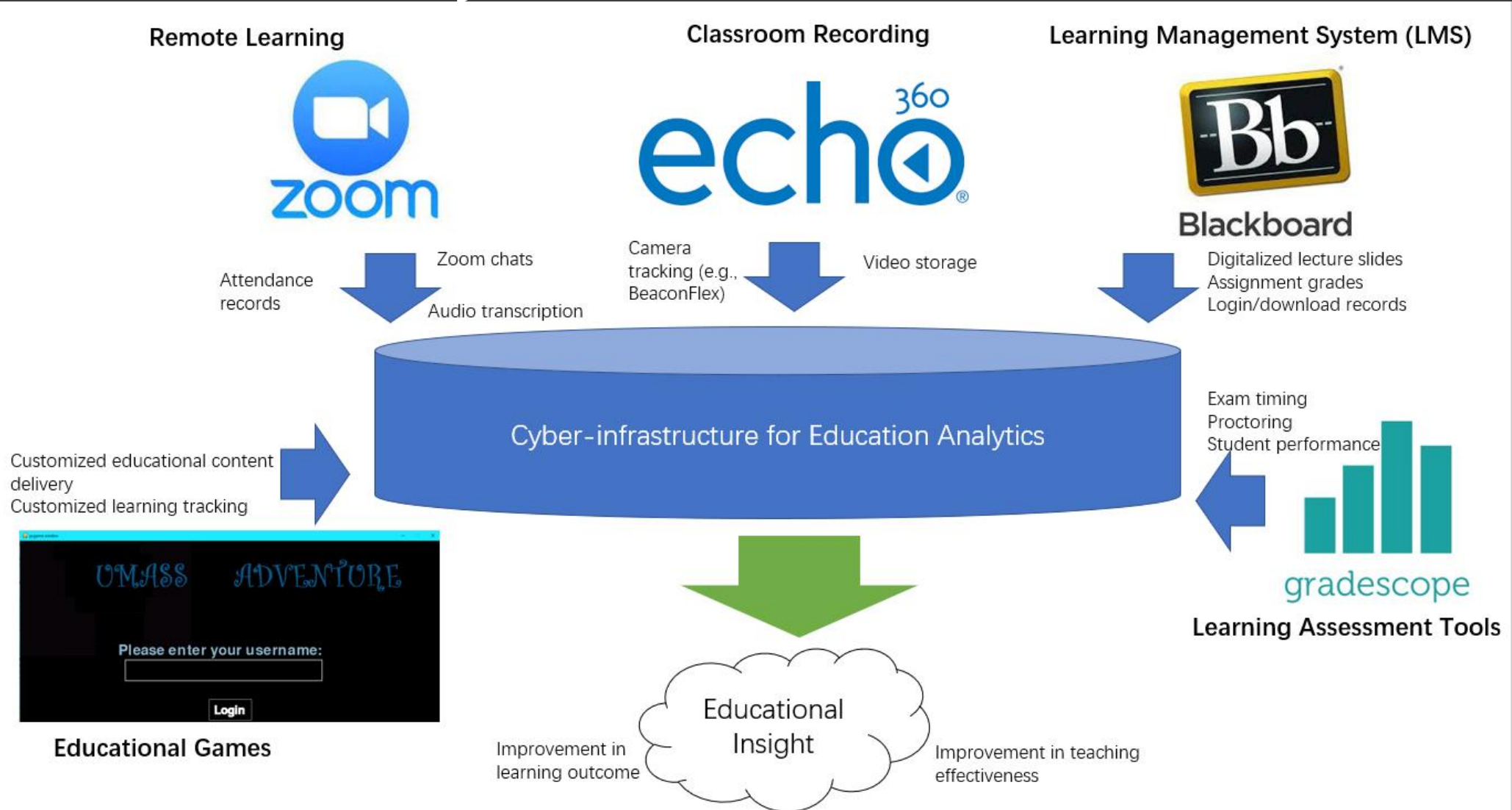
- **Figure 2** Framework of education cyber-infrastructure

DERs are Efficient (Attendance Tracking Example)

Zoom doesn't prepare this for you, but this can be done in 1 second

	User	Join Time	Leave Time
2	X	3/3/2022 17:26	3/3/2022 20:13
3	Y	3/3/2022 17:26	3/3/2022 20:13
4	Z	3/3/2022 17:26	3/3/2022 20:13
5	X	3/3/2022 17:27	3/3/2022 20:13
6	Y	3/3/2022 17:27	3/3/2022 20:13
7	Z	3/3/2022 17:27	3/3/2022 20:13
8	X	3/3/2022 17:27	3/3/2022 20:13
9	Y	3/3/2022 17:27	3/3/2022 20:13

Name
- participants_91249826333 (1).csv
- participants_91249826333 (2).csv
- participants_91249826333 (3).csv
- participants_91249826333 (4).csv
- participants_91249826333 (5).csv
- participants_91249826333 (6).csv
- participants_91249826333 (7).csv

Downloadable from Zoom

Attendance metadata

Student	Attendance	Total Duration (min)	Late15min	Late30min
Xlsqew$QgGerr	15	2162	1	1
Jsvfiw$Pii	14	2282	3	3
Wler$Nmerk	13	2312	0	0
Ihyevhs$We	13	2204	0	0
Vsfip$Qifvelxy	13	2169	1	1
tixiv$hs	13	2127	0	0
Hsykpew$Pme{	13	2117	0	0
Xem$Rks	13	2110	0	0
Nmer~lsy$Jerk	13	2103	0	0

- Zoom attendance metadata aggregated to semester attendance summary

All of these can be done with just **one click**

DERs are Efficient (Exam Grading Example)

- Digitalized Exams

- Generating Randomized Questions

```
Q1: string s='I have never taken an exam like this'.
    What will be returned by s[14:31] ?          (3 point)

Q2: Calculate  8+10+12+ ...+146+148            (3 point)
```

- Pros: **Help prevent cheating**
- **Automated Grading**

Question	Points	Standard Answer	Student Answer	Note
Q1	3	aken an exam like	aken an exam like	Corr
Q2	3	5538	5538	Corr
Q3	3	7	(allow +- 10% error) 7	Corr
Q4	3	190	0	Incorr
Q5	2	20	6	Incorr
Q6	2	Overheat	Heat Wave	Incorr
Q7	4	4	0	Incorr

All of these can be done with just **a few clicks**

DERs are Valuable (Audio Analysis Example)

```
▷ GMT20220127-22253    244   00:10:49.980 --> 00:11:03.690
▷ GMT20220203-22263    245   Shan Jiang: Practice that infe
▷ GMT20220210-22260    246
▷ GMT20220211-01013    247   62
▷ GMT20220217-22283    248   00:11:04.770 --> 00:11:25.350
▷ GMT20220218-01002    249   Shan Jiang: The l&r was hard,
▷ GMT20220224-22285    250
▷ GMT20220303-22263    251   63
▷ GMT20220304-00594    252   00:11:29.970 --> 00:11:41.220
▷ GMT20220310-22270    253   Shan Jiang: For the pedals que
                       254
                       255   64
                       256   00:11:59.610 --> 00:12:00.570
▷ GMT20220310-23542    257   Shan Jiang: copy and paste.
```

Audio Transcripts
(Downloadable from Zoom)

- Zoom chats and audio transcription texts can be aggregated to semester participation summary

Zoom doesn't prepare this for you, but this can be done in several seconds

Student	NumChats	NumWords	VoiceChats	SpokenWords	TotalCount
Wler$Nmerk	46	207	14235	176047	14281
Vsfip$Qifvelxy	257	1586	558	5614	815
Ihyevhs$We	85	309	492	5307	577
QH$Oler	217	842	41	336	258
Tihvs $Lirvmuyi$ Kvers $Pype$ Tekerm	148	968	78	999	226
Zer$Tleq	131	741	80	756	211
Pevv}$Li3lmq	151	682	28	162	179
Tvewlmhle	24	145	75	640	99
Jsvfiw$Pii	68	547	1	1	69
Tihvs $Tekerm$,Tlsri$Eyhms-	3	14	60	747	63
Ivmge$Jpsviw	60	287	0	0	60
Xem$Rks	56	119	0	0	56

Visualizing Lecture Speech

Talk Speed vs Student Response
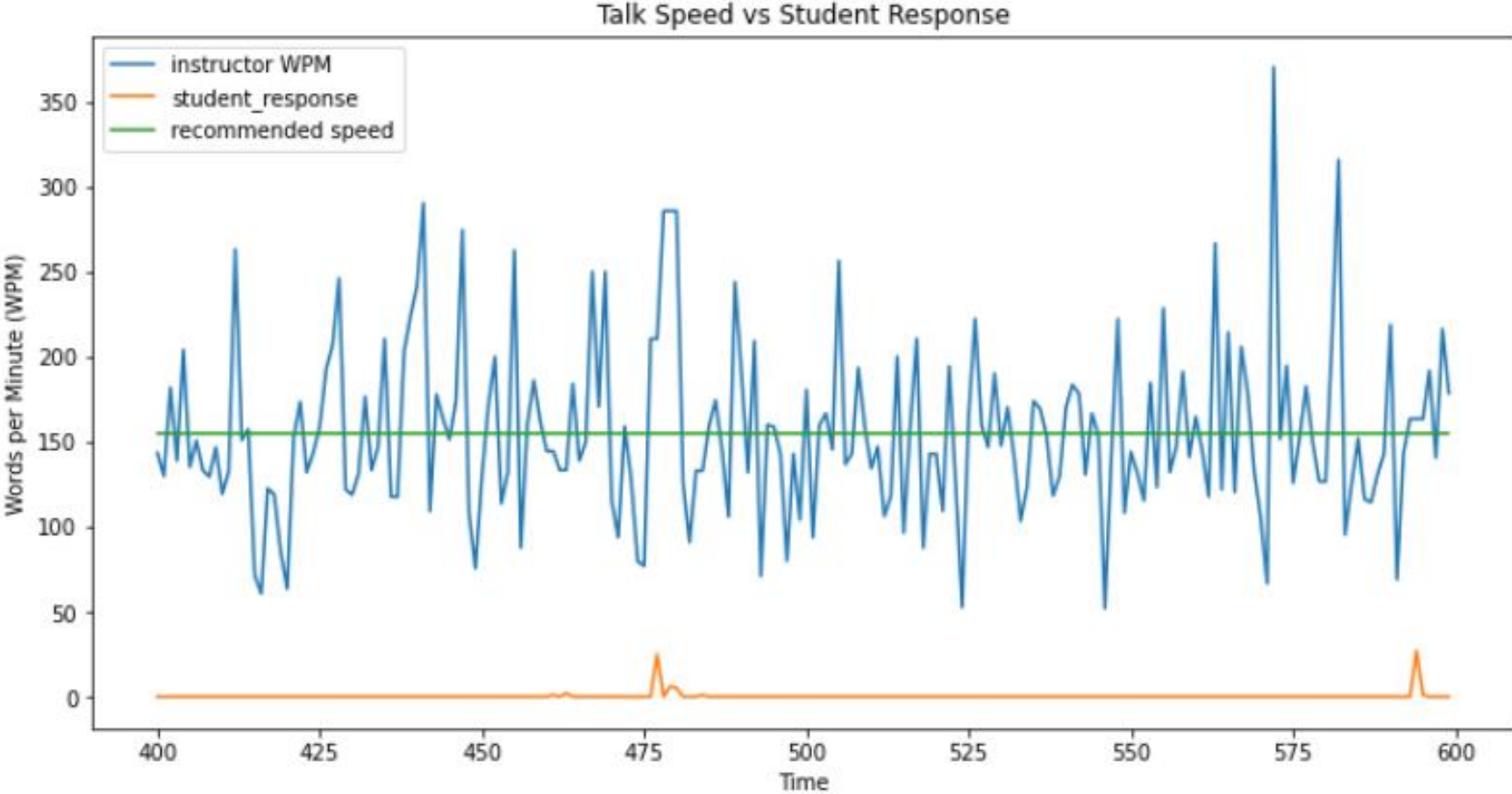
Wait a Minute …

- What if I want data that are unavailable from Zoom, Blackboard etc. (3rd party software) ?
  - e.g., How much time did students spend on exercises?
  - e.g., Which part of my classes do students have difficulties understanding?
- Need of in-house, customized DER collecting mechanism
  - DERs as strategic resources

- I started to develop educational games as a starting point
  - **Collection, Storage, Management, Analytics**

Why Educational Games?

- Game-based learning as an effective pedagogy

- (College) students love games!
- I love games, too!
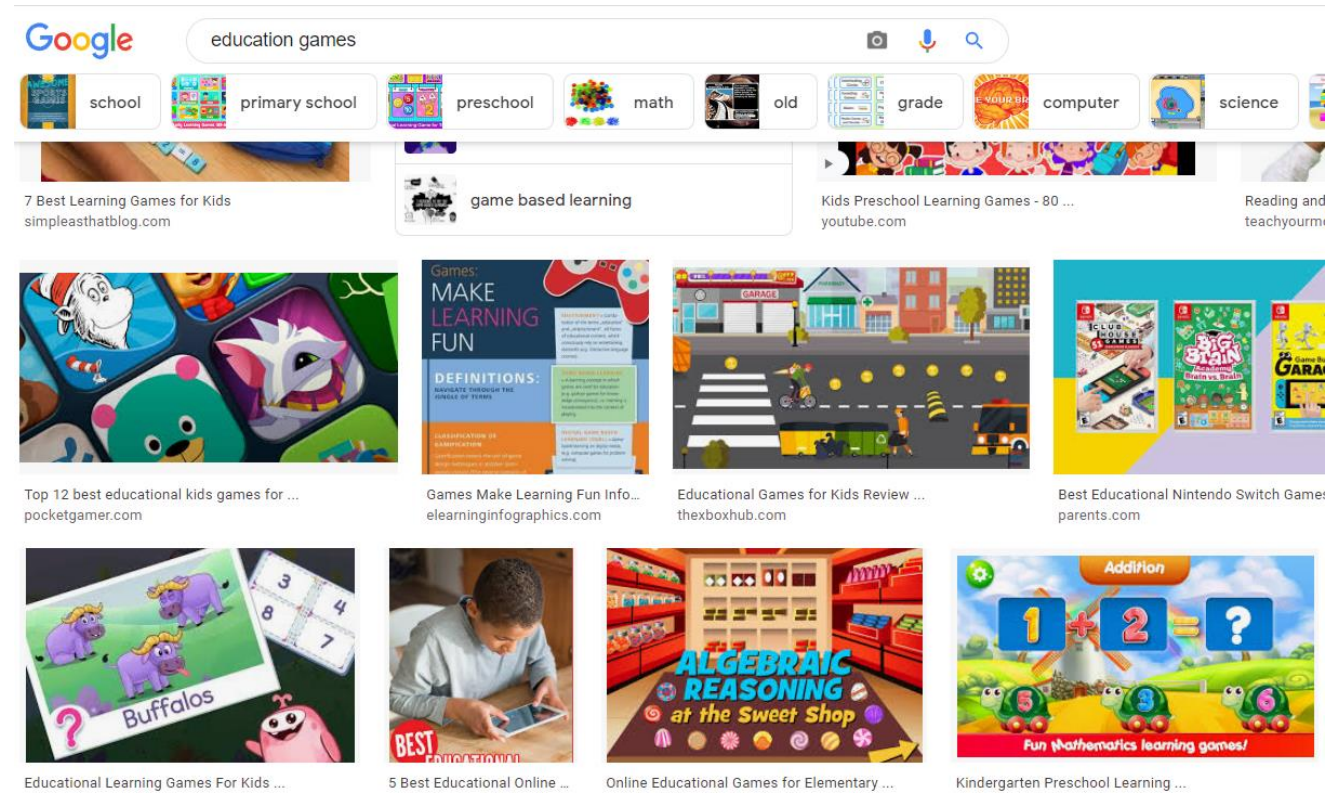
Figure 3 Lack of educational games for young adults

My First Game

- Developed in 2016
- Text-based
- Fun as learning material (for a few weeks)
- Boring as a game

```
Welcome back! Login completed.


Select an option below (input number 0~5):
1: Catch pokemon
2: Fight against another player
3: Visit PokeStop
4: View items in bag
5: View pokemons in hand
0: Save and Exit


2
```

Figure 4 Screenshot of PokemonGo v1.0

My Second Game

- Developed in 2017
- Added Graphical User Interface (GUI)
- Fun as learning material (for more weeks)
- Still Boring compared to commercial games
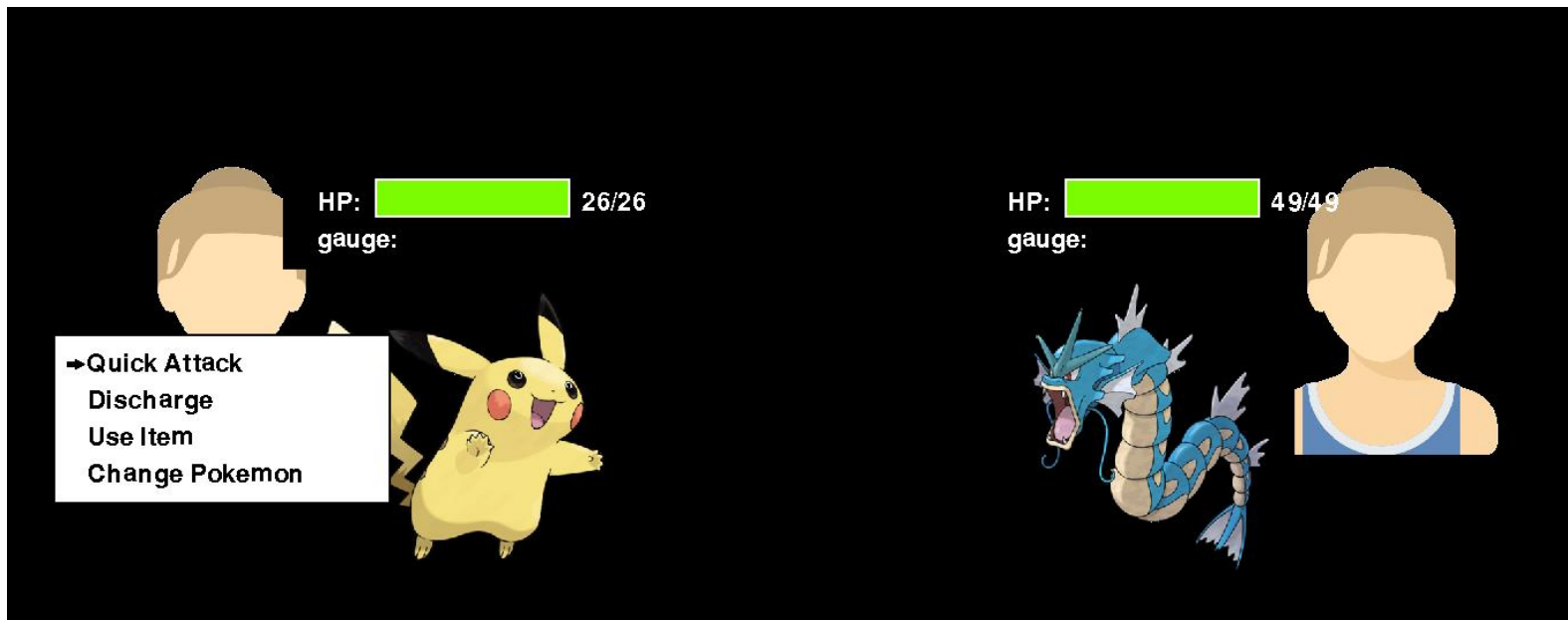
Figure 5 Screenshot of PokemonGo v2.0

My Third (Serious) Game

- Developed during COVID-19
  - 50,000+ lines of codes
  - demo
- Resemble a real-world game
- **Good** for teaching programming
- **Not good** for other courses

Figure 5 Hearth v1.0 Demo

My Fourth Game: UMass Adventure

- Prototype
  - Still under development
- Campus map integration: Reality
- Role-playing game: Fun
- Supporting education analytics for various courses: Meaning

- demo
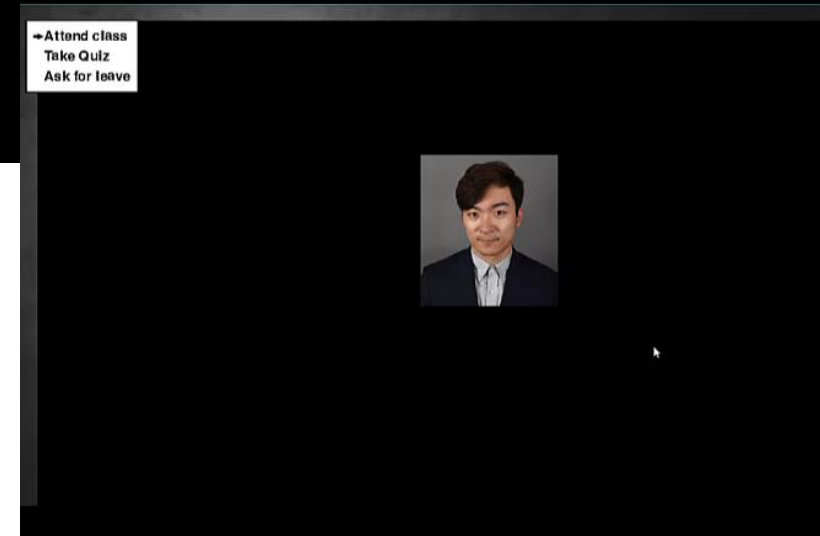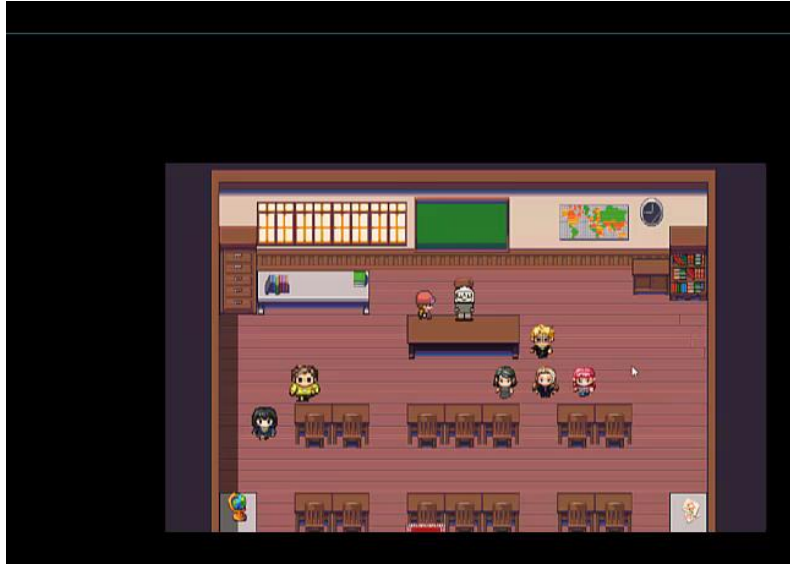
Figure 6 Game Demos:
Player walking in Wheatley Building (left)
Player taking quizzes from professors (right)

UMass Adventure: Supporting Analytics

- **Collection, Storage, Management, Analytics**
- Automatic collection of quiz/exercise activities

	pqID	player	professor	quizID	student_answer	correct_answer	register_time	resolve_time
1	1000003	Test2	Shan Jiang	100052	C. It translates languag...	C	2021-10-19 16:26:16.0000000	2021-10-19 16:26:17.0000000
2	1000004	Test	Shan Jiang	100055	D. "o W"	D	2021-10-19 19:20:49.0000000	2021-10-19 19:21:09.0000000
3	1000005	Test	Shan Jiang	100069	A. B	A	2021-10-19 19:21:17.0000000	2021-10-19 19:21:26.0000000
4	1000006	Test	Shan Jiang	100056	B. "HloW"	C	2021-10-19 19:21:30.0000000	2021-10-19 19:21:31.0000000
5	1000007	Test	Shan Jiang	100056	B. "HloW"	C	2021-10-19 19:21:30.0000000	2021-10-19 19:21:35.0000000
6	1000008	Test	Shan Jiang	100056	C. "drw"	C	2021-10-19 19:21:30.0000000	2021-10-19 19:21:40.0000000

Figure 7 sample snippet of automatically recorded exercise-level metadata.

UMass Adventure: Supporting Analytics

Discovering Educational Insight from Game Database

	Exercise	Error Rate	Correct Answer	Students tend to Choose
0	What is IDLE in Python?	30.50%	A	B
1	In Python which of the following is equivalent...	24.60%	B	A
2	Which of the following concepts belong to OOP?	19.20%	C	D
3	What is returned by 6.0//4?	17.20%	C	A
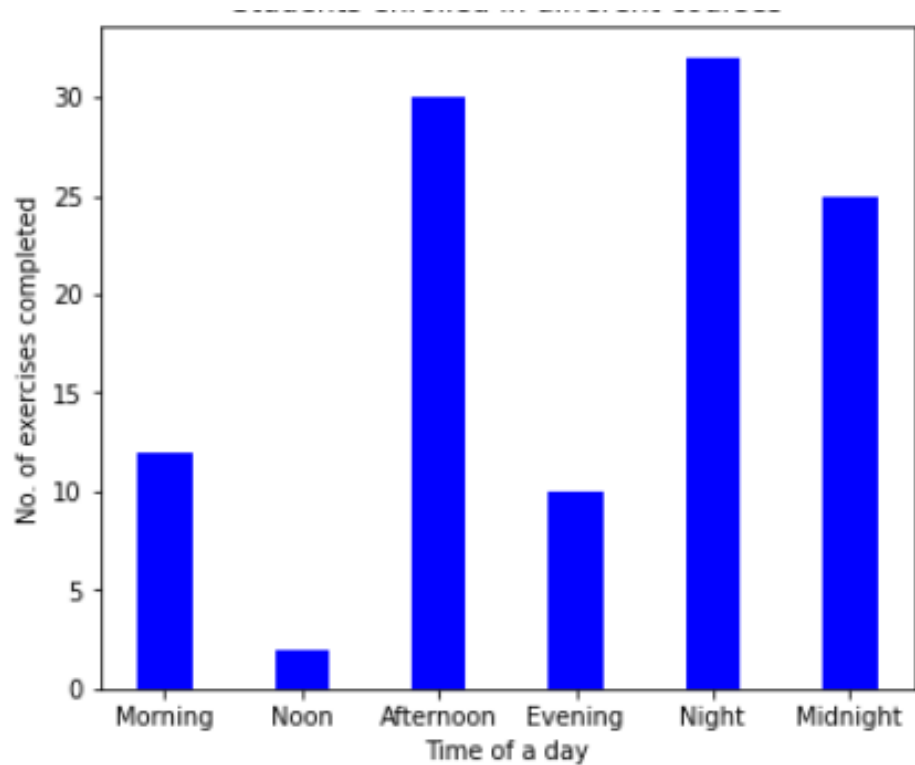
Example 1: When do students work on exercises?   **Example 2: Which exercises do students need more help?**

Adaptability

- Supporting various courses

- Currently supporting structured questions
  - Room for extensions

**Figure 8** Loading structured exercises of any courses into game database

Are DERs Utilized?

- *"I didn't know Zoom can transcribe audios"*

- *"I deleted the lecture recordings because it takes so much space"*

- *"The idea is cool, but I don't know how to implement it"*

- DERs are being generated, but not fully managed
- Analyses above need coding/technical support
  - Luckily, I am good at it!

- **Metaverse for Education Analytics**
  - **Infrastructure for DERs**
  Collection, Storage, Management, Analytics
  - Goal: Educational Insight, Teaching Improvement
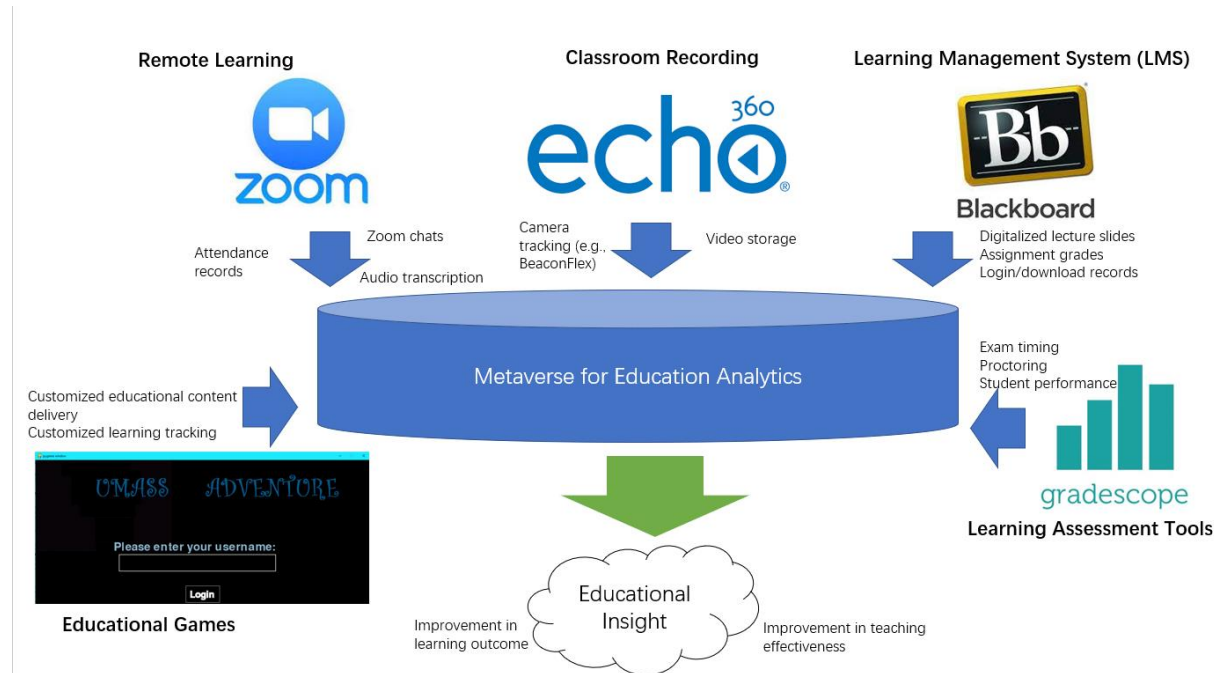
UMass Adventure ➔ Metaverse

- How do we motivate students to play?
  - Immersive experience
    - Upgrading Resolutions
    - VR/AR
  - Social Functions
  - Decentralized System
    - User Generated Contents (UGCs)
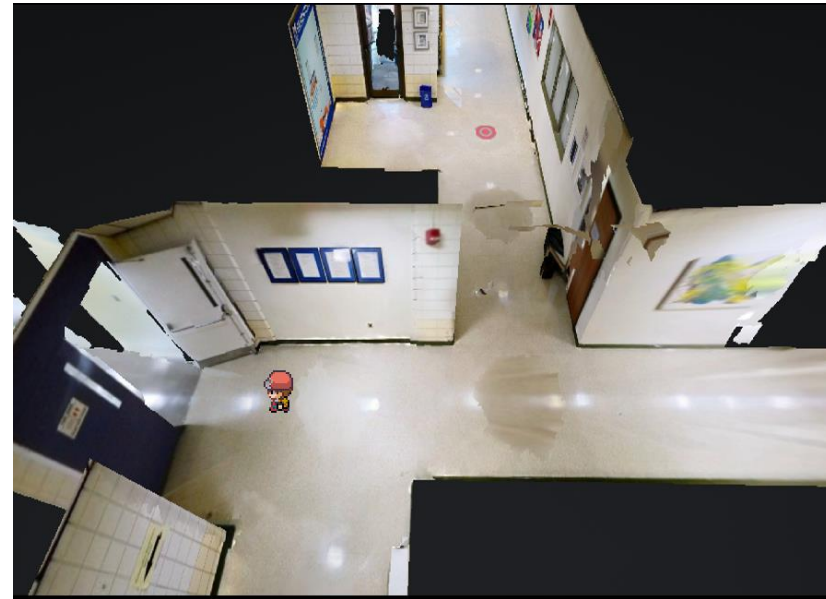 - Exchange of Real World Assets

Metaverse

Figure 9 Using 360-camera to restore virtual campus maps

Where are the Opportunities?

- Campus virtualization is not new

- Education metaverse is not new
  - Too much focus on VR
  - Profit-driven

Figure 10 Virtual Campus of Tsinghua University, China

- Education metaverse to support education analytics is **new**

The bottom line is that developers of so-called educational apps and scientists who study how children learn are not communicating with one another.

Faculty-driven, involving students and technical professionals

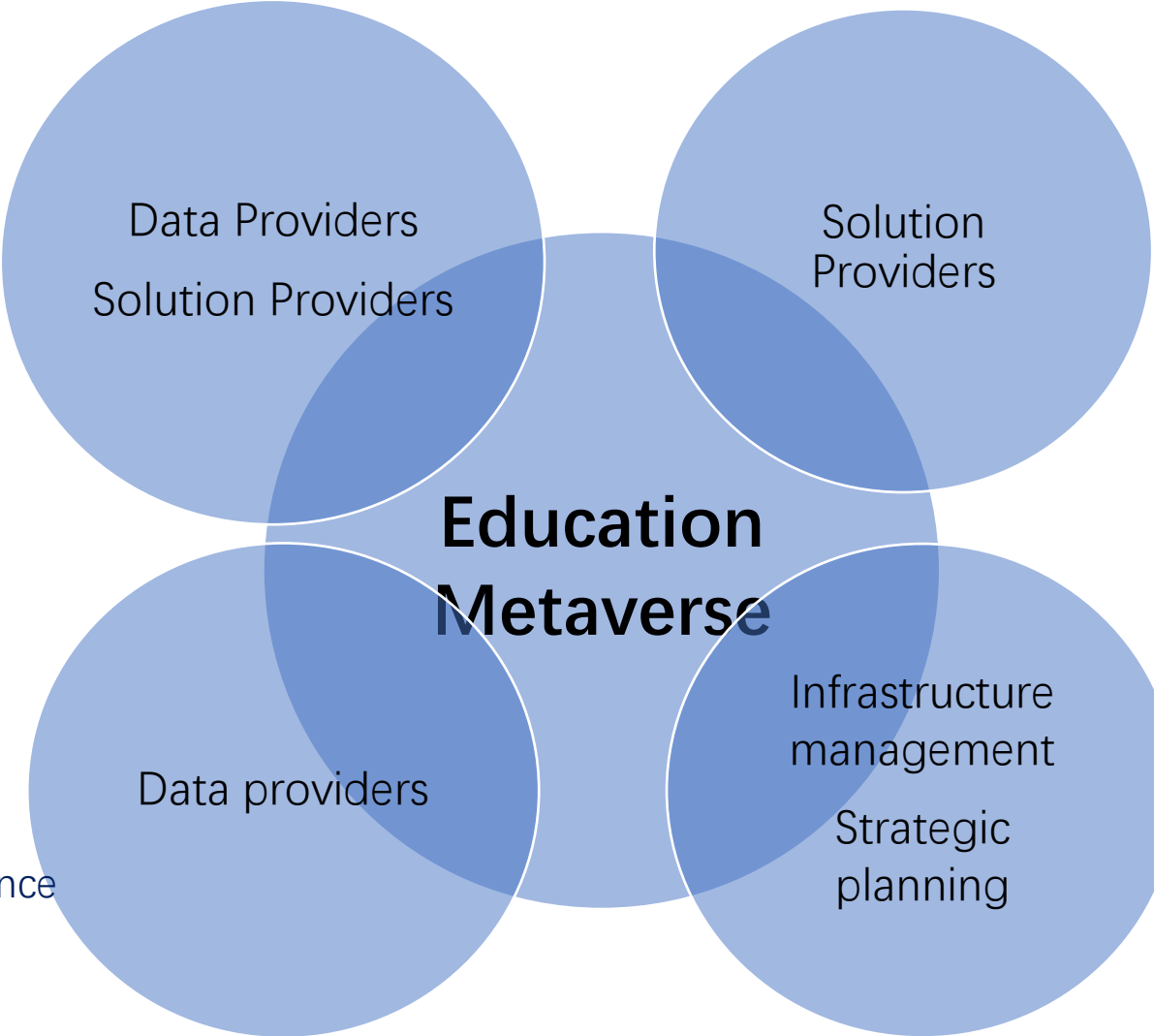[1]https://www.brookings.edu/research/a-whole-new-world-education-meets-the-metaverse/

Education Metaverse to Support Education Analytics

- Games are good, but not have to be
  - Key: incentives

- Benefit educators of all technical levels
  - Key: ecosystem

- Can be an ecosystem where users
  - Publish analytics needs
  - Publish DERs (privacy needs to be protected)
  - Publish analytics solutions

Stakeholders of Education Metaverse

Figure 11 Stakeholders of Education Metaverse and Their Roles

Next Steps & Challenges

- Better arts/cosmetics
- Transition to web-based or mobile-based
- Privacy & security Issues
- Recognizing DERs as strategic assets for institutions

To everyone:

Save your DERs even if you don't use them now

Q & A

• Thanks!

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