



Re-envisioning Engineering Labs: A Data-Driven Approach for Blended Learning



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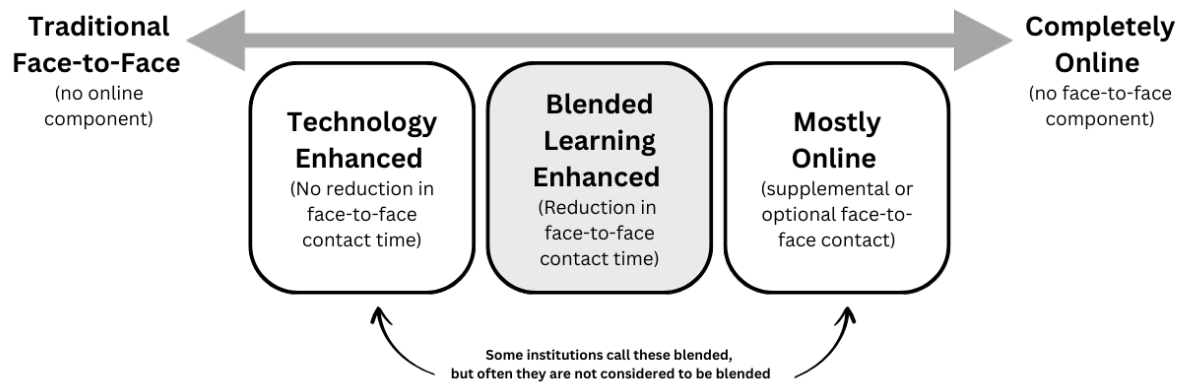
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Blended Learning in Context



Transferable Skills Remote Learning Builds

- Time management
- Digital literacy
- Problem-solving skills
- Work-life balance
- Online communication

The **primary instructional design challenge** resides in

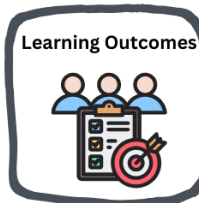
- **assessing the ability of these virtual learning modalities to impart knowledge and skills** equivalent to those acquired in traditional, face-to-face laboratory environments
- **equipping faculty and programs** with appropriate instructional techniques to navigate various delivery formats simultaneously.

Graham, Charles R., Wendy Woodfield, and J. Buckley Harrison. "A framework for institutional adoption and implementation of blended learning in higher education." *The internet and higher education* 18 (2013): 4-14.

Derrick, M. Gail. "Creating environments conducive for lifelong learning." *New directions for adult and continuing education* 2003.100 (2003): 5-18.

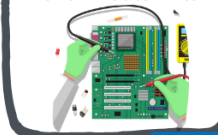


Research & Implementation Team:
Sindia M. Rivera-Jiménez & Fernando Mérida

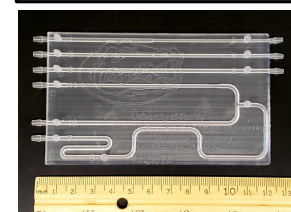
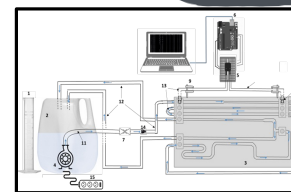


How to teach a **lab course** online while keeping the hands-on experience and other student learning outcomes?

Lab Experiments with ChemE Gator Kits



1. Reinforce fundamentals by experiment-based data collection
2. Gain proficiency in written and verbal communication
3. Gain teamwork experience
4. Create a sense of professional responsibility for the quality and integrity of engineering work.
5. Follow safety guidelines thus promoting a safe environment for others
6. Learn equipment, instrumentation, and procedures not covered in lecture courses
7. Apply basic concepts of design of experiments and experimental statistics



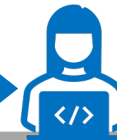
Desk-scale experimental kits for Chemical Engineering Laboratories:

- Modular, modern, versatile, easy to ship, low-cost.
- Remotely-assisted experimentation (synchronous or asynchronous)
- 3D-printed units, Arduino-controlled sensors
- Software for data monitoring and acquisition

Traditional Face-to-Face
(no online component)



Spring 2020
Emergency Remote Teaching



Technology Enhanced
(No reduction in face-to-face contact time)

Blended Learning Enhanced
(Reduction in face-to-face contact time)

Mostly Online
(supplemental or optional face-to-face contact)

Some institutions call these blended, but often they are not considered to be blended

Products

Educational

FLU: Fluid Flow

CUR: Pump/valve curves

BED: Fixed Bed Column

HEX: Heat Exchangers

Dissemination

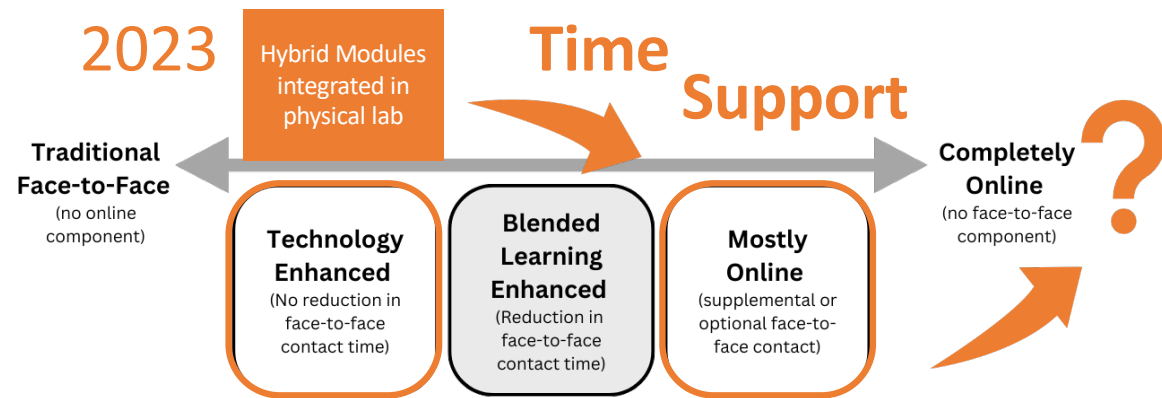
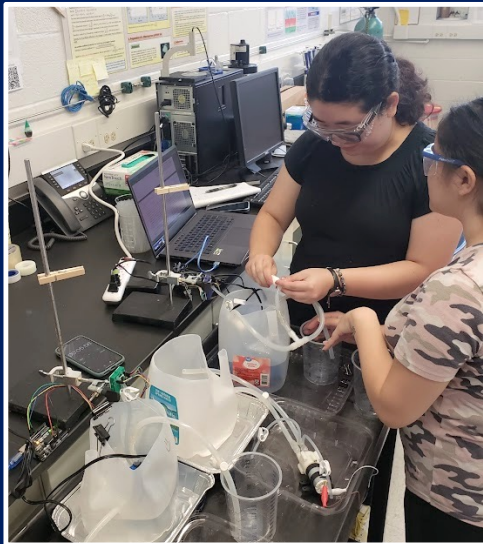
1 Conf. Proceedings

7 Presentations

1 HWCoe Seed Funding

1 Proposal In-Progress

2 Potential collaborators

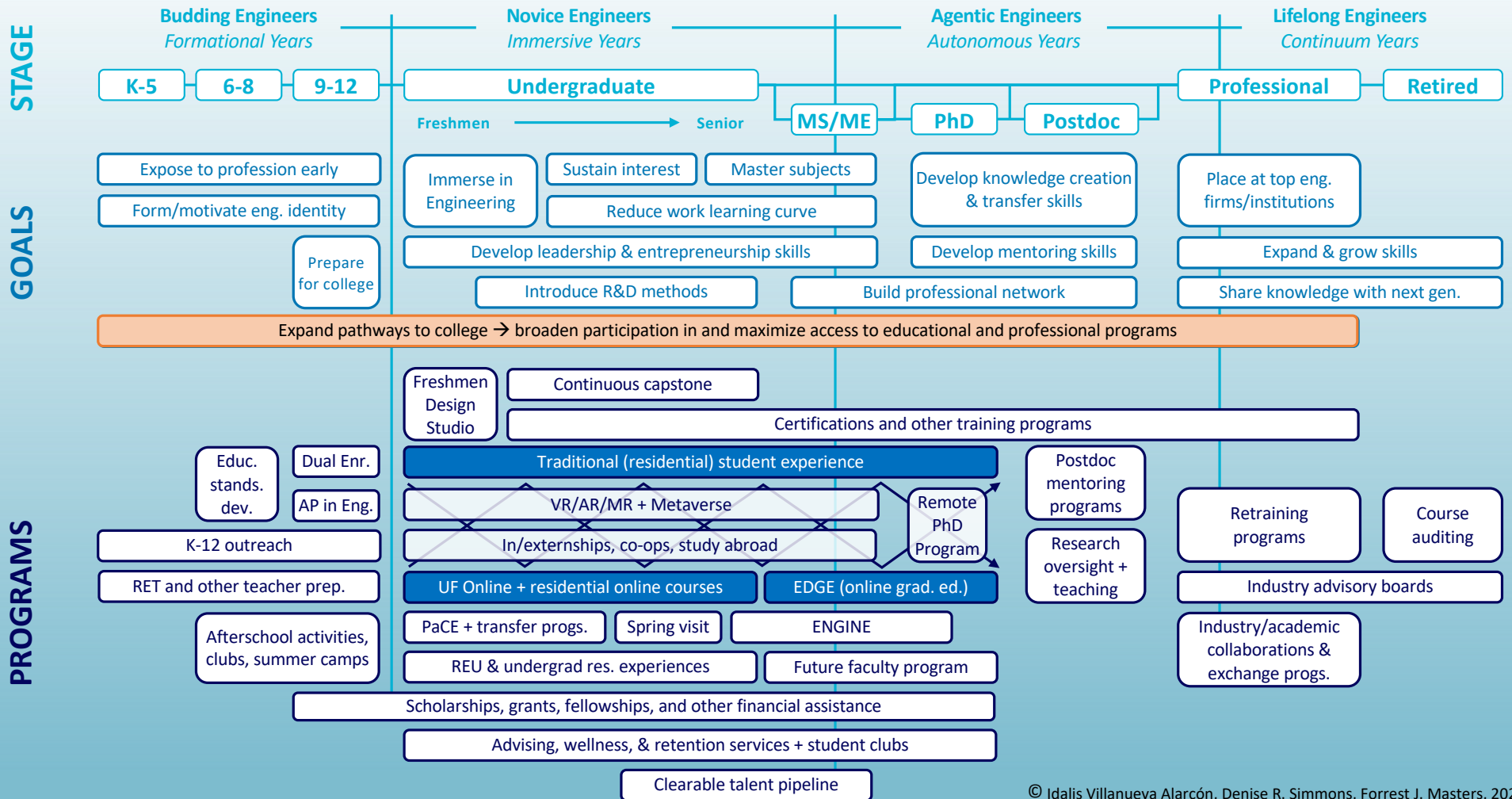


Emergency Remote Teaching Does Not Equal Quality Online Learning Design.

- 1 How can we effectively design **blended learning experiences** for engineering **laboratory courses** that not only achieve specific course learning outcomes but also enhance student's lifelong learning skills?
- 2 What strategies can be identified to effectively replicate **the hands-on, critical thinking, and experimental design experiences** traditionally integral to engineering education, **addressing critical challenges** in online engineering laboratory courses?"

Hodges, C. B., Moore, S., Lockee, B. B., Trust, T., & Bond, M. A. (2020). *The difference between emergency remote teaching and online learning*. <http://hdl.handle.net/10919/104648>

THE FLORIDA LIFELONG LEARNING MODEL



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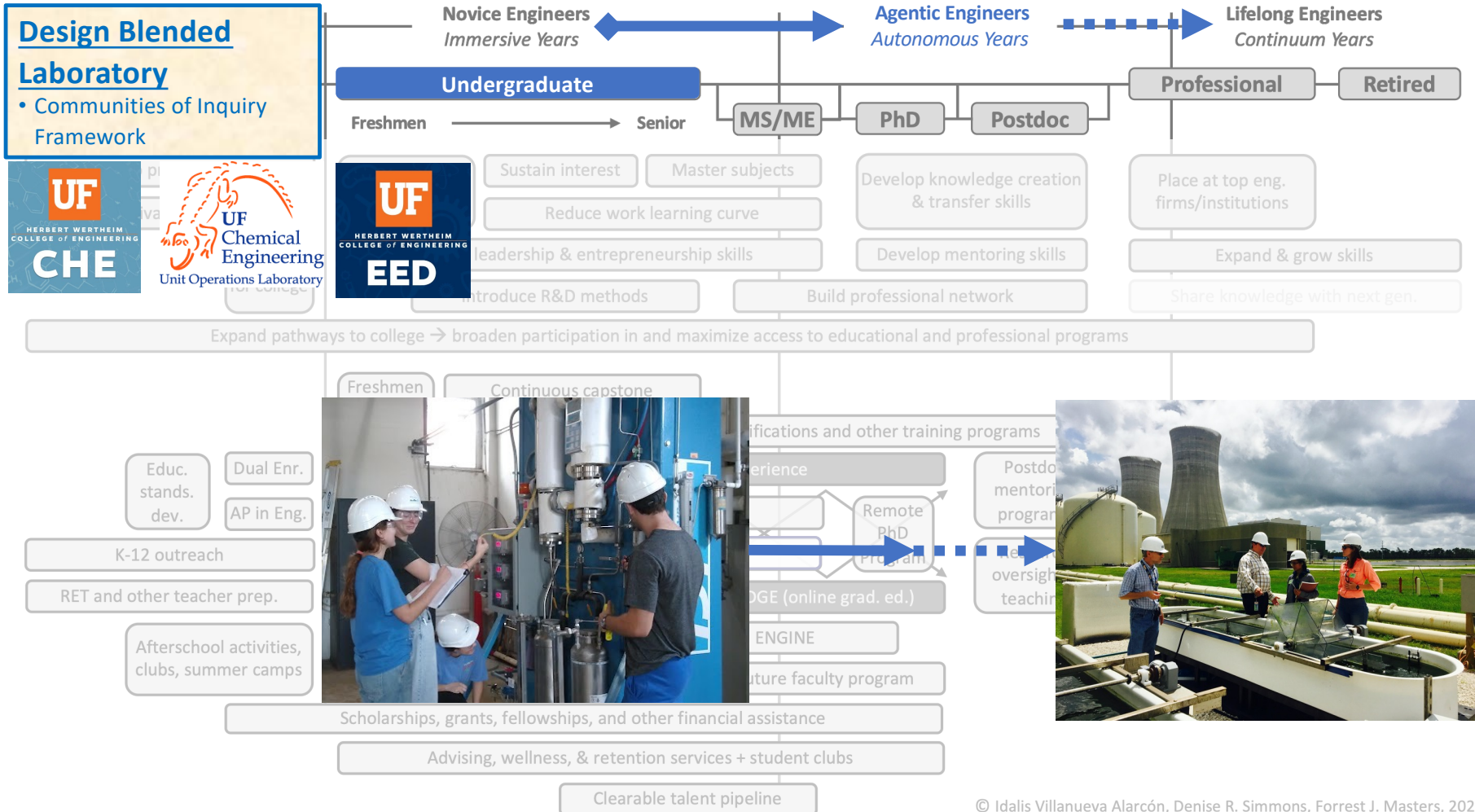
STAGE

GOALS

PROGRAMS

Short term impact

Long term impact



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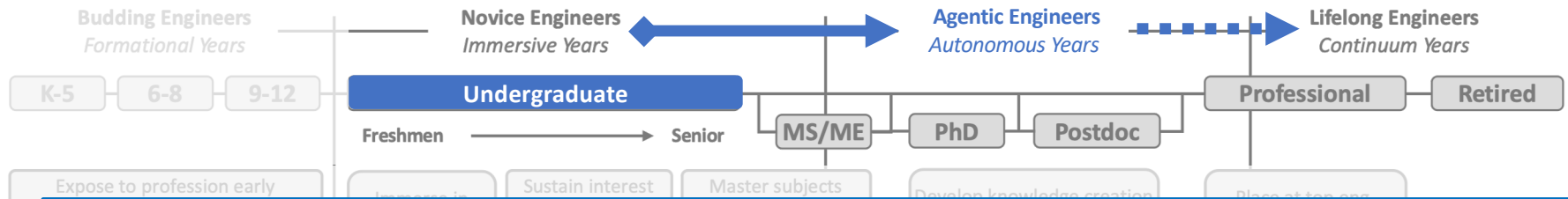
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Eight-week Pilot Study (Summer 2024)

Participants

- *Not for credit!*
- *IRB with Participants Payment*
- 12 UG students (3 teams), peer tutors, and graduate student

Instructional Design Materials

- *Team building, data analysis, report preparation, timely reflections*
- *One kit per student, but students will form teams*

Proposed Schedule for Blended Environment (Pilot: 75% Online)

- Week 1: Consent, orientation, and team building
- Week 2, 3, 4 & 5: Conduct two experimental modules (*e.g., fluid flow and heat exchangers*) + data analysis
- Week 6 & 7*: Conduct experimentation with existent pilot-scale lab equipment + data analysis (one week)
- Week 8: Wrapping up, presentations, and final surveys

* *in-person*

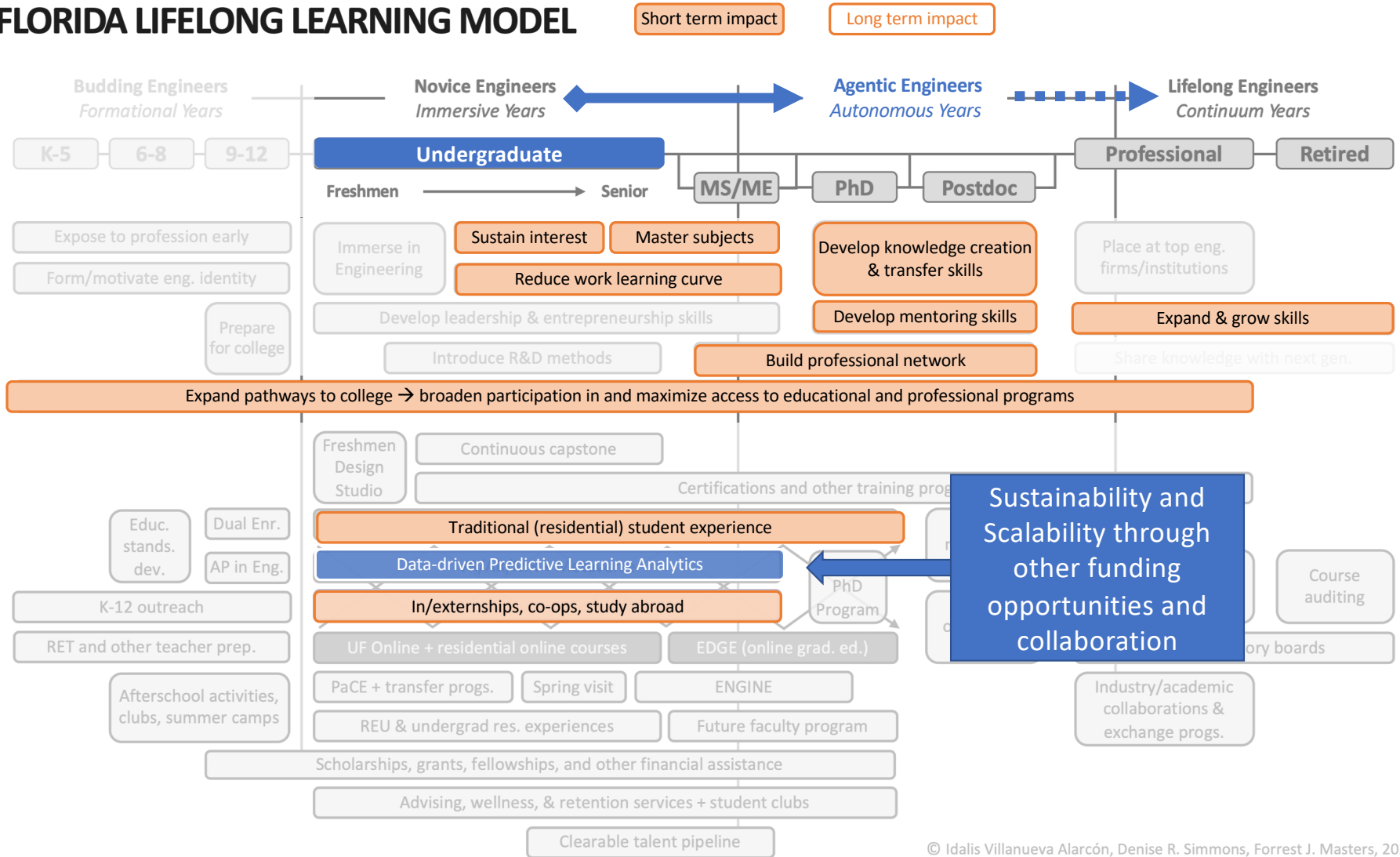
Clearable talent pipeline

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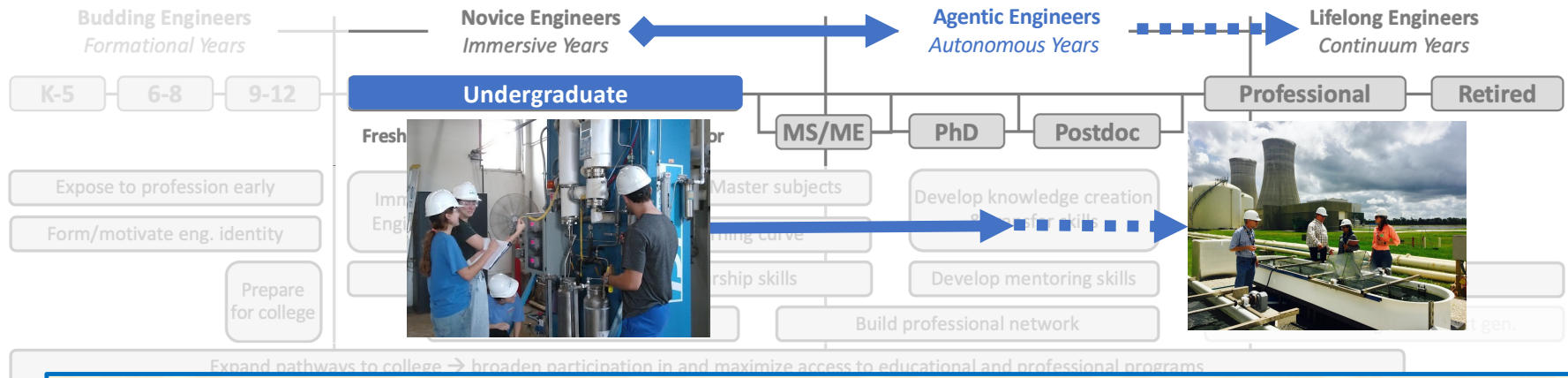
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Anticipated Challenges for Mostly Online Environment Pilot

1. Ensuring that the instructional design aligns with specific learning outcomes.
2. Consistently engaging and motivating students to participate actively can be challenging.
3. Developing assessments that accurately measure learning outcomes and provide meaningful feedback (e.g., balancing formative and summative assessments)
4. Maintaining rigorous academic standards and ensuring the quality of education is preparing student to succeed in the autonomous and continuum years.