Fortifying asynchronous online learning with digitally delivered in-person assessments to leverage the testing effect

Richard Thripp[1], M.A., Ronald DeMara[2], Ph.D., Baiyun Chen[3], Ph.D., and Richard Hartshorne[1], Ph.D.
University of Central Florida, Orlando, FL, United States
[1] Dept. of Educational and Human Sciences, [2] Dept. of Electrical and Computer Engineering, [3] Center for Distributed Learning

Scan to visit website of UCF's Evaluation and Proficiency Center.

"Students know *far less* upon completing a course than faculty think they do."

– NSF project assessing student achievement in undergraduate STEM courses

Why? What to do about it?

- What faculty think students get ≠ what students actually get
- Good exam scores ≠ conceptual understanding
- Effective assessment → student achievement ⇧
- **Formative assessment** monitors learning to give ongoing feedback
  - *used by instructors to tune teaching*
  - *used by students to hone their learning*
- "**Testing effect**" of quizzes vs. low compliance/efficacy of homework
- (Summative + Formative) assessments > Summative only
- Formative assessment + Peer Teaching → Student learning ⇧

What is the *testing effect*?

- Students learn more when open-book study is augmented by frequent closed-book tests.
- At the Evaluation and Proficiency Center, timely, detailed feedback with opportunities for Socratic dialog locks in learning gains.

How do we *assist students* to develop STEM knowledge and skills when we digitize STEM content and assessments?

Digitizing STEM Content: Four Foci

1) **Core Concepts and Experiences** — Foundation of knowledge, examples, and varied experiences organized around big ideas
2) **Task Analysis** — Develop understanding sufficient for learners to prioritize key issues and sequence their solutions
3) **Metacognition** — Help learners gain awareness of their thinking processes, enabling adaptation to changing problems
4) **Engagement and Integrity of Learning** — Facilitated by *course design* and *assessment delivery.* UCF's *Evaluation and Proficiency Center* (EPC) approach emphasizes these from the ground up by combining digitally-delivered proctored testing with digital and F2F remediation

How can we improve student learning and faculty effectiveness in online and hybrid STEM courses through innovative pedagogies and by leveraging the testing effect?

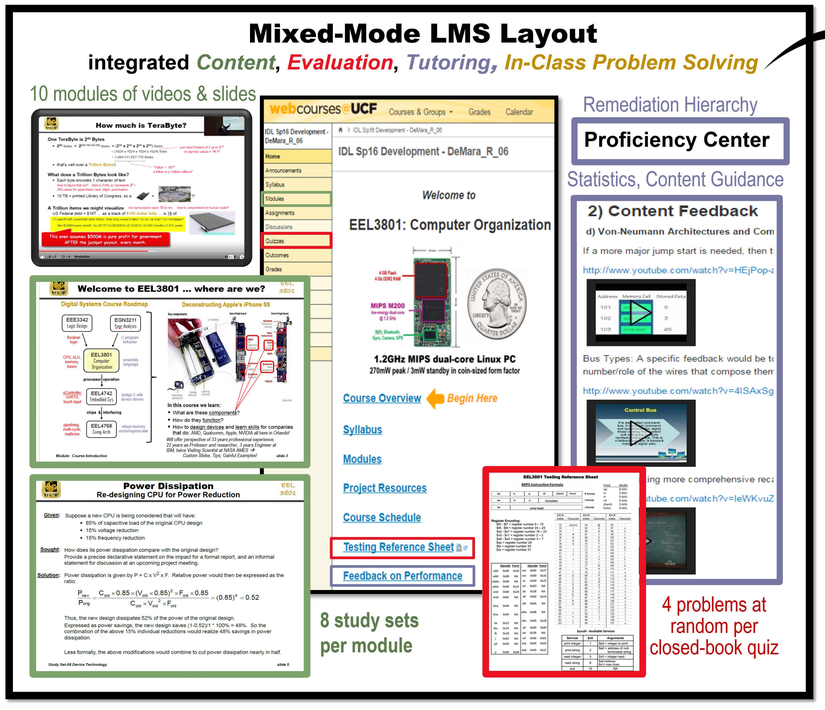
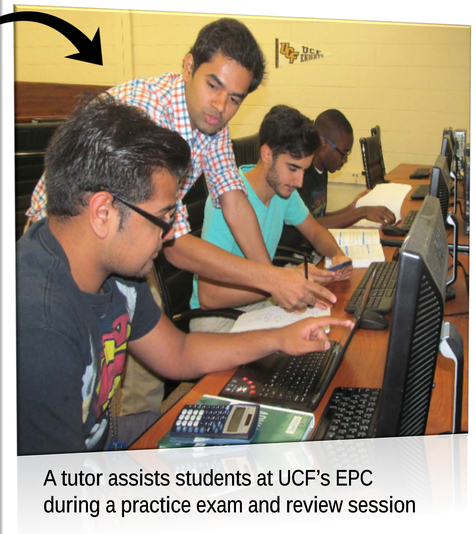


Figure 1. Hybrid STEM course with rich, interactive modules; study sets with worked examples; and dynamic test guides.



A tutor assists students at UCF's EPC during a practice exam and review session

Figure 2. The EPC is not just for proctored testing, but also open tutoring and exam prep. Tutoring, lab, and sign-in areas are separated from assessment areas to maintain quietness.

Score Clarification Improves Learning

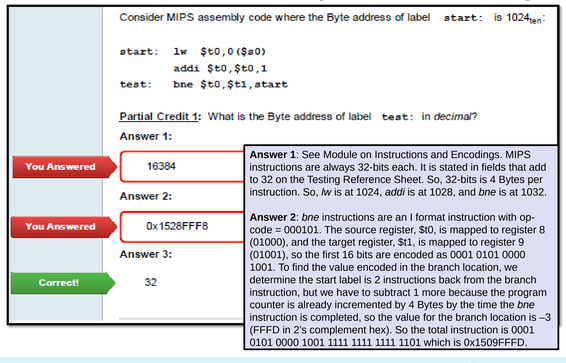


Figure 4. Score clarification explains why an answer was incorrect. Students can meet with tutors for further explanations and Socratic dialogs.

EPC Integrity Gains

- Test banks often get leaked online—non-proctored quizzes might easily be answered via Google.
- New ways to cheat are emerging all the time.

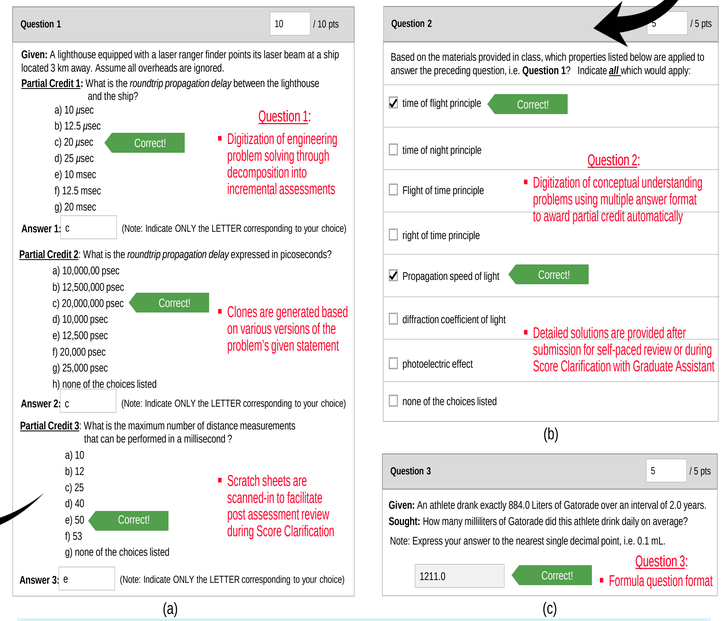


Figure 3. Through digitized quizzes, faculty can use dynamic variables, partial credit, scripted feedback, and more. Proctored delivery prevents cheating and increases content acquisition via the testing effect. Faculty typically provide a 3-day window for students to schedule their quiz.

Table 1. STEM instructional methods strengths and weaknesses.

Delivery	Strengths	*Weaknesses*
Conventional	Status quo bias; some advantages for large class sizes	*Lack of content engagement, potential for cheating, may not teach soft skills, lectures may inhibit learning*
MOOC	High instructor productivity—can reach thousands of students; peer-assessment is feasible	*No authentication, low retention, requires good Internet access, manual grading is difficult*
Flipped or Blended Classrooms	Videos improve comprehension and student enjoyment; in-class time is reallocated to active learning and productive activities	*Students may be unprepared or resistant, homework must be tailored to be effective, may lack instant feedback*
Testing Center	Reduces cheating and allows scheduling flexibility; improves instructor and GSA productivity	*Upfront equipment, software, and staffing costs; requires physical space and training*
Evaluation and Proficiency Center (EPC)	**Testing center, smart question design, score clarification, remediation, and open tutoring frees instructors' time and enables student success via integrity, engagement, and the testing effect**	*Challenging to implement—requires university- or department-level funding, changing existing instructor pedagogies, and cooperation from many stakeholders*

Digitizing and Remediating STEM Assessments
University of Central Florida

Week	Modality	Topic	Date
0	Online Only	Course Preparation *(read syllabus; intro discussion post)*	–
1	F2F Class	BLUESHIFT & Course Walkthrough	Friday 5/26 at 1:00pm
2	F2F Class	Modularization & Immersive EPC Experience	Friday 6/02 at 1:00pm
3	Online Only	Exemplar Vignettes, Tutoring, and Score Clarification	–
4	F2F Class	Structuring Creativity/Design/Soft (CDS) questions	Friday 6/16 at 1:00pm
5	Online Only	UCF Support Resources	–
6	F2F Class	Showcase & Future Online Content	Friday 6/30 at 1:00pm

Table 2. Course schedule for Digitizing and Remediating STEM Assessments faculty workshop, Summer 2017. At UCF, we educate faculty from diverse STEM fields on how to digitize their assessments and integrate the EPC into their courses. As an incentive, we offer a course release.

Imagine not having to create new questions every semester, not having to administer exams, and having a support staff to explain grades to students. The EPC approach frees your time for teaching, research, and other high-impact work.