

eCORNELL



Learning Molecules™: An Approach to Problem-Based Online Learning



David Shoemaker, Ph.D.
VP, Learning Solutions, eCornell
dshoemaker@ecornell.com



- **Authenticity**
 - Context is king
 - Problem-based pedagogy
 - Learning by doing
- **Social interaction**
 - Communicate, collaborate, and construct knowledge
 - Peer-to-peer & peer-to-instructor
- **Efficiency: cost & time to market**
- **Scalability**
- **Scheduling flexibility**

2

eCornell—a wholly owned subsidiary of Cornell University—has developed an asynchronous, cohort-centric, problem-based approach to professional development and training that combines the effectiveness of the face-to-face workshop with the efficiency and scalability of the online environment. Immersing participants in authentic situations while providing Structured Flexibility™ that enables them to learn at their own pace, eCornell's approach emphasizes the two most important drivers of effective learning:

Context (not content) is king

Yesterday, Robert Kozma talked about 3 goals of learning. Let's consider the 2nd of those goals, knowledge deepening, which Dr. Kozma defined as the acquisition of problem-solving skills. Such skills are essential to the ability to function effectively in today's knowledge economy. I would argue that regardless of what profession we're involved in, essentially what we do is solve problems. That requires that we situate learning in the context of authentic situations in which such problems are likely to arise. If we agree that authenticity is important, then:

- context is the key to authenticity
- PBL is the key to context
- Learning by doing is the result of PBL and a key component of speed to competence Learners must be able to make mistakes, fail painlessly, and try again.

Social Interaction

We learn as much from each other as we do from our teachers




- Peer-to-peer interaction extends the learning experience beyond the core course content and the core expertise of the instructor.
- P2P interaction enables further contextualization of the learning, heightening the level of authenticity.

Scalability

Must be widely available & readily accessible

Scheduling flexibility

Participants need to be able to fit the learning experience into their existing schedules--i.e., it's gotta be easy to take advantage of



- 1. A metaphor and language for designing learning systems**
Bridge the communication gap between SMEs and producers
- 2. A pedagogical approach**
Establish a learning methodology appropriate to the needs of your audience
- 3. A set of content templates arranged according to a taxonomy**
Provide a menu of available tools
- 4. A system of metrics**
Measure production and learner (and instructor) effort

Learning designers face 4 important challenges when working with a team to build an online learning system:

First, we need a shared language that allows the team to communicate effectively.


Second, we need to be able to apply a pedagogy consistently throughout the learning system.

Third, we gain efficiency in the production process by defining a set of re-usable interactive media templates. These templates are presentational formats that provide interesting and effective ways for students to engage with the learning material.

And lastly, we need a set of metrics that we can use to calculate production effort and learning time to ensure that we can produce a course on time and on budget that matches learners' expectations regarding how long it will take to complete.

eCORNELL

A Model for Effective Problem-based Learning

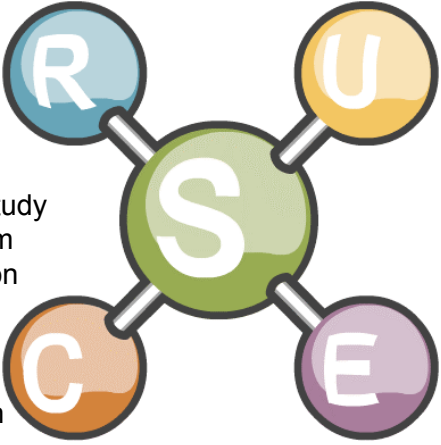


Resource:

- a video lecture
- an article
- a presentation

Utility:

- a self-assessment
- a check list
- a flow-chart



Scenario:

- a case study
- a problem
- a question

Evaluation:

- a test
- a simulation
- a final assignment

4

At eCornell, we developed the Learning Molecule™ as a way to structure the implementation of problem-based learning in our courses.

At the nucleus of the Learning Molecule is the *Scenario* (S). This is the contextualizing component, lending authenticity to the learning experience by presenting a problem, a task, or an assignment.

Orbiting the Scenario are four components serving different functions:



Resources (R) provide the knowledge and information learners need to be able to address the challenge posed by the Scenario. They can take many forms, from simple HTML pages to PDF versions of research documents to Flash-based interactivities, and so on.

Utilities (U) are the job aids, check lists, flow-charts, and so on, that help students apply what they've learned to the workplace. They may be printable documents or even electronic tools that can be downloaded and saved to their local hard drives.

Collaboration (C) tools facilitate the peer-to-peer and peer-to-instructor interaction essential to an effective learning experience. eCornell requires learners to participate in asynchronous discussions in order to receive credit for successfully completing a course. eCornell instructors use a built-in chat tool to conduct weekly office hours. Online polls and surveys help to reinforce the learning community.

The *Evaluation* (E) component enables learners to assess their mastery of the learning objectives. Formats vary, from simple multiple-choice quizzes to complex simulations to course projects and final assignments.

Together, these five elements comprise the basic unit of content around which an eCornell learning system is organized.



Suggested Learning Path

Scenario: [Big Red Value](#)
Management at Big Red Trucking faces an important business decision. View this scenario to find out how an NPV calculation can come in handy.

Learn how to solve problems like the one presented in the scenario. Use the resources and utilities provided here.

Resource: [Get to Know NPV](#)
This is your guided tour of net present value. Find out how NPV is defined, how it is used, what its pros and cons are, and how it is found. Work through several example problems for a full understanding of how this tool can help you evaluate prospective projects.

Utility: [Calculate NPV - Fixed Cash Flows](#)
Not all cash flows are created equal. When they are equal, however, there's an easy way to find the NPV for the project using your financial calculator. Here's a demonstration of how the NPV is found using the TI BA II PLUS or HP 12C calculator.

Resource: [Terminal Infinite Cash Flows \(Required\)](#)
Professor Scott Gibson explains a special case: the terminal infinite cash flow NPV calculation.


Evaluation: [What's the NPV? \(Required\)](#)
Are you ready to make a recommendation to the management team at Big Red Trucking? Put your NPV knowledge to work in this required evaluation.

1. Introduce the problem
2. Provide relevant knowledge & skill resources
3. Invite learners to solve the problem


5

There are two ways to use scenarios as contextualizing elements in a problem-based approach to learning: In the first, learners take on a role in a fictional situation and solve a problem or work through a case study relating to that situation. In the second, the scenario functions as an anecdotal frame of reference to help learners apply what they're learning to their own circumstances.





Let's take a look at an example of the first. Note how the lesson begins with the scenario, which introduces a problem students are asked to solve. That's followed by a number of informational resources introducing students to the knowledge and skills they need to be able to solve the problem. The lesson concludes by returning to the scenario problem, which students are now asked to solve.



Alternate Lesson Structure



Suggested Learning Path

-  Scenario: [Facing Resistance at Herringbone Press](#)
Hear the arguments against Bernard Schmidt's change agenda and his attempts to face down this resistance.
-  Resource: [Arguments Against Change](#)
Explore the arguments your colleagues may use against your change effort.
-  Resource: [Ask the Expert: Preparing Your Response](#)
What arguments are critics and resisters using to slow down your change effort? Professor Sam Bacharach answers questions about how to anticipate the arguments against change.
-  Evaluation: [Course Project: Prepare for Resistance](#)
In the third step of your course project, outline the arguments against your change effort that you anticipate and begin to develop a strategy for addressing these arguments.

- Present problem as anecdotal frame of reference
- Provide relevant knowledge & skill resources
- Invite learners to solve problem in relation to own organization

6

Now let's take a look at an example of a scenario used as an anecdotal frame of reference to help students apply what they're learning to their own circumstances.

Here, the lesson begins with a scenario illustrating a fictional character addressing a problem related to the lesson topic. Students then encounter a number of informational resources designed to teach the knowledge and skills necessary to solve similar problems. The lesson concludes with an exercise that asks students to apply what they've learned to accomplish the next phase in a course project that outlines how they would solve a similar problem in their own organization.

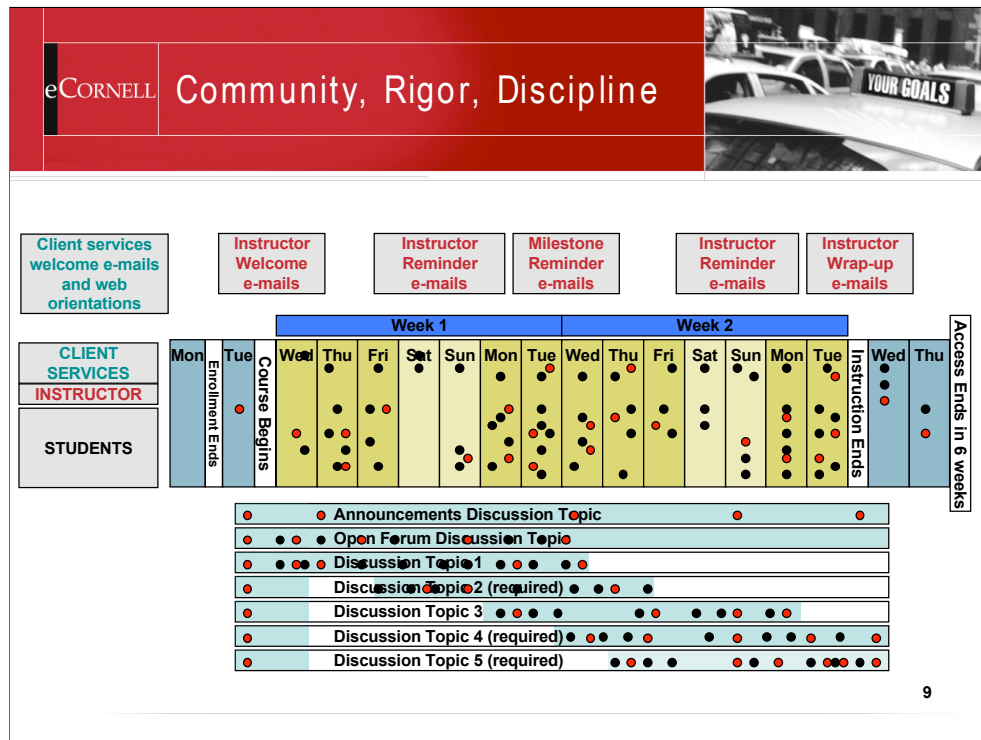
eCORNELL				A Periodic Table of Learning Elements				YOUR GOALS	
TD Text Document LW 5 PW 2	ID Illustrated Document LW 5 PW 4	AD Animated Document LW 7 PW 8	VD Video Document LW 7 PW 14	VW Virtual Workplace LW 15 PW 20	ATE Ask The Expert LW 7 PW 12	CL Calculator LW 7 PW 4	ST Self Test LW 15 PW 10	SP -E Simple Poll LW 8 PW 6	WF -P,S,A Web Form LW 30 PW 6
TM Text Mouseover LW 5 PW 4	IM Illustrated Mouseover LW 7 PW 8	AM Animated Mouseover LW 7 PW 10	VM Video Mouseover LW 7 PW 16		ATP Ask The Panel LW 13 PW 20		GT Graded Test LW 15 PW 10	OP -E Ordering Poll LW 10 PW 6	GF Group Forum LW 30 PW 4
TF Text Flipbook LW 10 PW 6	IF Illustrated Flipbook LW 10 PW 10	AF Animated Flipbook LW 10 PW 12	VF Video Flipbook LW 10 PW 16					RP -E Rating Poll LW 10 PW 6	SE Synchronous Event LW 60 PW 32
TA Text Assessment LW 15 PW 12	IA Illustrated Assessment LW 15 PW 16	AA Animated Assessment LW 15 PW 18	VA Video Assessment LW 15 PW 24		ATE Ask The Expert LW 7 PW 12			OF Open Forum LW 30 PW 4	
TS Text Simulation LW 15 PW 16	IS Illustrated Simulation LW 15 PW 20	AS Animated Simulation LW 15 PW 22	VS Video Simulation LW 15 PW 28					CH Chat LW 30 PW 4	

7

We then extended the molecule metaphor to create the *Periodic Table of Learning Elements*. These elements represent different presentational formats: ways in which learners engage and interact with the course content. The elements are color-coded to correspond to the components of the Learning Molecule: green elements are specific to scenarios, blue to resources, yellow to utilities, purple to evaluations, and orange to collaboration. Those in gray are “neutral” elements, adaptable to any of the components of the Learning Molecule.

The neutral elements are arranged taxonomically. Each row represents a different media type: document, mouseover, flipbook, assessment, simulation. Each column represents a different level of media richness: text, illustration, animation, video. So different media formats can be enhanced with varying levels of richness.

Each element of the periodic table is assigned two numbers (analogous to the concept of atomic weight in organic chemistry): learner weight (LW) and production weight (PW). Learner weight represents the amount of time we expect the average learner will require to complete a particular element. In the example above, the resource we call Ask the Expert has a learning weight of 7, which means learners will require an average of seven minutes to complete it. Production weight ranges from 1 to 32 and is a relative measure of the effort required to produce a particular element. For example, a text document (i.e., a simple HTML page) has a PW of 2, while a video simulation has a PW of 28. That means that we estimate a video simulation to require 14 times the effort to create as a simple text document. Currently at eCornell, 1 unit of PW translates to approximately 1.6 person-hours of labor. However, the relationship between PW and person-hours is variable, according to how facile individuals are in working with particular templates, the efficiencies they may develop over time, and so on. What's not likely to change is the relationship between the amount of effort required to produce the various elements.



Integral to the eCornell learning experience is a unique approach to asynchronous learning that we call Structured Flexibility™. When students register for an eCornell course, they are placed into a section comprising up to 25 learners. Each section is led by an instructor. All eCornell learning experiences have defined start and end dates—students have access to the course material beginning on a certain date and must complete the required elements of the course within a specified time frame: two weeks for a six-hour course; four weeks for our longer, 15-hour courses.

Within this specified time frame, students work asynchronously and at their own pace, logging on to the course whenever it's convenient for them. At the same time, they remain part of a cohort group whose sense of community is reinforced by periodic communication from the instructor and by their required participation in asynchronous online discussions.

Just as classroom educators make discussion an integral part of their students' learning experience, eCornell embeds opportunities for discussion into the flow of the course. However, experience has demonstrated that most learners choose not to take advantage of such opportunities. Left on their own, the majority of online students approach their learning experience as an individual activity, rather than as a collaborative one.

We therefore require students to communicate and collaborate. In order to receive credit for completing an eCornell course, students must contribute meaningfully to at least two required discussions per six hours of content. The quality of their contribution is evaluated by the instructor, and students do not receive credit for having successfully fulfilled a discussion requirement unless and until the instructor is satisfied. In that way, we ensure that all students contribute to the construction of a shared knowledge base.



- Knowledge without the ability to apply it is merely information
 - Learning Molecules™ approach to PBL provides authenticity and involves students as active participants in learning process.
 - Structured Flexibility™ helps build community of practice that further contextualizes and situates learning.

10

By conceptualizing a metaphor that is informed by a pedagogy and implemented through a taxonomy, eCornell has developed a unique system for translating content and pedagogy into effective online learning experiences for the purpose of professional development and executive education.

Our approach positions students as active participants in the learning process, enabling them to build the necessary skills to confront the challenges they face on the job, while giving them the flexibility to work at their own pace in a manner that conforms to their individual learning styles. Learners become active participants in their own education, developing and practicing new skills in a safe, engaging, collaborative, online environment.

Knowledge without the ability to apply it is merely information. The eCornell model is designed to ensure learners' ability to apply their learning to the workplace and to adapt their newly acquired skills and competencies to evolving circumstances. eCornell instructors facilitate the learning experience, answer learners' questions, and support them in their ability to complete the required elements of the course. At the same time, the peer-to-peer collaboration that is integral to every course enables learners to share best practices and build a collective knowledge base. In a world in which professional development and continuing education are increasingly vital to both individual and organizational success, the Learning Molecule provides a uniquely effective solution to these ongoing challenges.



Q & A

eCORNELL

Contact Information



David Shoemaker
dshoemaker@ecornell.com

eCornell:
www.ecornell.com/capability