

LEAP – Essential Learning Outcomes and Engaging to Learn: Simulations and Games

We asked the awardees of the Engage Simulations and Games Award Program to explain how their simulation or game addresses one of the Essential Learning Outcomes identified by the UW-Madison LEAP Project (see attached outline and template). Eight of the 13 projects participated and their responses are written here.

- I. C'est la (seconde) Vie!** – Thomas Armbrrecht, French and Italian
- II. Cool-It** – John Pfothenhauer and Greg Nellis, Mechanical Engineering
- III. GASP** - David Griffeath, Mathematics; James Morris, Business
- IV. Got Ice Cream?** – Rich Hartel and Steve Ingam, Food Science
- V. JD Consult** - Michael Collins, Veterinary Medicine\
- VI. Malaria: Beating the Bugs** - Linda Bauman, Laurie Hartjes, Nursing
- VII. Melody Mixer** – Jamie Henke, Music; Alan Ng, Continuing Studies
- VIII. WiSCO (Wisconsin Speech Chain Online)** – Tom Purnell, Linguistics; Eric Raimy, English; Joe Salmons, German

I. C'est la (seconde) Vie! – Thomas Armbrrecht, Dept of French and Italian

- **ELO 2: Intellectual and Practical Skills**

Cognitive Dimension: Students will show they know the rules of certain French grammar points and will improve their writing in French. Students will know how to communicate in French in a “live” setting. Students will learn more about French culture by speaking with native speakers and visiting French spots. Students will know how to use Second Life and navigate other virtual worlds.

Skills Dimension: Students will be able to communicate in French more easily, both in written and oral forms. Students will be able to organize their experiences in a coherent, relatable written format. Students will improve grammar and writing by turning their experiences into analytical essays. Students will be able to navigate Second Life and to use it to interact with French speakers and to have cultural experiences.

Affective Dimension: Students will be able to demonstrate their appreciation of one-to-one cultural interaction outside of a traditional classroom setting. Students will value the autonomy they have exploring French in the context of the Second Life. Students will appreciate working in teams and they solve puzzles together. I hope that they value the ludic aspect of the experience.

Experiences for Learning: Passing a series of quizzes designed to test the student’s competency with knowledge that they need to complete later activities. Talking (or chatting) with and observing native French speakers and then reflecting on the experience in written form. Visiting Francophone locales within Second Life and then reflecting on the experience in writing.

II. Cool-It – Cryogenics - John Pfothenauer and Greg Nellis, Mechanical Engineering

- **ELO 1: Knowledge of Human Cultures and the Physical world**
The student will know how physical properties of materials change at low temperatures. They will be able to select appropriate materials and geometries to minimize the expense and energy consumption of systems that need to operate at cryogenic temperatures. In short, they will be able to design optimized cryogenic systems. The students will develop an appreciation both of the variety of 'acceptable' solutions as well as the impact of poor design selections.
- **ELO 2: Intellectual and Practical Skills** (inquiry and analysis, critical and creative thinking, quantitative literacy, information literacy, and problem solving)
Cool-it is all about numbers. By playing the game, students will develop a quantitative literacy with material properties, how they impact final temperatures, heat loads, cooling capacity, stress requirements, and costs. They will need to analyze and problem solve to address the consulting challenges with which they are faced. Through their creative choices, they will empirically discover the physical laws behind the design principles, and they will be able to distinguish between good, better, and best solutions. They will develop the skills required of a cryogenic design engineer and will become familiar with the specific cryogenic properties of a wide variety of materials.

III. GASP - David Griffeath, Mathematics; James Morris, Business

- **ELO 2: Intellectual and Practical Skills** (inquiry and analysis, critical and creative thinking, quantitative literacy, problem-solving)
GASP is designed to exploit the power of observation by allowing students to:
 - Observe the effects of randomness in a controlled setting to deepen their understanding of and, especially, their intuition about probability and random processes - when combined with classroom instruction students are readied to make sense of what they are observing
 - Discover rules governing tendencies inherent in outcomes produced by accumulations of probabilistic events
 - Appreciate differences between short term results and what can be expected in the long run, and then what the long run means in terms of rates of convergence for different settings
 - Appreciate the interplay between average results and variation around that average; the message being to pay attention to variability when making decisions, not just the average
 - Solve the progressively more challenging problems that are provided with the intent that the student transfers back from their acquired specific concrete experiential knowledge to more general abstract knowledge and understanding; often this is the reverse of how the subject matter is delivered in courses - indeed, concrete to abstract is how probability laws were "learned" in the first place
 - Have fun while learning, so much so that they gain warranted confidence in the subject matter while embracing rather than enduring the journey

IV. Got Ice Cream? - Rich Hartel and Steve Ingam, Food Science

- **ELO 2: Intellectual and Practical Skills**
The game meets "Intellectual & Practical Skills" by utilizing inquiry and analysis, critical/creative thinking (or parts there of), quantitative literacy, and information literacy.

V. JD Consult – Johne’s Disease – Michael Collins, Veterinary Medicine

- **ELO 1: Knowledge of Human Cultures and the Natural World**
Students using JD-Consult engage in problem solving in the context of individual dairy farms addressing the challenge of a highly pervasive infectious disease. Each farm presents a unique setting that requires understanding the work of dairy farmers, their goals and challenges in herd management and profitability while applying their knowledge of Johne's disease and its impact on the health of dairy cows.
- **ELO 2: Intellectual and Practical Skills**
Students using JD-Consult observe, analyze, and synthesize information such as herd health, physical features of individual farms, availability of human labor to manage herd hygiene, and economic status of each farm to evaluate and recommend a specific management plan.
- **ELO 3: Personal and Social Responsibility**
On each farm students make critical decisions, balancing the risks to consumers of Johne's infected milk in the food supply against the economic necessities of the dairy farmer. They must also make difficult choices about culling infected cows in each herd.
- **ELO 4: Integrative Learning**
Students apply their theoretical knowledge about Johne's disease into the context of a working dairy farm that includes dimensions of human culture, economics, business operation, and animal management. Some students have not been exposed to dairy farms before and the JD-Consult game provides a virtual experience to this unique setting.

VI. Malaria - Linda Bauman, Laurie Hartjes, Nursing

- **ELO Outcome 1: Knowledge of human cultures and the physical and natural world**
Cognitive Dimension: Students will understand epidemiology of malaria, how to prevent it, how to recognize infection, and what to do if sick. Students will know about malaria risk globally. Students will learn what to do to reduce personal risk.
Skills Dimension: Students will be able to offer advice to simulated travelers to protect them from malaria or from bad outcomes if infection occurs
Affective Dimension: Students will recognize that malaria is a complex disease that can kill quickly if unrecognized and/or untreated, so a fear of bad outcome should motivate safe behavior. Students will appreciate the complexity of prevention behavior decisions and carrying through with them when resources are limited or when environments contain hazards.
Experiences for Learning: Reading about students going to 4 different continents and then helping these students to gain correct information and to make "safe practices" decisions. By maneuvering through the game, students will learn the consequences and benefits of 'right decisions' for preventing malaria.
- **ELO 4: Integrative learning**
Cognitive Dimension: Demonstration of malaria knowledge and good decision-making skills through high game score and improvement on post-test knowledge survey.
Skills Dimension: Game skill will be evaluated through game score and post-test, as

mentioned above, but also by actual behaviors when they travel abroad.

Affective Dimension: Feelings of self-efficacy when students travel abroad and have both an appropriate anxiety about malaria risk (rather than none, due to ignorance), and have experience doing simulated malaria risk reduction decision-making

Experiences for Learning: Student study abroad experience, which frequently involves travel beyond their destination country.

VII. Melody Mixer - Jamie Henke, Music; Alan Ng, Continuing Studies

○ **ELO 1: Knowledge of Human Cultures and the Physical and Natural World**

Students are introduced to melodies that cover the spectrum of music from the Baroque period to the Twentieth century. The game also allows for real-world practice of theoretical concepts used in the analysis of music, and creates an empowered listener.

○ **ELO 2: Intellectual and Practical Skills**

Students are required to practice both theoretical and aural analysis techniques to play the game.

The game requires critical thinking as students choose measures based on what they have learned about music theory. This is followed by a different skill and level of critical thinking as they assess the melodic fragments that they hear, and create a proper melodic order of those segments by combining theory knowledge with both their existing real-world music experiences and new experiences developed as they play the game.

The game provides for creative thinking during the aural phase as students can experiment with different combinations of the various measures and assess the resulting melodies. Students are also provided with an open melody lab in the experiment zone. Here students can create and experiment with an unlimited number of melodies, instrumentations, and textures using the entire bank of resources provided in the game.

The game also provides opportunities for teamwork and problem solving. In an ideal setting, the game is played in pairs or small groups. In this format, students work together and share their analysis of each example, thereby learning from each other as they work through the game together.

○ **ELO 4: Integrative Learning**

The game provides for a critical level of integrative learning between the theoretical and aural aspects of music. Too often students learn music theory as a series of abstract concepts outside an aural setting. Music is an aural art and as such it is critical that students have both an aural and theoretical understanding of the subject matter. The student will learn and understand music theory on a much deeper level when it is paired with the real-world associations of sound.

WiSCO (Wisconsin Speech Chain Online) - Tom Purnell, Linguistics; Eric Raimy, English; Joe Salmons, German

○ **ELO 1: Knowledge of Human Cultures and the Physical and Natural World**

Students using WiSCO learn about differences in human cultures by exploring variation in dialects of English.

Cognitive Dimension: Students will know differences in dialect are physically instantiated by how vowels are pronounced and are distributed geographically.

Skills Dimension: Students will be able to record their own speech, make quantitative measurements of their vowels, share their data with other students and be able to discuss patterns found in the vowels based on geography.

Affective Dimension: Students demonstrate that they value local Wisconsin dialects of English and appreciate that they can learn about language and Wisconsin by studying themselves.

Experiences for Learning: 'Bag Variation' homework from English 331 English Language Variation in the US.

For this question you are going to use data from four different speakers:

- (1) yourself
- (2) 1970 Erie Male
- (3) someone from WI/MN
- (4) someone not from WI/MN

Plot the following words:

bead, bode, bod, bag, bang, bad, ban and back.

Answer the following questions.

(1) Remember your answer to the previous 'Bag' question. Do the other speakers that you have chosen have the 'Wisconsin Bag' or not?

(2) Are there any patterns in how the words 'bag', 'bang', 'bad', 'ban' and 'back' pattern? Do they form a single group for any speaker? Do they form different groups for different speakers? Is there any basis for the grouping based on where the speakers are from?

**** Page taken from UW Madison General Education Requirements, LEAP**
<http://www.ls.wisc.edu/gened/LEAP/default.htm>

Note: This listing was developed through a multiyear dialogue with hundreds of colleges and universities about needed goals for student learning; analysis of a long series of recommendations and reports from the business community; and analysis of the accreditation requirements for engineering, business, nursing, and teacher education. The findings are documented in previous publications of the Association of American Colleges and Universities: *Greater Expectations: A New Vision for Learning as a Nation Goes to College* (2002), *Taking Responsibility for the Quality of the Baccalaureate Degree* (2004), and *Liberal Education Outcomes: A Preliminary Report on Achievement in College* (2005).

The Essential Learning Outcomes

Beginning in school, and continuing at successively higher levels across their college studies, students should prepare for twenty-first-century challenges by gaining:

Knowledge of Human Cultures and the Physical and Natural World

- Through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts

***Focused** by engagement with big questions, both contemporary and enduring*

Intellectual and Practical Skills, including

- Inquiry and analysis
- Critical and creative thinking
- Written and oral communication
- Quantitative literacy
- Information literacy
- Teamwork and problem solving

***Practiced extensively**, across the curriculum, in the context of progressively more challenging*

problems, projects, and standards for performance

Personal and Social Responsibility, including

- Civic knowledge and engagement—local and global
- Intercultural knowledge and competence
- Ethical reasoning and action
- Foundations and skills for lifelong learning

***Anchored** through active involvement with diverse communities and real-world challenges*

Integrative Learning, including

- Synthesis and advanced accomplishment across general and specialized studies

***Demonstrated** through the application of knowledge, skills, and responsibilities to new settings and complex problems*

Essential Learning Outcomes for UW-Madison Students – Template

** Template taken from UW Madison General Education Requirements, LEAP
<http://www.ls.wisc.edu/gened/LEAP/default.htm>

_____UNIT NAME_____

Unit-level statement of mission and purpose: Since the specific articulation of student learning outcomes relates to the distinctive mission of the unit, it is useful to include a brief description of the unit’s mission and how that mission affects learning for students and others who come into contact with the unit. This discussion can be broad or narrowly focused – what matters most is that learning is aligned with core mission, and core mission promotes learning.

Essential Learning Outcome 1: Knowledge of Human Cultures and the Physical and Natural World...	<i>Cognitive Dimension</i> What the student will be able to KNOW	<i>Skills Dimension</i> What the student will be able to DO	<i>Affective Dimension</i> What students will be able to demonstrate they VALUE and APPRECIATE	Sample developmental Experiences for Learning
<ul style="list-style-type: none"> • ...through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts. <p><i>Focused by engagement with big questions, both contemporary and enduring.</i></p>				

Essential Learning Outcome 2: Intellectual and Practical Skills, including...	<i>Cognitive Dimension</i> What the student will be able to KNOW	<i>Skills Dimension</i> What the student will be able to DO	<i>Affective Dimension</i> What students will be able to demonstrate they VALUE and APPRECIATE	Sample developmental Experiences for Learning
<ul style="list-style-type: none"> • Inquiry and analysis • Critical and creative thinking • Written and oral communication • Quantitative literacy • Information literacy • Teamwork and problem solving <p><i>Practiced extensively, across the curriculum, in the context of progressively more challenging problems, projects, and standards for performance</i></p>				

Essential Learning Outcome 3: Personal and Social Responsibility, including	<i>Cognitive Dimension</i> What the student will be able to KNOW	<i>Skills Dimension</i> What the student will be able to DO	<i>Affective Dimension</i> What students will be able to demonstrate they VALUE and APPRECIATE	Sample developmental Experiences for Learning
<ul style="list-style-type: none"> • Civic knowledge and engagement—local and global • Intercultural knowledge and competence • Ethical reasoning and action • Foundations and skills for lifelong learning <p><i>Anchored through active involvement with diverse communities and real-world challenges</i></p>				

Essential Learning Outcome 4: Integrative Learning, including	<i>Cognitive Dimension</i> What the student will be able to KNOW	<i>Skills Dimension</i> What the student will be able to DO	<i>Affective Dimension</i> What students will be able to demonstrate they VALUE and APPRECIATE	Sample developmental Experiences for Learning
<ul style="list-style-type: none"> • Synthesis and advanced accomplishment across general and specialized studies <p><i>Demonstrated through the application of knowledge, skills, and responsibilities to new settings and complex problems</i></p>				