# POSITIONNEMENT DU PROJET D.S.C.E.L PAR RAPPORT AUX PROJETS INNOVANTS ACCOMPAGNANT LA REVOLUTION NUMERIQUE

*Comment positionner notre projet D.I.S.C.E.L ?*
*Avec les extraits ci-dessous, le lien est très fort entre notre projet et « serious games » thème à la mode, mais dont les différentes interprétations le rapprochent beaucoup plus des jeux vidéo que du « e-learning » des années 2010-2015. En lisant les références indiquées dans ce résumé, je me suis aperçu que nous pouvons nous attaquer à plusieurs sujets de Mastère pour approfondir notre projet et aboutir à des outils industriels. La gestion automatisée des processus sur un serveur en-ligne avec des commandes activées par le document intelligent est un moyen efficace pour faire participer tout type d' utilisateurs sans faire appel à des compétences pointues en informatique.*
*Amin Elsaleh*

**Quelques extraits de l'étude « La société et l'économie à l'aune de la révolution numérique – mai 2009 » publiée par Le centre d'analyse stratégique. Réf :**
http://www.strategie.gouv.fr/article.php3?id_article=999

Extrait p.36-37
« L'*e-éducation* progresse, les TICEs sont au cœur de la pédagogie. Les outils de formation sont interactifs, plus personnalisés et plus ludiques via la réalité augmentée. Ils permettent l'*interaction* (hors les cours) *avec les professeurs* et des interventions ciblées pour compenser, tout particulièrement, des inégalités sociales.
La technologie permet que se généralisent une médecine préventive et personnalisée en fonction, par exemple, des caractéristiques génétiques de chacun, et le contrôle à distance pour des traitements curatifs lourds.
Cette généralisation de l'*offre virtuelle interactive* pour la *formation*, des *systèmes de diagnostics*, de *prévention*, voire de soins médicaux, d'assistance aux personnes a une incidence directe en terme d'efficacité et de qualité des services publics et de coût.
A l'issue d'une renégociation laborieuse avec tous les partenaires sociaux du code du travail, le télétravail et la télé formation se développent fortement permettant aux individus de gérer selon leurs goûts ou situations familiales leur temps de travail. L'appropriation généralisée des technologies permet des *séances de travail/réunions virtuelles* ou des pré-visites médicales avant un déplacement réel. Aussi la mobilité physique « contrainte » est de plus en plus remplacée par une *mobilité virtuelle.* »

Extrait p. 39
Quelques exemples d'outils numériques améliorant la créativité dans la recherche scientifique ou les fonctions administratives :
- les *moteurs de recherche sémantique d'articles* – stockés dans des bases de données inter opérables -contrôlent, organisent, comparent, hiérarchisent et évaluent les connaissances scientifiques (articles académiques, conférences, expérimentation)..
- la traduction automatique en temps réel multilingue donne accès à pratiquement toute information produite ;
- l'évaluation de l'activité des utilisateurs et l'optimisation automatique des collaborations..

Extrait p.40
Les TICE adaptent l'enseignement aux forces et faiblesses des élèves, stimulent leur créativité.. Les *salles de classe organisées en réseau sont constamment connectées, munies d'outils interactifs certifiés entre professeurs et entre élèves.. La formation professionnelle est également assurée régulièrement par des plates-formes de formation personnalisée à distance et fondée sur les besoins..*

Extrait p.42 « Renouveau »
*Les TICs pour l'enseignement (TICE) sont placés au cœur de l'Education,* suite à une rénovation de l'enseignement autour de l'excellence scientifique et de la prise de risque. Ces nouvelles réflexions sur

l'e-éducation sont catalysées par le nouveau rapport de force entre gouvernants et gouvernés (pratiques de la e-démocratie).[1]

Extrait p.48 « recommandations à court termes » :

- Créer dans l'enseignement supérieur un cursus de formation des enseignants (grade Master) adossé à la recherche et décloisonner la recherche des sciences informatiques vis-à-vis de l'enseignement.
- Développer, grâce notamment au fonds d'investissement social, *la formation tout au long de la vie par et pour le numérique*, le promouvoir comme outil de créativité et d'innovation.
- Développer grâce au numérique, de nouveaux outils de formation et de gestion des projets pédagogiques (logiciels 3D, serious games[2], classes virtuelles, tables numériques..).

**Quelques extraits du Guide Méthodologique de l'Université Numérique (janvier 2009)**
Réf :
http://pperes.wordpress.com/
http://www.cpu.fr/uploads/tx_publications/CDC_Guide_universite_numerique_version_finale.pdf

p.29  Le serveur HAL géré par le  CNRS, permet de déposer et de rendre publics des documents scientifiques de toutes les disciplines.

p.42 La mutualisation : faisons ensemble au niveau n+1 ce que chacun ne sait pas faire au niveau n. Externalisation interne : Il s'agit pour un établissement, d'externaliser des activités, au sein d'une structure inter-établissements (comme dans le domaine de calcul scientifique).

p.56  Centrer la stratégie numérique sur les acteurs et leurs besoins :

p.57 Les étudiants : Besoins au cours de la phase d'acquisition de savoir et de compétences :

- Accéder à des ressources pédagogiques, documentaires et scientifiques.
- Produire et diffuser des rapports, des exposés, des compositions.
- Travailler en collaboration.
- Communiquer avec les enseignants et les étudiants.
- Assister à des cours magistraux et des travaux pratiques.
- Disposer de salles équipées en numérique.
- Bénéficier de tutorat.[3]

p.60 : Besoins du groupe enseignants-chercheurs :

1. au cours de la phase de préparation de son cours:
- Disposer des ressources documentaires.
- Disposer de retours d'expériences et de conseils pédagogiques[4].
2. au cours de la phase d'animation de son cours :
  - Diffuser des ressources numériques.
  - Interagir  sur les ressources numériques avec ses étudiants dans des espaces multimodaux[5].
3. au cours de la phase de support à l'acquisition de savoirs et de compétences des étudiants [6]:
  - Diffuser ses ressources numériques aux étudiants.
  - Communiquer avec ses étudiants.
  - Permettre l'évaluation de son enseignement par ses étudiants.

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[1] La e-démocratie alimente et évalue les décisions politiques (web participatif dans les partis politiques, les assemblées, les ministères..) et les rend plus transparentes. Les dispositifs (vote électronique par mobile ou internet..) sont sécurisés, plus performants et mieux adaptés aux citoyens.

[2] Les Serious Games utilisent tous les ressorts des jeux vidéo pour un apprentissage spécifique en entreprise.

[3] Le précepteur virtuel dans le projet D.I.S.C.E L. peut :- renforcer la communication avec les enseignants, les étudiants, - enrichir les ressources avec la création de la banque questions/réponses, et – produire des rapports et des exposés de qualité évolutive.(Note AEL).

[4] L'objectif du document intelligent est d'établir une collaboration entre le précepteur virtuel (automate) et le précepteur physique. Cette collaboration permettra d'enrichir la banque de questions-réponses qui sera la base d'une formation en-ligne continue et évolutive.  (Note AEL).

[5] La banque de questions/réponses est une extension numérisée des ressources documentaires (support de base).

[6] Le rôle du précepteur virtuel est crucial dans cette phase. Je pense qu'il y aura une forte relation à explorer entre le précepteur virtuel et un moteur du type « serious games ». (Note AEL).

**Autres extraits :**

1. "Within universities using virtual worlds, the activity of students *building basic interactive content* will become a critical and increasingly dominant rationale for the continued use of the environments."
   "Finally, and truly, the most valuable content in the world will be educational simulations and serious games."

Ref: http://clarkaldrich.blogspot.com/2009/03/virtual-worlds-gamessimulations.html

2. **What Makes a Game Engine *Serious*? Réf:**
   http://seriousgamessource.com/features/feature_022107_shootout_1.php

Wikipedia's definition of a *game* engine is "…the core software component that provides the underlying technologies, simplifies development, and often enables the game to run on multiple platforms such as game consoles and desktop operating systems… and typically includes a rendering engine for 2D or 3D graphics, a physics engine for collision detection, sound, scripting, animation, artificial intelligence and networking."

That definition is a good start, but a *serious* game engine needs to deliver a lot more. At a minimum it needs to track player behavior, assesses their ability, capture and report on those metrics and make them available. In some serious games where player behavior must be analyzed closely, providing "instant replay" may also be essential. Depending on the product and market segment, an engine may interact with real world data from GPS systems, instrumentation, weapons, vehicle simulators, as well as other players and non-player characters. And for certain government or education applications, conforming to SCORM, Regulation 508 and COPA standards may also be required.

There are other important differences between entertainment and serious games. Lee Wilson, formerly chief marketing officer at Harcourt Achieve and a strong proponent of serious games in K-12 education observed, "Unlike in the consumer space for games, schools are complete ready-made communities. As such, the software should be able to dynamically access the existing user databases of those communities, rather than requiring redundant data entry. Think of it as acquiring user communities wholesale. This will dramatically ease deployment and accelerate usage, but is not commonly found in existing tool sets designed for a world where customers are added one at a time."

"The other challenge is on the publisher side: it's the time and expense of producing high-quality games" says George Kane, VP of business development for Pearson Education. "Modularity is important, so that content and functionality, and whole engines, can be reused in different contexts in order to maximize the return on our investment. Flexibility, such as the ability to turn features off and on, by us and by the teacher or school administrator, is also a central requirement."

3. **Serious games: online games for learning réf:**
   http://www.adobe.com/resources/elearning/pdfs/serious_games_wp.pdf

**Par Anne Derryberry** http://imserious.typepad.com/.
50% of all americans play computer and video games. Learning preferences:
- Receive information quickly from multiple multemedia sources.
- Processing pictures, sounds, and video before text.
- Interacting/networking simultaneously with many others.
- Learning "just-in-time".
- Instant gratification and instant rewards.
- Learning that is relevant, instantly useful and fun.

Learning management system (LMS) / serious game presents two interesting dilemma:
1. In the "learn by doing" world of serious games, learners are frequently called upon to "do" things that results in the generation of content. In fact, learner generated content

will be recognized as one of the principle design mechanisms for learners to demonstrate mastery of a game's learning objectives. What tools will learners use? What standards will apply? What new learning approaches may or may not result as a function of this technical capability?

2. Group learning for building team skills and intra-team coordination is emphasized in serious games. How do we set group goals? Break them down into individual objectives? And then roll up in-game activity to support group outcomes and individual measurments?

In-game communications capabilities: traditional chat & email functions, game blogs, team wikis and other web 2.0 communications technologies. Learners will want equal access to serious games on their laptops, PDAs and phones.

Serious game design team composition: C programming, Java script writing, art, instructional design, animation, story writing and database programming.

Learning designers must plan for easy and natural integration of a serious game into the overall learning design.

Serious games[7] (p.3) are used in emergency services training, in military training, in corporate education, in healthcare.

What is different about today's worker or learner[8] (p.11):

- Receiving information quickly from multiple multimedia sources.
- Parallel processing and multitasking.
- Processing pictures, sounds, and video before text.
- Random access to hyperlinked multimedia information.
- Interacting/networking simultaneously with many others.
- Learning "just-in-time".
- Instant gratification and instant rewards.
- Learning that is relevant, instantly useful and fun.

Example serious games for learning: **OTIS[9]**: http://wharton.pearsoncmg.com/otis/

OTIS allows students to apply the concepts of investments and portfolio management in a hands-on learning environment while working with real-word data without risking real money. For instructors, OTIS provides unmatched analytical tools to evaluate and track their students' performance. Created by Marshall E. Blume, the Howard Butcher III Professor of Financial Management at the Wharton School of the University of Pennsylvania, OTIS offers invaluable practice for students learning about investments.

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[7] Serious games have other names including *immersive learning simulations*, *digital game-based learning*, *gaming simulations*, and "*games you have to play*".

[8] Ces objectifs sont aussi ceux du projet D.I.S.C.E.L. où le précepteur virtuel jouera un rôle primordial dans l'acquisition dynamique de l'information qui doit nécessairement être composée du trio texte image voix. (Note AEL)

[9] Le rapprochement entre le 1er pilote du précepteur virtuel et OTIS est incontournable dans le processus de validation

| 2<sup>ème</sup> milestone | di-sc-el -Pilote1 | LOT4, LOT5 | M12 | Mise en place de la Version1 pour test et validation. |
|---|---|---|---|---|

p.19 du projet.

**Web-Enabled Simulations: Exploring the Learning Process**
The Wharton School explores whether Web-enabled simulations provide new ways of learning that are fundamentally unlike traditional methods
By **Kendall Whitehouse**

http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolum/WebEnabledSimulationsExploring/157358

**Wharton Learning Lab Simulations**
To date, Wharton's Learning Lab (http://www.wharton.upenn.edu/learning/) has created 18 applications and deployed them in Wharton classrooms and elsewhere. Some of the Learning Lab applications mentioned in this article are described briefly below. For more details on these applications, see the *EDUCUASE Quarterly* web site at <http://www.educause.edu/eq/>.

# OTIS

Wharton's Online Trading and Investment Simulator (OTIS) uses data from the financial markets (supplied by a feed from Financial Times' *FT Interactive Data*) to allow student "fund managers" to buy and sell equities in the current market. OTIS illustrates concepts such as portfolio balancing and management, benchmarking, and the effect of large-scale fund buys and sells on market positions. OTIS also includes analytical tools that students can use to evaluate their performance. OTIS is available to educational institutions through the Wharton Addison-Wesley Business Series (http://www.aw-bc.com/wharton/).

# OPEQ

Oil Pricing EQuilibrium (OPEQ) is used in negotiations classes to teach issues involving shared resources and incomplete information. A round-based simulation, OPEQ combines computer-enabled game play with face-to-face interaction. Teams of students play different oil-producing companies in competition with other student teams. In the early rounds, students interact through the computer simulation only. In later rounds, the players meet in person to attempt to make deals regarding future production levels. Unexpected "events" further complicate the picture, forcing the teams to make decisions under increasingly difficult and ambiguous conditions.

# VIBE

Wharton's Virtual Interactive Bond Engine (VIBE) forms the basis for an entire semester's work in bond portfolio management. It presents a series of increasingly complex assignments on managing a portfolio of fixed-income securities. Taking long or short positions, students build portfolios from a universe of bonds created by the instructor. As virtual time passes, VIBE automatically calculates the effects of the changes and reveals them to the players. The VIBE interface allows students to assess their progress throughout the semester.

# Fare Game

Based on research on Midway Airline's aggressive entry into the Milwaukee marketplace in 1989, Fare Game is a real-time exercise in price-setting and resource allocation. Students participate in a mock "fare war" to demonstrate how airlines compete or cooperate through fare cuts or price hikes.

# FutureView

FutureView demonstrates how "information acceleration" can be used to develop quantitative marketing data for new products that differ radically from anything currently on the market, such as auto-pilot cars that may one day drive themselves. Faculty can configure FutureView to deliver different scenarios that are automatically assigned to users when they enter the simulation. FutureView's behavior tracking, conjoint survey data, and configuration options provide a rich collection of data for detailed analysis.

# Rules of Engagement

Rules of Engagement is a team-based simulation that lets students try different competitive strategies. After an in-class discussion on marketing and advertising strategy, students divide into teams to establish their company's marketing budget for a given year and set rules that will automatically determine the budget in future years. Back in the classroom, the instructor plays out the students' strategies over long periods of time and uses the results to generate class discussion. Once they see the impact of the rules they selected, students can modify their strategies and run additional simulations based on different strategies.

# Approaches to Technology-Enhanced Education

While it is beyond the scope of this article to classify the large and varied universe of learning technologies, a brief overview may clarify where Wharton's Learning Lab stands in regard to these approaches. While there are a number of exceptions to this simple taxonomy, the major categories of technology-based or technology-enhanced education can be described as follows:

- Electronic textbooks
- Distance learning
- Computer-assisted communication
- Blended or hybrid models

*Electronic textbooks* typically use HTML, Adobe's Portable Document Format (PDF), or Macromedia FlashPaper to disseminate electronic content to a broad audience via the Internet, CD-ROM, or DVD. While Macromedia Flash or Java Applets can add interactive components to these documents to provide capabilities not available in the traditional printed book, the pedagogical paradigm closely parallels that of the traditional textbook.

*Distance learning*[10] initiatives typically seek to bring the classroom experience to an audience that is not physically present. They focus on using technology to achieve a larger scale or to address an audience beyond the reach of a physical classroom.

*Computer-assisted communication*[11] uses electronic technology (typically Internet-based) to assist communication outside the classroom. Tools in this category include e-mail, bulletin boards, instant messaging, and groupware products such as Documentum's eRoom.

*Blended or hybrid models* combine one or more of the above techniques with traditional classroom instruction. The rise of such models is in part a response to the perceived limitations of these other approaches. Because electronically reproduced content and electronically mediated communications do not have the richness of classroom interaction, blended models combine traditional classroom experience with electronic services outside the classroom.

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[10] Cette application est très proche du projet D.I.S.C.E.L., cependant l'objectif à court terme de ce projet est de créer d'ici 3-5ans, un laboratoire similaire à Wharton's Learning Lab.(AEL)

[11] Cette application doit accompagner le projet D.I.S.C.E.L dès le départ quoique nous verrons par la suite, l'approche de WLL est nettement plus évoluée par rapport aux expériences existantes.

All the techniques described above either use technology to replicate the classroom experience outside a physical classroom, side-step the classroom entirely, or supplement classroom activities outside of class sessions. In general, the activities of Wharton's Learning Lab follow none of these paths.

# The Learning Lab Approach

Based on faculty feedback from the initial pilot projects, a key goal emerged for the Learning Lab: to *enhance the classroom experience, not replace it*. Learning Lab applications typically seek to expand the depth of the educational experience, not extend its reach. These products aim to teach students better by using technology to create situations that are difficult or impossible to experience in an instructional setting through any other means. The technology serves to strengthen student-faculty interaction, not replace it. Although not all the projects fit this model, these are characteristic of most Learning Lab initiatives (see endnote 6).

Most Learning Lab projects would be categorized as *simulations*, although the term is fraught with ambiguity. Everything from multimedia cases with a simple branching structure to full emulations of complex control systems fall into the category of "simulation." Other than the attempt to emulate real-world events or processes, these tools have little in common, and their pedagogical outcomes may be very different.

Many of the Learning Lab's projects, however, share a number of characteristics that differentiate them from other technology-enhanced learning models. In general, Wharton Learning Lab simulations:

- Have open-ended outcomes.
- Don't always present the object of the game as the object of the game.
- Encompass more than meets the eye.
- Teach by doing rather than describing.
- Facilitate interaction and dialogue.

## Open-Ended Outcomes

One weakness of many business simulations is the tendency of participants to focus on the mechanics of "the game" rather than on the underlying principles the simulation attempts to teach. This is only natural for participants who know they are engaged in a simulation whose goal is to "win." Unless the simulation possesses a high degree of complexity, participants often find it more efficient to look for the underlying algorithm of the simulation than to learn the abstract concepts the simulation seeks to demonstrate.

Many of Wharton's Learning Lab applications seek to avoid this situation in their construction. Some—such as OTIS—are driven by real-world data. *The simulation consists of recording, tracking, and reporting the students' financial portfolios as if their trades actually occurred*. The calculations that drive the application reflect changes in actual market data. Anyone who can figure out the underlying algorithm of this type of simulation can be equally successful on Wall Street.

Most Learning Lab simulations are not based on real data, of course, but they are nevertheless open-ended. In many cases there is no "right answer" nor a single, optimal outcome. The behavior of the participants determines the outcome of the simulation. With OPEQ (Oil Pricing EQuilibrium), Fare Game, and Power Play, for example, teams compete against other teams of individuals. The computer merely stores the state of the game, transmits the players' moves, and presents the results. There is no computer to outsmart—only the other human competitors in the game.

Comparing Wharton's VIBE (Virtual Interactive Bond Engine) bond portfolio management to earlier pen-and-paper-based exercises, Wharton Finance Professor Michael Gibbons stated, "The old problem sets were 'toy' examples. These are 'serious' problems—much more open-ended," which require students to work toward a solution. As in the real world, there are multiple ways in which one can

arrive at a correct outcome. According to Gibbons, the students "learn real-world techniques and understand their application to solve open-ended, real-world problems."

## The Object of the Game Isn't the Object

In David Fincher's 1999 movie *The Game*, Nicholas Van Orten (Michael Douglas) is involved in a complex game, the nature and goal—even the existence—of which is not clear to him. "The object of the game is to discover the object of . . . The Game," he is told at one point.

While none of Wharton's simulations embody the complexity (or the perversity) of the game staged by the mysterious CRS Corporation in the film, in many cases the object of the simulation is not entirely known at the outset—and may not be the explicit topic of the exercise. While Learning Lab simulations such as the OTIS equities trading simulation and the VIBE bond-trading environment teach the explicit topics presented in the simulation (equities markets and fixed-income investment strategies), often this is not the case.

Although OPEQ is ostensibly about trading oil on the open market, the real point of the simulation is to demonstrate various negotiating strategies. Each team determines the number of barrels of oil its fictional country will produce during each time period, with the goal of maximizing profits (and making more money than the teams playing other oil-producing countries). Although the students have enough information to calculate the "optimum" strategy (and many, in fact, do), the intent of the simulation isn't to teach the mechanics of global markets or pricing strategies. OPEQ creates a series of situations in which students have to negotiate with representatives from other teams in increasingly difficult or ambiguous circumstances. The oil trading exercise is merely a platform to get students invested in the outcomes of their negotiations as they try to "win" the oil pricing game.

Similarly, in **Fare Game** student teams price seats and select routes for major airline carriers. Although the game loosely models the conditions when discount carrier Midway Airlines entered the Chicago market to compete against the established carriers, the point of the simulation isn't the economics of airlines. Rather, it is about signaling and how pricing strategies can be used to communicate intentions and influence the behavior of competitors.

In Wharton's **FutureView**, students browse through dozens of screens of detailed product information and user opinions on futuristic auto-piloted vehicles, but the point of the exercise has little to do with the automotive industry per se. Rather, it demonstrates how tools can be developed to generate quantitative marketing data for radically new technologies.

*In all of these cases, the simulation is used as a tool to stimulate a series of interactions or produce a situation that becomes the basis of the teaching point.*

## More Than Meets the Eye

Many of the simulations have a "reveal" in which the faculty member "pulls back the curtain" to unveil new facts or additional details not apparent during earlier stages of the simulation. A number of applications combine a homework-based exercise with a subsequent, in-class discussion of what was "really going on."

In OPEQ, new twists are added to the conditions of the simulation as the game progresses. In FutureView, after students have gone through the detailed information of the simulation and answered a simple survey, they later learn that different students saw different scenarios in the simulation and that the survey results have been analyzed in light of these variations.

## Teach by Doing

*Textbooks and classroom lectures typically provide information about a concept. Wharton's Learning Lab simulations often demonstrate the concept itself.*

With OTIS, students manage equities portfolios based on real stock data. Kelly Kamm, who teaches finance at the University of Texas using OTIS, stated that "[Students] can read about [complex

investment strategies like] hedging, but they don't really understand how it works until they actually do it." Kamm finds that her students quickly learn the details of investing "when they have a million dollars [to invest in OTIS], and they're watching [their portfolio] start to go up or down."

Rather than describing how information acceleration can be used to uncover quantitative market data for radically new technologies, FutureView actually implements an information accelerator. In class, the faculty present students with an analysis of the data generated by their classmates. Wharton Marketing Professor Peter Fader, one of the faculty members who developed FutureView, pointed out the impact this has on his students: "It's the vivid example that will be remembered years from now—and, hopefully, this brings with it the teaching point as well." When the student actually experiences a vivid instance of learning by doing, "the teaching points are not washed away," he said.

According to Wharton Finance Professor Gibbons, who developed Wharton's VIBE product for his finance class,

Wharton's Fixed Income Securities class is a very analytical course. VIBE lets the class combine that analysis with hands-on practice. This offers huge benefits. I can tell whether the students really understand the principles being taught by how well they perform in the simulations. Perhaps more importantly, the exercises help the students to better understand the course content by applying the lessons they've learned.

Gibbons pointed out that "Students now learn things they didn't learn before. For example, some computationally complex techniques—like Monte Carlo simulations—begin to have real meaning for the students," since these can be helpful in calculating the potential future value of the investment instruments in the VIBE universe. "They have to figure out the value of the VIBE securities, and this leads them to explore many areas they never would have seen otherwise."

## Facilitate Interaction

Wharton's Learning Lab products are typically not stand-alone, self-paced learning modules. Often the purpose of the application is to create a situation that fosters interaction and dialogue. OPEQ, for example, puts student oil-producers in a situation in which they must negotiate with competing students. The VIBE portfolio management product contains features to allow students to form teams for each round of exercises.

According to Gibbons, these tools are more than just a convenience; they "create socialization in the class." Students start by finding teammates, creating teams, and planning their group strategy. Even though many of these processes occur online, this type of interaction is key to the learning process. "This is particularly important in large classes," said Gibbons, "when students might not otherwise interact as often." Even exercises that include homework modules for individual exploration are typically geared toward stimulating classroom discussion once the details of the underlying application are revealed to the students in class.(see endnote 7)

Marketing Professor Fader believes stimulating discussion is the goal of most teaching materials, whether case studies or simulations. "[When taught properly], both case studies and simulations are used to catalyze discussion. [It's important to] turn the simulation off [to discuss] what's good and what's bad."

In short, applications such as these create a unique classroom experience rather than providing a substitute for it.

# Phased Assessment

If Wharton's Learning Lab is a lab, how are its experiments validated? How do we know if these tools have a positive impact on the educational process? From the outset, Wharton's Learning Lab sought to follow a phased approach to evaluating the success of the program. This plan has three steps:

- Faculty acceptance, adoption, and expansion

- External adoption
- Data collection and assessment

## Faculty Acceptance, Adoption, and Expansion

Acceptance by Wharton faculty was a key initial goal. While not a replacement for more formal evaluation, faculty acceptance is a necessary step for the continued growth of the Learning Lab and the development of a sufficient base for later quantitative assessments. If the faculty members who invest their time to develop these simulations don't find them valuable, the applications will not continue to be used in the classroom.

Faculty acceptance means more than positive feedback from the faculty. Although the Learning Lab informally seeks opinions from all faculty participants, it also tracks how an application is used beyond its original deployment (see endnote 8). The main assessment criteria follow:

- *Frequency*: Does the original faculty member use the simulation more than once? How often is the simulation used?
- *Enhancement*: Does the faculty member who developed the simulation have additional ideas on how to extend the product and submit a proposal for an enhanced version following the product's initial use in the classroom?
- *Expansion*: Does use of the application expand to encompass additional classes and new audiences beyond the original classroom deployment? Does use of the application spread from the originating faculty member to additional faculty?
- *Pervasiveness*: Does the use of these applications become widespread in Wharton's curriculum?

The results of assessing these criteria for the first 14 applications in production by the spring 2004 semester follow:

- *Frequency*: Twelve applications are still in use(see endnote 9) and have been used in each successive school year since their initial deployment.
- *Enhancement*: Ten applications generated subsequent proposals for additional features and enhancements based on their earlier use in class.
- *Expansion*: Eight applications were used in additional courses besides their original target class (with four used by courses outside the Wharton School). Seven are now being taught by additional faculty at Wharton, and the commercial version of OTIS is now used by more than 100 faculty at other institutions (see endnote 10).
- *Pervasiveness*: Since a number of the early applications focused on MBA core courses, by the end of the second full year of the Learning Lab virtually all first-year Wharton MBA students had experience with at least three Learning Lab applications. **FutureView**, one of the earlier Learning Lab simulations still in production, has been used by more than 3,000 Wharton students.

## External Adoption

In February 2003, Wharton entered into a partnership with the Addison-Wesley division of Pearson to make Wharton Learning Lab applications available to other educational institutions*(see endnote 11)*. This external adoption is the second threshold in measuring the project's success. By engaging a larger number of external faculty and students in teaching and learning with the tools, the Learning Lab builds a broader base from which to garner feedback and insights.

A pilot deployment of the first Wharton Learning Lab Series—OTIS—was launched in August 2003. Based on feedback suggested by an initial group of 30 schools, the first major commercial version was launched in August 2004. As of this writing, more than 2,000 students at more than 100 educational institutions have used OTIS.

## Data Collection and Assessment

Now that Learning Lab applications have achieved a sufficient scale of usage, the project is beginning the third phase of the evaluation—quantitative data collection. This past year, the Dean's Graduate Student Advisory Council (DGSAC), a group of Wharton MBA students who work on special projects for Dean Harker, conducted a preliminary survey of MBA students from the classes of 2004 and 2005 on the *impact of simulations in the classroom*[12]. Overall, the 290 students who responded to the survey were pleased with the use of computer-based tools in their classes and found them to be effective. Seventy-seven percent of the respondents were either very satisfied (30 percent) or satisfied (47 percent) with computer-based tools in classes. Eighty-six percent of the respondents said that computer-based tools significantly enhanced (21 percent) or enhanced (65 percent) learning in class. When asked to rate the importance of 10 criteria in facilitating overall learning in a classroom setting, students ranked "attention and engagement" the highest, with 70 percent of the respondents rating this category "very important." (In contrast, only 46 percent rated the next-highest ranked category, "applicability to your professional goals," as very important.)

On the same list of criteria students assessed computer-based tools as being most effective on the dimension they regarded as most important to learning—"attention and engagement" (42 percent rating them very effective). Also highly ranked were team collaboration (42 percent very effective) and "student-student interaction" (37 percent very effective).

Students rated computer-based classes as more effective than case-based classes on several criteria, most notably "attention and engagement" (62 percent), "team collaboration" (67 percent), "fun" (69 percent), "retention of material" (47 percent), and "student-student interaction" (51 percent). Similarly, students rated computer-based tools as more effective than lecture-based classes in enhancing "attention and engagement" (79 percent), "retention of material" (54 percent), "team collaboration" (81 percent), "student-student interaction" (72 percent), and "fun" (80 percent).

The students' assessment of specific Learning Lab products reveals an interesting grouping based on the nature of the application. Of the Learning Lab applications listed in the survey, the highest ranked (WSX, see Table 1) involves real-time game play among a class of 30 or more students. The next highest ranked applications—Fare Game, OPEQ, and Power Play—involve real-time team play in the classroom. The next simulations in the satisfaction ranking—OTIS and VIBE—involve complex, long-term (semester-long) exercises played by teams. Applications that function as stand-alone, self-directed exercises (Marketing Math Essentials) or that are assigned as homework exercises with a classroom "reveal" and discussion (FutureView, Rules of Engagement, and RATE) were rated somewhat lower.*( see end note 12)* These results appear to support the notion that a key function of these applications is to stimulate interaction in the classroom.

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[12] D.I.S.C.E.L. est plutôt proche du « case study » classique et ne s 'attaque pas à des *simulations*, technique beaucoup plus proche des « serious games ». Or il s'avère d'après l'expérience de  Wharton's Learning Lab que l'apport de la simulation pour l'enseignement moderne est crucial, mais il va falloir développer des projets similaires à OTIS pour acquérir le savoir-faire de WLL. L'exploitation de D.I.S.C.E.L. peut réaliser cette ambition, le projet actuel doit avoir un volet simulation dans un pilote avancé.

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**Table 1**

**Student Satisfaction with
Learning Lab Applications**

| Application | Satisfied or Very Satisfied |
|---|---|
| WSX | 86% |
| Fare Game | 81% |
| OPEQ | 79% |
| Power Play | 78% |
| OTIS | 72% |
| VIBE | 67% |
| Marketing Math Essentials | 52% |
| FutureView | 51% |
| Rules of Engagement | 47% |
| RATE | 44% |
| Market Magic | 28% |

Based on the results of this preliminary survey, Wharton plans to develop a more formal assessment process. Wharton will both conduct specific surveys about the Learning Lab and its impact on classroom instruction and include questions on technology-enhanced learning in the school's annual series of stakeholder surveys.

# Future Directions

In addition to working with faculty to develop an increasingly rich portfolio of learning applications, key future goals for the Learning Lab include the following:

- *Establish a community of educators.*

The Wharton Learning Lab products distributed through Pearson Addison-Wesley extend the use of these simulations to a significant number of faculty and students. Professor Kamm at the University of Texas Department of Finance has prepared detailed lesson plans for using OTIS that are available to other instructors using the application. Wharton hopes to foster a "community of educators" who use these tools in their instruction, continue to provide ideas and feedback for their enhancement, and extend the products into new areas.

- *Provide an increasingly sophisticated user experience.*

The past few years have seen a rapid evolution in tools to create rich user experiences over the Web. The first generation of Learning Lab applications typically used HTML interfaces connected to the Macromedia ColdFusion application server with Oracle or Microsoft SQL Server databases. **More recent Learning Lab applications have interfaces written entirely in Macromedia Flash.**

- *Perform ongoing evaluation.*

Wharton plans to develop more formal assessment tools and to expand the scope of these assessments to other schools that are using Wharton Learning Lab products.

Through these methods of ongoing experimentation in the classroom, Wharton hopes to discover how technology can have a lasting impact on learning. As Wharton School Dean Harker said recently to Wharton's MBA students, "Business thrives on innovation, and innovation doesn't spring just from the wisdom of the ages. It arises from the knowledge we create through experimentation and analysis."*(see endnote 13)*

**References & Endnotes**

1. R. Zemsky and W. F. Massy, "Thwarted Innovation: What Happened to E-Learning and Why," The Learning Alliance for Higher Education, University of Pennsylvania, 2004, <http://www.irhe.upenn.edu/Docs/Jun2004/ThwartedInnovation.pdf> (accessed April 5, 2005).

3. "Wharton Establishes Learning Lab with $10-Million Gift from Alumnus Alfred West, Jr.," <http://www.wharton.upenn.edu/whartonfacts/news_and_events/newsreleases/2001/p_2001_9_50.html> (accessed April 5, 2005).

4. The MERLOT project has cataloged a significant amount of content of this type. See <http://www.merlot.org>.

5. Lab structure and process applies not only to the initial development but also to requests for future enhancements to Learning Lab products. The lab wants to avoid having programmers permanently attached to a specific project—the goal is to complete each application and see it through its initial deployment in the classroom. To date, success in this arena has been mixed. It has proven difficult for developers to "let go" of an application once it has been completed, and faculty tend to assume that programming resources are permanently attached to each project. The proposal process helps mitigate these issues.

6. These are general principles for the Learning Lab, not hard-and-fast rules. They evolved from development efforts on different types of learning applications. Because the Learning Lab pursues multiple parallel paths of technology-enhanced learning, not all projects fit this model. For example, the Learning Lab's "Marketing Math Essentials" is a traditional, self-paced learning module to help students diagnose their basic math skills.

Wharton also has an extensive deployment of tools for computer-assisted communication. In addition to the "conventional" tools of e-mail and bulletin boards, Wharton's webCafé collaborative environment is a customized version of Documentum's eRoom. The majority of Learning Lab projects, however, exhibit the characteristics described in this article.

7. Student assessment of the value of the exercise is closely tied to degree of real-time student-to-student interaction produced by the simulation.

8. In their proposal to the Learning Lab, faculty commit to use the application in a Wharton course. Thus all Learning Lab applications have been used by students in at least one class.

9. The two discontinued applications were not as successful as the others in demonstrating their intended teaching points. In one case, the application was a version of the faculty member's research application, and the application proved more suited to gathering research data than as an instructional application on the nature of that research.

10. While creating complex applications around specific faculty requirements helps achieve the initial goal of faculty acceptance, it can work against wider adoption. Several of the original Learning Lab applications implement techniques specific to the research and instructional needs of the developing faculty member, and it is unlikely that these applications will be adopted by other instructors. In some cases, the goals of faculty satisfaction and project expansion are at odds.

11. "Wharton Extends Experience-Based Learning Methodology to Other Schools Through Software Licensing Agreement," <http://www.wharton.upenn.edu/whartonfacts/news_and_events/newsreleases/2003/p_2003_2_9.html> (accessed April 5, 2005).

12. Market Magic proved to be something of an outlier. This was one of two applications—and the only one included in the survey—that did not continue past its first use in the classroom. This application proved to be less effective than the others as a teaching application, reflected both in the students' assessment rating and the faculty's prior decision to not continue using the application.

13. "Dean Harker on Wharton Learning: Remarks by Dean Patrick T. Harker, MBA Convocation, Wednesday, September 8, 2004," <http://www.wharton.upenn.edu/whartonfacts/news_and_events/features/2004/f_2004_9_240.html> (accessed April 18, 2005).

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