Centre for Learning and Teaching

focus

on university teaching and learning

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From the Director

The most significant contributions we make to student learning often occur well before classes begin. The investment we make in planning our courses has a huge impact on learning. In this issue of *Focus*, Dalhousie colleagues demonstrate how they combine scholarship and creativity to create what Fink would certainly call "significant learning experiences" in their disciplines.

Lynn Taylor
Centre for Learning and Teaching

EDITORS
Suzanne Le-May Sheffield
Carol O'Neil

ASSISTANT EDITOR
Zita Hildebrandt

PUBLISHED BY
Centre for Learning and Teaching
Dalhousie University
Halifax, NS B3H 4H8
Ph: (902) 494-1622
Fx: (902) 494-3767
Email: CLT@Dal.Ca

www.learningandteaching.dal.ca

DALHOUSIE UNIVERSITY
Inspiring Minds

The Power of Course Design to Increase Student Engagement and Learning

L. Dee Fink, former director of the Instructional Development Program, University of Oklahoma

All professors would like for their students to be prepared when they come to class, to be motivated to learn, and to achieve high-quality learning that prepares them not only for future classes but also for future personal, social, and professional life experiences. But it often doesn't happen that way. What many professors are finding is that students become more motivated and engaged when courses are designed and integrated with significant learning goals. In this article, I will describe the meaning of "significant learning," identify the principles of effective course design, and then offer two examples of what happens when people use these ideas.

Significant Learning

If we want students to have a "significant learning experience," we must begin by figuring out what we might mean by significant learning. In my book (2003), I offer a taxonomy of significant learning. This builds upon but goes beyond the well-known taxonomy that was created by Benjamin Bloom and his associates five decades ago (1956). Like Bloom's taxonomy, this taxonomy has six general categories of learning, but—unlike Bloom's—they are interactive rather than hierarchical (see fig. 1).

Briefly, these six kinds of learning can be described in the following way:

1. *Foundational knowledge: This is the set of facts, principles, relationships, etc. that constitute the content of a course. This we want students to "understand and remember."*
2. *Application: Most disciplines require students to do something with the foundational knowledge. This might involve some physical skills (e.g., operating technical equipment); more commonly it involves engaging in some kind of problem solving, decision making, or creative thinking.*
3. *Integration: It is often helpful for students to be able to identify the similarities or interactions between one subject matter and another, or between different*

theories, historical trends, etc. This is the whole thrust of interdisciplinary learning.

4. Human dimension: When students report that they have learned something in a course about themselves or about how to interact with others in life, this is truly significant.

5. Caring: This is what happens when students change their feelings, interests, or values in relation to a subject.

6. Learning how to learn: Given the fact that we never teach students everything they will ever need to know about a subject, we need to help them learn how to keep on learning about it after the course is over.

The premise is that any course can address all six of these general kinds of learning. And the more of all six the course can promote, the more significant will be the overall learning experience for the student.

How can we do this? By learning how to design our courses in a much more powerful way. We have to learn how to design significant learning into our courses, and this is the purpose of integrated course design (ICD).

Integrated Course Design

The basic idea behind ICD is that, rather than simply develop a list of topics in a course and then provide students with lots of information about each topic, we need to design our courses in a way that is learning-centered, systematic, and integrated. If we can do this, students will respond by becoming more engaged in the work of learning and will succeed in achieving more important kinds of learning.

How does this process work? The key steps are illustrated in figure 2.

Situational Factors

Every time we teach, the situation is a little different. Therefore we need to begin by gathering information about a number of factors:

- *Specific context: How many students are in the course? What is the level of the course and the time structure? Will it be offered live, online, or in a hybrid context?*
- *Expectations of others: Is this course expected to meet certain department goals, university goals, professional licensing requirements, etc.?*
- *Nature of the subject: The sciences are often "convergent" (working toward a single correct answer), while the humanities are often "divergent" (intentionally seeking multiple interpretations of a piece of work). How do these and other differences in the nature of the subject need to be taken into account?*
- *Nature of the students: What feelings do they have about this subject? What prior knowledge or experiences related to this subject do they bring with them?*
- *Nature of the teacher: What beliefs and values do we bring to the course? How do these compare with those of students?*

This information is then used (as indicated by the arrows in fig. 2) in making the major decisions about how the course is going to operate.

Learning Goals: What Do We Want Students to Learn?

The first decision in a learning-centered course is about what we want students to learn. As we consider this, we need to go beyond wanting them learn everything about the major topics; we need to formulate more exciting and challenging learning goals. This is where the taxonomy of significant learning can be helpful. It provides us with six kinds of learning to consider for any course.

When formulating our learning goals, it can be helpful to frame this process around a sentence-completion exercise. The exercise begins with the phrase: "By the end of this course, my hope is that students will. . . ." We then complete that sentence with our learning goals.

The following list shows how we could use the taxonomy of significant learning to formulate a generic set of learning goals. My hope is that, by the end of this course, students will . . .

1. understand and remember the key concepts, terms, relationships, etc.;

2. know how to use the content;

3. be able to relate this subject to other subjects;

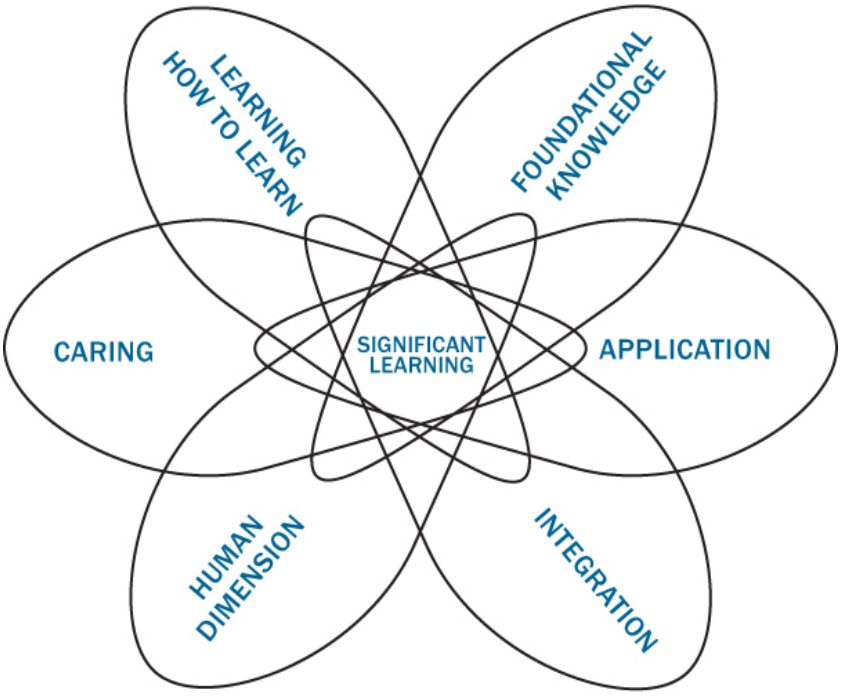
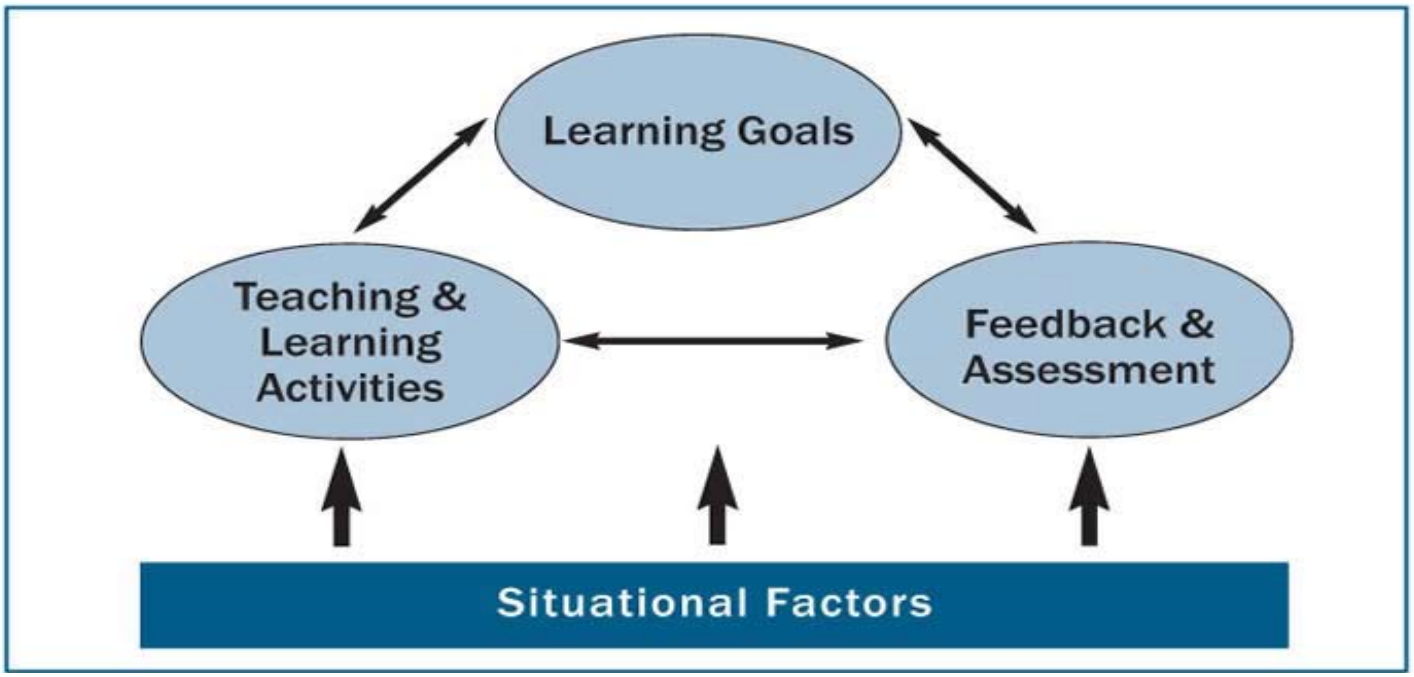


Figure 1. The taxonomy of significant learning

Figure 2. Model of integrated course design



4. identify the personal and social implications of knowing about this subject;

5. value this subject as well as value further learning about the subject;

6. know how to keep on learning about this subject—after the course is over.

Learning Activities: How Will They Learn That?

Once we have formulated important learning goals, we need to identify learning activities that will in fact enable students to achieve those goals. This requires using the principles of active learning (Bonwell and Eison 1991), one of the more important concepts to appear in the literature of college teaching in the last fifteen years. If we want students to achieve more powerful kinds of learning, we need more powerful learning activities.

I adapted the central tenets of active learning into what I call a "Model of Holistic Active Learning." This model proposes that students need some way of

- *acquiring the necessary information and ideas—this is usually accomplished by out-of-class readings or in-class lectures;*
- *having an observing or doing experience—-case studies, problem-solving and decision-making exercises, role playing, hearing stories of others' experiences, etc;*
- *reflecting on the meaning of the information or experience through one-minute papers, weekly journals, or learning portfolios.*

It is important that the teacher find some way of including all three kinds of learning activities not only in each course, but also in each of the major units within the course.

Feedback and Assessment: How Will We Know If Students Have Achieved the Intended Learning Goals?

A good concept for guiding our efforts on this task is "educative assessment" (Wiggins 1998). This concept proposes that good assessment is assessment that does more than provide a basis for assigning a grade; it educates as well. To do this, our assessment activities need to include several key elements:

- *Authentic tasks: A part of assessment requires knowing whether students have a basic understanding and retention of the content. But our assessment needs to focus on whether they can do something with that content.*
- *Clear criteria and standards: When we assess complex learning, we need to develop clear criteria (the "yardsticks") and clear standards (the levels of achievement on the yardsticks).*
- *Opportunities for self-assessment: After college is over, students will have to assess their own performance in most situations. We can help them do this well by giving them practice with and feedback on assessing their own work.*
- *"FIDeLity" feedback: Students need feedback on their work that is Frequent, Immediate, Discriminating, and delivered "Lovingly," i.e., in a user-friendly way.*

Integration: Do All the Parts of Your Course Reflect and Support Each Other?

After you have developed significant learning goals, learning activities that reflect the principles of active learning, and educative assessment opportunities, the next step is to make sure all three of these components are integrated, i.e., that they reflect and support each other. There are two tools for accomplishing this.

The first is to use a three-column table to construct the specific components. You want to begin by listing all the major learning goals in the left-hand column. Then, for each learning goal, fill in the rest of the row. Identify the learning activities needed for students to achieve that goal and then the assessment activities appropriate for that kind of learning. What quickly becomes apparent is that, for each kind of learning, you need different learning activities and different assessment activities. An example, just using three learning goals, is shown in table 1.

A second tool for integration is to give serious thought to the teaching strategy you want to use. A teaching strategy is a set of specific learning activities arranged in a particular sequence.

A good strategy has different activities that serve different purposes within the overall learning process, e.g., providing information and ideas, doing or observing, and reflecting. It is also important that each learning activity builds on what has happened previously and prepares students for what comes next.

Does It Work?

When teachers design their courses this way, does it make a difference in terms of student engagement and learning? The answer is clearly yes. Although these ideas have only been available a few years, professors who have learned about them and tried them are reporting major differences compared to what they were doing before. I will share two of these stories here, one from social science and the other from engineering.

Carolyn Fellahi, a psychology professor at Central Connecticut State University, recently tested the ICD model by comparing two sections of a course on lifespan development, both taught by herself (2006). One section was taught using the lecture-driven method that she had been using for many years; the other was redesigned using integrated course design.

She assessed the students in each section with pre- and post-tests that focused on each of the six kinds of significant learning. The results are shown in table 2.

Scores of student learning in the redesigned course were higher on five of the six kinds of learning, and higher at a level of statistical significance in four of the six. While the scores for "learning how to learn" and "caring" were not where the model would predict, the author noted that "one possible explanation involves the limitations of the test that was developed" to measure these two types of learning.

The second story involves Bill Weeks, a professor of computer engineering at the University of Missouri—Rolla who used the ICD model to redesign a course on coding theory (2003). Weeks had been using the traditional teaching strategy of lectures and homework in this math intensive course, but students felt overwhelmed by the material, frustrated, and apathetic, and they gave the course low evaluations.

After attending a workshop on ICD, he wrote new learning goals, applied the principles of active learning and educative assessment, and used team-based learning—a teaching strategy that uses small groups in a distinct and powerful way.

In the redesigned version of the course, students did just as well in learning foundational knowledge (as evidenced by their performance on the same exams), even though he spent less class time focused specifically on that kind of learning. And they did much better on the new learning goals, which he had not even been attempting to promote before. But the major change reported by the professor was in student morale in the class:

The student response was nothing less than phenomenal. I never could have anticipated such drastic improvements in student morale. I was especially surprised that the students were motivated to work so hard. Many students reported to me that they enjoyed the workload in the class.

And seeing that change—students working harder and enjoying it more—had a predictable effect on the professor: "Teaching such an excited group of students was an unforgettable experience. It made my job seem worthwhile and very fulfilling. I will be feeding off that student excitement for years."

Conclusions

Professors in higher education are finding that, when they use the model of integrated course design to restructure the learning experience, students respond by becoming more engaged in the learning process and by achieving more significant kinds of learning. This happens because students become co-creators of their own learning, the intended

Table 1. Three-column table: An example

Learning Goals	Teaching and Learning Activities	Feedback and Assessment
1. How to solve problems	Practice solving problems, with feedback	Solve new, complex problems
2. How to work with others in a team	Work with others—with periodic feedback	Assessment by peers
3. How to plan for future learning	Identify future learning needs, develop a learning strategy	Assess the learning plan

Taxon	Original course (mean difference ± S.D.)	Redesigned course (mean difference ± S.D.)	P Value
Foundational knowledge	5.15 ± 4.08	10.23 ± 3.02	<0.001
Application	1.54 ± 0.93	2.39 ± 0.74	<0.001
Integration	1.54 ± 0.87	2.43 ± 1.17	<0.001
Learning how to learn	5.92 ± 2.20	7.06 ± 1.56	0.665
Human dimension	1.67 ± 3.59	11.84 ± 5.07	<0.001
Caring	2.93 ± 0.59	2.08 ± 0.54	0.9333

*Table 2. Differences in pre-test and post-test scores for original course (fall 2004) versus redesigned course (fall 2005).**
** Data analyzed using independent samples t-test.*

learning has greater meaning, and students are given a wider range of tools to create this learning—often including the opportunity to work closely with other students on promoting each other's learning.

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Teaching and Learning with Technology Grants

Call for Proposals

This grant competition is intended to support faculty members who are seeking innovative ways to incorporate technology into their teaching practice. Three types of grants will be awarded to individuals and/or groups who can demonstrate the project's benefits to students and/or faculty. All grant recipients will be required to share their project results for the benefit of the wider Dalhousie community through the Centre for Learning and Teaching or other means.

Proposal deadline: **October 5, 2007**

For more information go to the Learning and Teaching website at: http://learningandteaching.dal.ca or call CLT at 494-1622

Teaching Assistant Professional Development Workshops Fall 2007

October 10, 2007
More Than a Bus Ride–New Directions for University Field Trips
Suzanne Le-May Sheffield, Centre for Learning and Teaching

November 1, 2007
Accommodation
Bonnie Best-Flemming, Employment Equity Officer
(with Rosemary Matsell, Manager and Advisor, Student Accessibility Services)

November 21, 2007
Enhancing Your PowerPoint Lectures
Scott Harron, Physiology and Biophysics and Osama Majdalawieh, School of Biomedical Engineering

Teaching Integrated Information Technology

Ernst Grundke
Computer Science

But is it Music?

It is just before lunch on a Friday in February, and three first-year students are performing their original musical composition for a mixed audience of their first- and second-year peers. Beethoven never composed for their instruments—cardboard box, an empty pop can, a whistle, and a bottle. Reading a score in a notation of their own design, they discover the difficulty of keeping in step under the stress of live performance. The composition conveys tension, contrast, resolution, and a touch of humour in the antics of the performers.

This is not a class in ultra-modern music! It's one of the interdisciplinary excursions of the new Bachelor of Informatics program offered by Faculty of Computer Science together with the Faculties of Medicine, Arts and Social Sciences, Health Professions, and Science. The music performance concludes a module on improvisation led by Jérôme Blais of the Music Department, built on Gary Ewer's earlier sessions on musical form, especially the sonata form. The students have learned by experience that purpose, form, structure, notation, documentation, teamwork, and communication transcend the boundaries of academic disciplines. Beyond that, they have gained an insight into what musicians might bring to a multidisciplinary team in a future workplace. All of this is part of creating a new kind of computer science graduate.

Overture: A New Program–Bachelor of Informatics

The Bachelor of Informatics is one of Dalhousie's newest and most innovative degree programs, launched in the fall of 2006. As our website explains, the study of Informatics brings people, technology, and information together [http://informatics.dal.ca]. It's more than learning about computers: it's learning how to use technology to meet the needs for information in human organizations for human purposes.

This program is a response to the ramifications of the dot-com bubble burst of 2000. By mid-decade the industry had more than recovered its pre-2000 strength, and although demand for graduates was higher than ever, Computer Science enrollments continued to drop across North America. Participation by women in these programs was particularly low. Further, the industry was looking for a new kind of computer science professional. Employers told us that although they appreciated the graduates' technical skills they required more "professional skills" or "soft skills." The new workplace was less about writing programs and more about selecting, configuring, and integrating software. It was less about understanding the computer and more about understanding the organization and its information needs, less about prima donnas and more about teamwork. In short, the focus was more on people and multidisciplinary teams, and less on the computer.

Music with (un?)sound objects

During 2004-05 a committee in Computer Science began to grapple with many possible approaches to these issues. One of us had taught in the DISP program earlier, and we learned about the Kings Foundation Year Program. We agreed that a multi-disciplinary, integrated approach seemed to be the right cornerstone for our new program but our goal was to extend this approach across all four years of study. The workplace orientation of our program suggested that co-operative education programs be mandatory for all our students. By spring our ideas began to gel, and we benefited from discussions with an amazing panel of industry and government experts assembled for us by Industry Canada in June 2005.

By the fall of 2005 we put forward a formal proposal. Our documentation listed four goals: to provide a diverse multi-disciplinary curriculum combining core informatics content with a major in an application area in order to meet the needs of the changing workplace; to teach professional skills as well as technical skills; to attract more students into information technologies; and to balance student participation by gender and background.

We wrestled with program approval, teaching assignments, integrated scheduling, space allocation, budgeting, marketing, and all the challenges of a new program launch. To meet our multi-disciplinary goals we sought and

found enthusiastic collaborators in the Faculty of Arts and Social Sciences, the Faculty of Health Professions, and the Faculty of Science, and partners in the Faculty of Medicine agreed to create new courses for our Major in Health Informatics. Lynn Taylor of the Centre for Learning and Teaching and Janice MacInnis of Human Resources Development provided very helpful training sessions for our instructors during the summer. We admitted our first students in the fall of 2006.

First Movement

The music activity described above is a small part of INFX 1600XY.18, the integrated year 1 Informatics course that meets for 12 hours a week and counts as 3 full-year courses. In addition to the interdisciplinary modules, it includes streams in computer science, programming, mathematics, and communications. Students also work in teams on projects for real clients; this provides a setting for learning teamwork and leadership and for peer learning and mentoring. The student teams have a "cross-cohort" membership, that is, each team consists of students from all years of study. The course is taught by a team of instructors who meet weekly to discuss topic coordination, student progress, joint assignments, tests, and so on. Instructors use a variety of activities to engage students in the content and to interconnect content with skill building. For example, the final "deliverable" in Suzanne Sheffield's module on the impact of technology on society was a group-created poster for an in-course conference. Instead of asking for a traditional interim book report, Barry Boyce had pairs of students practice an "elevator pitch" (a one-minute conversation during an elevator ride) and report to the class on the other student's book.

University instructors hope that students will learn professional skills like problem solving, creativity, critical thinking, time management, communication, teamwork, conflict management, leadership, project management, and negotiation. In the Informatics program we teach these skills explicitly, integrating them into content modules and streams throughout the four years. Many of our teaching strategies actually imitate workplace activities: multi-disciplinary teams, cross-cohort project teams, peer learning, co-op, and professional skills development. We could describe the Bachelor of Informatics as a holistic program that builds a learning community modeled after the best of the workplace.

The program places special emphasis on communication, specifically reading, writing, listening, speaking, as well as presenting. Under the guidance of instructors, students have many opportunities to practice these skills. Oral testing is included as part of the assessment process to train students for the oral readiness required in the workplace. All students' written assignments, tests, projects, and presentations are graded by the subject instructor as well as the communications instructor; the two grades are combined in a way that makes it worth the students' while to excel at both content and communications.

The program is delivered in a dedicated "home room" environment that creates a sense of community, giving a social context in which the professional skills can be learned and practiced. This sense of community is also promoted through social activities such as Friday lunches that bring together students and instructors in the program in a more informal way.

Critical Acclaim

During our first year we have certainly provided a diverse multi-disciplinary curriculum and taught professional skills as well as technical skills. The program's first and second year entry points attracted 27 students, most of whom would not have enrolled in a traditional computer science field. Eight (30%) of our students are women, and six of them (22%) belong to visible minorities. Two are mature students.

Student feedback has generally been very positive. The Bachelor of Informatics core instructors perceive that student morale and motivation were better than in our traditional Computer Science program. The efforts to build a sense of community have worked very well: the students have coalesced as a class and have learned to work together as team members, well-supported by a team of instructors. Many of the students have become close friends. The instructors have designed meaningful class objectives reflecting the goals of the program as a whole, while guiding and mentoring individual students. This commitment has enhanced community-building and class morale.

INFX 2600 - working together in the "home room" Informatics Centre

Second Movement

This past summer we overhauled the curriculum in the light of our first year's experience. This year we are enhancing the subject integration, the specification of

learning outcomes, problem-based learning, hands-on lab activity, and industry contact. The fundamental curriculum and delivery model (professional skills, integration, cross-cohort teams, projects, building a learning community, and workplace orientation) seems to be valid in our setting and will not be changed in the coming year.

Finale

Watching our new-found "improv" musicians dissolve in laughter at the end of their performance reminds us that innovative learning can be fun. Last year our students as well as our instructors probably worked harder and learned more than ever before. We are excited by knowing that we are doing our bit to rethink university education in the new millennium.

Acknowledgements

A new degree program is the work of many people. The original planning committee included Nick Cercone, Kori Inkpen, Allan Jost, Melanie Kellar, Regan Mandryk, Mike McAllister, Norm Scrimger, Jacob Slonim, and the author. Instructors in the integrated program and in special courses included Raza Abidi, Samina Abidi, Connie Adsett, Christian Blouin, Mike Bolton, Barry Boyce, Stephen Brooks, Linda Burke, Theo Chiasson, Ernst Grundke, Peter Hitchcock, Melanie Kellar, Gwendolyn MacNairn, Regan Mandryk, Mike McAllister, Sampalli Srinivas, and Thomas Trappenberg. Instructors from our partner faculties included Peter Selinger, Thomas Vinci, Darren Abramson, Gary Ewer, Sam Scully, Jérôme Blais, and Suzanne Sheffield. David Zitner co-ordinated arrangements with the Faculty of Medicine. We are grateful to these people and many others who gave freely of their time, energy, and advice.

Photos courtesy of Ernst Grundke

Posters on the social impact of computers


INFX 2600 - students estimating number of leaves

CUTL

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Certificate in University Teaching and Learning

Graduation 2007

Congratulations go out to:

(top row L-R) Heather O'Brien, Amin Majdalawieh, Chris Jordan

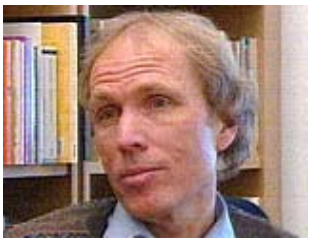
(middle row L-R) Jason Pearson, Margaret Dechman, Heather Phillips

(bottom row L-R) Abulmaali Taher, Fiona McDonald, Clarence Batan

(not shown) Jennifer Hargreaves, Nina Squires

on completing the program. All the best in your future careers from Dalhousie University and the staff at the Centre for Learning and Teaching. (Pearce photo)

CRWR 2000.06: The Creative Process



J.A. Wainwright
Department of English

The Creative Process class was first taught in the 2005-2006 academic year to approximately ninety students, the same number who registered the following year. It is designed as an interdisciplinary introduction to the 3rd- and 4th-year creative writing seminars in poetry, fiction, playwriting, and non-fiction that make up the Creative Writing Concentration in the Faculty of Arts and Social Sciences, but is open to any student with an interest in concepts and issues of creativity. Students from across the Dalhousie campus are encouraged to take *The Creative Process*, and although the majority of those who enroll are arts majors, students from science, business, commerce, and computer science programs are also important members of the class.

In the first term, the class has been team-taught by Drs. Andrew Wainwright (English) and David Overton (Theatre). Dr. Wainwright is a published poet and novelist, and Dr. Overton a published playwright and director. Because of the nature of the class, it is vital that it be taught by those for whom creativity is a significant part of their professional careers; this is particularly important given the creative journals and large creative project required from each student. Students appreciate the fact that their work is judged and graded by those sensitive to creative expression and who are experienced university professors within a regular academic system of assessment.

In the first term, students participate collectively and individually in a variety of creative exercises designed to school the imagination and emphasize such practices as observing, abstracting, patterning, empathizing, modeling, transforming, and synthesizing. In one class, students were divided into small groups, given sufficient Lego pieces, and asked to design an abstract representation of the city of Halifax. If this seems, at first, like child's play, it is important to recognize this is precisely the point—too often, as we grow older we abandon childhood innocence of perception and expression; in addition, 'abstract representation' is a contradiction with which mature minds must grapple.

In this term, students also consider the relationship between verbal and visual imagery in comparisons of poems/songs and paintings, and a work of fiction or non-fiction that has been adapted to film. For example, W.H. Auden's poem "Musée des Beaux Arts" is studied in relation to several paintings by Breughel to which Auden refers in his verse; Don Maclean's famous pop song "Vincent" is looked at through van Gogh's iconic work "Starry Night"; the creative process in Truman Capote's seminal book *In Cold Blood* is compared to that revealed in Richard Brook's film of the same title and the more recent film *Capote* that gets behind the sensational story of murders in Kansas to reveal the writer's ways and means of producing a masterpiece. Students keep over-sized journals of response to what takes place in class and are expected to do so in experimental and original fashion, employing written, visual, and even audio material as they respond to ideas and concrete illustrations of creativity. There is also a term examination on the written and visual 'texts' studied in class.

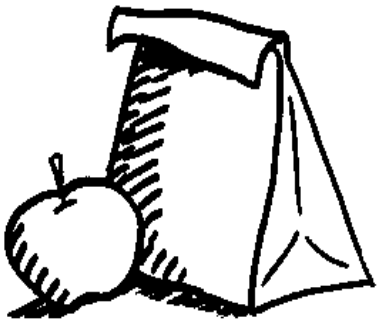
The second term, taught by either Dr. Wainwright or Overton, with the assistance of a tutor-marker, is unique in the Canadian post-secondary system. Sixteen guest-artists are invited into the classroom to discuss their own creative processes and then take informed questions from the students. Writers, actors, musicians, dancers, painters take centre stage, but in order to emphasize the interdisciplinary forms of creativity, mathematicians, physicists, neurosurgeons, and advertisers have also appeared. The result is a profound interaction between creative individuals and their audience many of whose members are themselves aspiring artists and/or practitioners of the creative within academic disciplines. Once again, students keep journals of response to what they have seen and heard in class. After each disciplinary set of guests has appeared (writers or musicians, for example), the class is divided into tutorial groups handled by the professor and the tutor-marker in order to provide for discussion of the guests' presentations. Each student also engages in a major creative project that involves the presentation and explanation of the drafts that precede and lead into their final version of writing, music, film/video, painting, photography, and a host of other areas as fashion and architectural design.

Response to *The Creative Process* class has been overwhelmingly positive, and the work done by students in their journals and projects has revealed a profound interest in and commitment to the creative concepts and experiences under study. Students clearly see the intentions and results of the class as powerfully contextualizing their work in other classes and programs, whether or not they subsequently take the Creative Writing Concentration. They are strongly stimulated to push themselves beyond usual insights and expectations because they are being asked to think and perform in innovative ways that nonetheless constitute learning within a familiar academic structure.

It is important to note that exercises, texts, and guests change from year to year, so that different approaches to creativity remain at the heart of pedagogy in the class.

Lunch & Learn: TA discussion group

Challenging Questions in University Teaching and Learning



The Lunch & Learn series of discussion groups will provide an opportunity for teaching assistants to engage in informal conversations about teaching and learning with their peers.

All sessions will be held in Killam B400

Tuesday, September 25, 2007 • 12:00 to 1:00
Professional Netiquette—Addressing Student Email and In-Class Laptop Use

Wednesday, October 31, 2007 • 12:00 to 1:00
Office Hours—Getting Students to Visit and What to Do When They Get There

Thursday, November 15, 2007 • 12:00 to 1:00
Providing Critical Feedback—and Getting Students to Use It

presented by
Centre for Learning and Teaching
Tel: 494-1622 • Email: CLT@Dal.Ca • www.learningandteaching.dal.ca

Dalhousie's 2006-2007 Teaching Excellence Awards

Shown here are some of the award recipients at a celebratory luncheon sponsored by the Vice-President Academic. A complete list of award recipients is on CLT's website at http://learningandteaching.dal.ca/awt.html (Pearce photo)

Experiencing Entrepreneurship in the Classroom

David C. Roach
School of Business Administration
Director, Norman Newman Centre for Entrepreneurship

In the Winter term 2007, students in their second year of the MBA program participated in a unique graduate level entrepreneurship class. BUSI-6007 - Starting the Emerging Technology Venture, was first introduced in the Fall of 2002 as part of a thrust within the School of Business Administration in the area of technology entrepreneurship. Students are introduced to the issues facing early stage technology start-ups, particularly managing the innovation process, entrepreneurial marketing, and opportunity recognition. Although the course content remained the same, in 2007 the teaching approaches and the student projects were radically different.

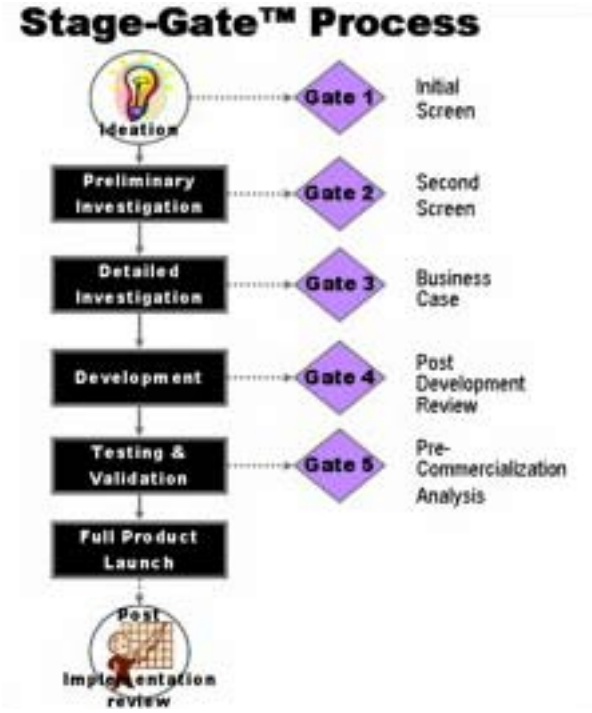
The objective of the course assignments has always been to simulate real entrepreneurial situations, based on identifying opportunities within emerging technologies. This approach had been successful to a degree, but the topics were often difficult for non-technical students to understand and did not fully simulate a technology start-up. Missing were key learning objectives which included the understanding of the multi-disciplinary aspect of new product development and the real-time decision-making characteristics of entrepreneurship. Instead of assigning projects based on current technology trends, this year's class project was based on a product concept from a small Nova Scotia firm, Uplift Technologies of Dartmouth.

In order to reproduce a real entrepreneurship experience, the course was set up to mimic a product development process based on the Stage-Gate System© developed by Dr. Robert G. Cooper. This multi-disciplinary process is widely used by Fortune 1000 firms to control risk in new product development by establishing "stages" in the new product development process by setting "gates" which function as "go" and "no-go" decision points (see figure). In this case, the company had completed the first "ideation stage" of the process and was entering into "preliminary investigation stage." The product chosen was a new class of light therapy products known as Dawn-Dusk simulators used to treat mood disorders, such as Seasonal Affective Disorder (S.A.D.). Uplift Technologies is a market leader in the light therapy category with their current Daylight™ product and wanted to investigate the feasibility of creating a "clinically relevant" Dawn-Dusk simulator.

For the first half of the course, students were broken into three groups and were joined by design students from the Nova Scotia College of Art and Design (NSCAD). Their assignment was to conduct a preliminary assessment of light therapy product category, while the NSCAD students created design concepts for products of this type. NSCAD Assistant Professor of Product Design Glen Hougan reflected on this collaboration by saying "[H]aving (NSCAD) product design students work with MBA students… is a valuable learning exercise as it allows both groups to experience and understand the various design approaches…that each profession brings. [This] type of multi-disciplinary experience allows for truly innovative solutions."

Students presented their findings in class to the company in a simulated Stage-Gate meeting. The students made recommendations, including requesting real funds for the next stage of the project. Based on the students' research, the company committed project dollars to perform additional market research and conduct a multi-disciplinary brainstorming session. The company was so pleased with the results that they gave each student a $25 gift certificate for a job well done!

In the second half of the course, students were re-assigned to new groups and given one element of the business case to investigate. Using state-of-the-art techniques, one group conducted a "Lead User Research" study, based on the work of Dr. Eric Von Hippel at M.I.T. Unlike traditional market research, this method seeks out user innovations that are ahead of the general marketplace. Using this technique, students were able to find a new LED technology and novel application of traditional LED technology which



Left Dr M Terman (Columbia)
Right T Quigg (Marketing Director Uplift)

could highly differentiate this new product. Another group conducted a brainstorming session based on the IDEO product development model developed by Dr. David Kelly of Stanford University. IDEO is widely regarded as the most successful product development firm in the world and uses a process characterized by highly iterative brainstorming and fast prototyping. The session was organized by the students who invited participants from NSCAD, Dalhousie Engineering's iDLab, Uplift Technologies, and even included Dr. Michael Terman (the foremost authority on light therapy) from Columbia University in New York City. The session was facilitated by Professor David Roach, course instructor and Director of the Norman Newman Centre for Entrepreneurship. Dr. Terman kicked-off the session by presenting an overview of light therapy and his latest research on the clinical benefits of Dawn-Dusk simulation. The session resulted in a number of product concepts which could be refined into a leading-edge commercial product. According to Anne Swan, MBA Candidate 2007, "the most valuable aspect…was the exposure to many different ways of thinking and tackling problems. Having artists, designers, engineers and marketer[s] all working toward the same goal was very productive and different from anything I had previously experienced. I am grateful Dalhousie offered me [this] opportunity." The course wrapped up with each student making a recommendation on starting an e-commerce business based on this new product.

From a pedagogical perspective, students were required to work in multifunctional groups with people with different skills, backgrounds, and perspectives. The company established objectives, but the execution was left largely up to the students. The assignments were also designed to empower students to think for themselves, relying on their ability to synthesize course materials in a real entrepreneurial situation. This pushed many outside of their comfort zone, forcing them to structure their arguments based on sometimes conflicting information. According to Professor Roach, "Students like structure; unfortunately, the world they are going into is largely unstructured. Pushing students outside of their familiar academic setting forced them to make decisions with incomplete information, tapping their ability to make reasoned decisions. This was a key learning objective for this course." This successful approach has set the new standard for this course and is already attracting interest of new students and companies alike.

Michael Speraw, CEO Uplift Technologies, summed it up as follows, "This exercise was a great learning experience, not only for the students but for our company. This approach to product management will likely result in a new product for our firm and each student will have played a small part in its success. A great deal of thanks goes to David Roach and the Norman Newman Centre for Entrepreneurship for their leadership role in this novel approach to education."

Christina Waddy explains one of her concepts

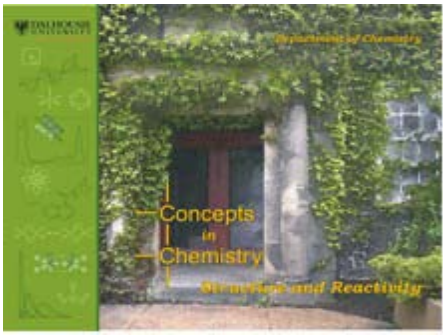
The final words go to Dr. Terman, who probably best described the experience, saying that "It was a thrill for me to join your session (in Halifax)–so smart, productive, and fun."

Re-Inventing our Concept of First-Year Chemistry

Patricia Laws
Department of Chemistry

In considering how to bring "Inspiring Minds" alive for our first year students—arguably the most important students we teach—the Department of Chemistry decided to undertake a complete revitalization of its first year program. Key elements of the new program included the creation of new textbooks and online learning resources, redesigned lectures that focus on active student participation, and enhanced opportunities for out-of-class interactions with faculty members, teaching assistants, and other students.

Preparation for the launch of the new program in the 2006-2007 academic year was achieved through the extensive collaborative efforts of the faculty and staff of the Department of Chemistry. What follows briefly describes the nature and result of these efforts: the new first year program, "Concepts in Chemistry."



Concepts in Chemistry: Structure and Reactivity (fall semester textbook)

Textbooks

Traditional first year chemistry textbooks are massive books that incorporate many pedagogical tools to promote student success. Typically, however, less than half of the content is covered in a first year course, and the textbook and accompanying resources are underutilized by students because the books are too heavy to carry around and too detailed to effectively support the learning of first year students.

In the early stages of program redesign, the Department reviewed existing textbook resources and concluded that if we wanted a truly effective textbook for our first year students, we would have to write it ourselves. And so we did.

Concepts in Chemistry: Energy and Equilibrium (winter semester textbook)

Concepts in Chemistry: Structure and Reactivity (used in the fall semester) and *Concepts in Chemistry: Energy and Equilibrium* (used in the winter semester) were written by 22 faculty members, all of whom generously transferred copyright ownership to Dalhousie University. The books are specifically designed to be concise, focused, relevant, and engaging. Students are relieved to find that the *Concepts in Chemistry* books, unlike most first year textbooks, contain no superfluous information; only the content covered in the course is included.

The format of the books is designed to be accessible and to promote active learning: the pages are typeset in landscape format with a third of each page reserved for students' notes, the book is spiral bound for ease of use, and it is light-weight, which means student can—and do—bring it to each class. As an added benefit, the two books are less expensive than the previously-used textbook.

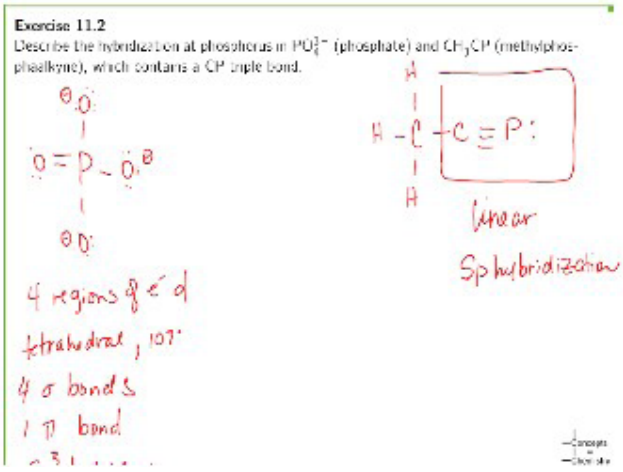
The design of the books are organized to promote integratation into other

Concepts in Chemistry
© Dalhousie University

aspects of the course. Each of the *Concepts in Chemistry* textbooks is divided into sections of about 10-pages and the contents of each section correspond to topics covered in, on average, two one-hour lectures. Prior to each lecture, students are assigned a "bite-sized" reading from the textbook. They can also review the solved examples and attempt the exercises before class. During the class, the lecturers base the lesson on the textbook and students follow along using the figures, tables, and exercises, while writing annotations and notes directly in the book.

Lectures

During the inaugural year, lectures were presented in one-hour time slots on Mondays, Wednesdays, and Fridays to over 1000 students in eight sections with a maximum of 160 students per section. This ensured maximum efficiency while maintaining relatively small class sizes.



Sample slide from a first year chemistry lecture

All lectures take place in classrooms in the Chemistry Building—a deliberate part of the design of the program. First, the Chemistry Building provides faculty with the facilities to effectively deliver lectures and engage students. These

facilities include the proper safety equipment for live demonstrations and a large-scale periodic table—an essential reference during each class. Second, as the students wait for class or go from lecture to lab to tutorial, they read the displays throughout the building and they see their teaching assistants and professors doing chemistry in the research labs and talking chemistry in the hallways. This gives them a secondary association with chemistry that they would not experience in another location.

All lectures are taught using a tablet PC that allows the large-screen projection of a real-time image of handwritten material. It is the modern equivalent of a blackboard with the advantage that it is multi-coloured and that images (e.g. figures from the textbook) can be projected and annotated, as the professor or students speak. The students like this method of presentation in which the lecturer actively demonstrates the process of solving a problem or drawing a molecular structure instead of simply presenting a series of slides loaded with text or images. Because the lecturer actually works through these tasks in the students' presence, the pace moves at a comfortable rate for them, creating the circumstances for more effective learning to occur.

Prof. Norm Schepp in The Concept Room

The Concept Room

To increase the potential for faculty-student interaction, we created a "drop-in" centre near the first year chemistry laboratories and the Chemistry Resource Centre. Known as "The Concept Room," this area creates a space where, for two hours a day, professors work with groups of first-year students, effectively replacing tutorials and office hours. This face-to-face interaction is supplemented by an online discussion board that allows faculty to correspond with students and to answer their questions.

Online Resources

Students have 24/7 access to online resources through the class BLS (Blackboard Learning Systems) website. Department-designed online assignments provide opportunities both for students to practice and for faculty to assess students' performance. Every semester, for each of ten assignments, students can make 4 attempts over the course of one week, taking up to three hours for each attempt. Almost without exception, students use several attempts as practice before they finally submit one for the required grade.

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> *— Student Comment*

Online vignettes are short, real-time audio and video clips generated using the tablet PC. The approximately 160 vignettes record professors or an advanced graduate student working through the methodology for solving a variety of problems. These examples provide "just in time" learning resources for students working on assignments or studying for tests and exams.

Conclusion

We are pleased with the results achieved in the inaugural year of the Concepts in Chemistry program. As expected, students made extensive use of the textbooks, completing reading assignments, bringing the books to class, making notes, highlighting important points, even collectively turning pages as the lecture progressed. Attendance at the Concept Room sessions was optional but this was nonetheless very popular—with standing room only at times. Student response to the online resources was mixed. Some students complained that the online assignments were too time-consuming, taking away from study time; we continued to emphasize their importance in the learning process and to reassure students that doing the assignments was studying. As for the Vignettes, one student's comment says it all: "Vignettes were very helpful. It was very easy to miss parts of the explanation of problems in class, these gave you a chance to pause, take it all in, and copy it down on your own schedule! Not so rushed. Very useable! A Big Help!"

Overall, students were very positive about the program and complimentary of the obvious interest and effort invested by faculty. Many students provided us with thoughtful and constructive feedback on their experiences and observations—feedback that we are using in editing the textbook and in reviewing other aspects of the program.

While the primary goal of the Concepts in Chemistry program is the improvement of the student experience in first year chemistry, we are also optimistic that this will result in increased student enrolment in the first year as word spreads about the quality of the program and in subsequent years as we are successful in attracting more students to continue their studies in chemistry.

Acknowledgements

The Department gratefully acknowledges financial support for the development of the first year program from: the Faculty of Science, the Office of the Vice-President Academic, and the Centre for Learning and Teaching.

TEACHING WITH TECHNOLOGY SHOWCASE

Tuesday, November 6, 2007
10:00 a.m. to 3:30 p.m.

CALL FOR PROPOSALS

The Centre for Learning and Teaching announces the second annual one-day showcase of Dalhousie courses, programs, and services that use technology to support student learning on campus and at a distance.

Faculty, librarians, staff, and administrators are invited to share their knowledge and experience by showcasing their innovative uses of technology to enhance the learning environment at Dalhousie University.

Other people want to know what you are doing; come and show us how you use technology to:

- develop and teach an online course
- deliver a course or program by distance
- engage students in active learning
- extend learning outside of class
- enable communication with and among students
- create simulations, animations, video, or other media-rich learning materials
- promote effective online discussions
- better organize and manage courses
- provide meaningful and timely feedback to students on their progress
- make library resources available to students
- support students through counseling, skill development, personal and career counseling
- achieve any other goal that enhances students' learning experiences

Types of Sessions:

Exhibits: Displays, posters, demonstrations (including computer-based demos), sample learning activities, videos, etc. Exhibitors will interact with participants as they circulate around the Hall.

Presentations: 20-minute presentations on some aspect of technology in higher education. (For example, teaching with technology activities and methods, the impact of the technology on student learning, the role of distance and flexible learning in enrolment management, or institutional support for the development of technology-mediated instruction.)

Deadline for proposal submissions: **Monday, September 24, 2007**.

To submit a proposal for an exhibit or presentation, please visit the Showcase website at www.learningandteaching.dal.ca/showcase.html or contact Carol O'Neil at the Centre for Learning and Teaching (Carol.ONeil@Dal.Ca or 494-1895).

Centre for Learning and Teaching
Dalhousie University
Halifax, N.S. B3H 4H8