Professors Robert Gorbet and Bruce Taylor in the Technology Art Studio where they examine how the concept of sculpture develops in an interdisciplinary course for Engineering and Fine Arts students.

- The University of Waterloo's Teaching-Based Research Group is taking a leading role in promoting the scholarship of teaching and learning as a vital part of the research mission of the university.

- Composed of a multi-disciplinary community of researchers from many faculties, this initiative is contributing to the advancement of knowledge through research into student learning.
The scholarship of teaching and learning views teaching as more than the transmission of knowledge. Learning is the active construction of knowledge by students and teaching creates the opportunities, capabilities and motivation for learning to occur. A scholarly approach to teaching engages faculty - and students - in research inquiries to develop, evaluate and share advances for learning.

The University of Waterloo’s Teaching-Based Research Group (T-BRG) is promoting this new form of scholarship as a vital part of the university’s research mission. We are committed to fostering systematic inquiry into teaching and learning within the context of our disciplines.

Contributions to advancing knowledge through our research into student learning include conducting assessments of the impacts of teaching practices on learning outcomes and developing research-based innovations in teaching. Faculty members share the results of their research on teaching and learning with discipline colleagues and with the broader community at Waterloo and beyond.

The group works closely with colleagues in other universities, such as the Research University Consortium for the Advancement of the Scholarship of Teaching and Learning, in the development of new models for supporting this initiative within the environment and culture of research-intensive universities.

T-BRG members come with an interest in enhancing their teaching through scholarly activities and with research expertise from their own disciplines. Their activities include assessing student learning experiences and ways to improve them; developing innovations in teaching methods; conducting classroom-focused action research; and more formal research studies.

The participants are from across Waterloo faculties, including members of all ranks, each committed to providing systematic validation of the effects of their teaching on student learning.

Interdisciplinary learning research combines engineering, fine arts

The Technology Art Studio is a novel interdisciplinary course involving Engineering and Fine Arts students. Professors Robert Gorbet, Electrical and Computer Engineering, and Bruce Taylor, Fine Arts, are studying the effectiveness of cross-disciplinary learning in which students collaborate on technology-mediated sculptural work. The researchers obtain feedback from students on their conceptual development, collaborative learning experiences and impact on post-course learning and practice. The study design and methodology are primarily qualitative in nature including data from student profiles, design journals and guided-question interviews. A questionnaire will assess students’ attitudes to the interdisciplinary learning experience. The professors have been invited to participate in the Carnegie Research Institute for Scholarship of Teaching and Learning as part of a select group of new scholars applying their research skills to study their own teaching.
Dr. Robert Mann explains the Feynman Diagrams Tool he uses to assist physics students.

Testing a diagram tool for students learning particle physics

Dr. Robert Mann is studying the use of the Feynman Diagrams Tool in his Introduction to Particle Physics class. The tool assists students to learn how to construct and visualize diagrams invented by Richard Feynman more than 50 years ago. Pictorially, they express interactions between subatomic particles and allow a visualization of the processes. Each is constructed according to a set of rules that in turn depend upon the theory describing the particles and their interactions. While the diagrams are easy to see, students often find it challenging to learn how to construct them. The tool software knows the rules and the math so students are able to draw diagrams using the computer with this additional level of guidance. How the tool impacts student learning outcomes will be assessed through performance on course assignments, a mid-term and two final exam questions. A questionnaire will be administered to get student feedback on learning experiences with the tool. Dr. Mann plans to present the results of this study to colleagues in a forthcoming conference.

Role of co-op education in transition to the workplace under study

Dr. Maureen Drysdale, Psychology, St. Jerome’s University (UW), is the principal investigator examining the role of co-operative education in the transition from post-secondary education to the labour market. Despite co-op’s size – at UW and in more than 80 Canadian universities and colleges - Dr. Drysdale found that little research has been conducted into its merits, impact on transition from education to jobs and whether apparent short-term benefits persist. An Associate with the Waterloo Centre for the Advancement of Co-operative Education (WatCACE), her study will determine if there are significant differences in the transition of students entering co-op versus traditional learning programs; compare the impact of the entering characteristics on the students’ success in higher education; and look at the impact of the students’ post-secondary experience on their transition and success in the labour market. Co-investigators are Dr. Mark Baetz, Dr. James Downey, Dr. John Goyder and Dr. Patricia Rowe.

Assessing student perceptions in blended classroom setting

Research to assess students’ perceptions of online learning experiences blended with traditional teaching practices is being conducted by Dr. Vivian Schoner of the Teaching-Based Research Group and Research Associate Professor, St. Paul’s United College at UW. This study integrates inquiry into instructional and technological issues in five key areas: online learning activities; collaborative learning (small group work); technology function; student satisfaction; and instructor feedback. The study results, including student commentary about their experiences, are helping the instructors and technology designers to modify activities as needed in the next offering of the courses. The study was presented at the Carnegie Colloquium for the Scholarship of Teaching and Learning.

Enhanced learning in quantitative economics

Dr. Trien Nguyen, Economics, is researching ways to help students overcome their learning difficulties as well as the psychological fears of mathematical and problem-solving skills. Students will gain more confidence about their ability as a direct result of the project. It also aims to enhance teaching by course instructors in economics as well as other disciplines. Students are surveyed to identify specific problems in mathematical background preparation they will most likely encounter. The data determines those requiring remedial measures. Case studies are prepared to teach higher-order problem-solving skills. Students learn to analyze realistic situations, apply economic theory to well-formulated problems, use software to generate solutions and simulate changes and discuss the results. The studies depict open-ended problems they will encounter in workplace settings, such as trade liberalization, tax reform and budget simulation, to stimulate student thinking. Dr Nguyen plans to present his findings to the International Society for the Scholarship of Teaching and Learning.

Humanities research skills’ module to aid English honours students

Dr. Katherine Acheson, English Language and Literature, leads a project to create and field test a module in foundational research skills to be offered to English honours students as they begin their third year of studies. Its implementation and testing is in a “gateway course” for literature majors. “This is an ideal situation in which to offer a module for consistent, manageable instruction in humanities research skills;” Dr. Acheson said. The long-range plan is to develop and test more advanced modules in research skills for both undergraduate and graduate instruction. Researchers will also work to adapt the module to other disciplines and expect the module will be appropriate for co-operative education enhancement. A teacher of digital design, Dr. Acheson and colleague Dr. Andrew McMurry are preparing a book entitled In Multimedia Res: Towards a Rhetoric for the Digital Humanities.
T-BRG promotes scholarship of teaching, learning

UW's Teaching-Based Research Group (T-BRG) is an initiative of the Office of Learning Resources and Innovation, headed by Dr. Tom Carey, Associate Vice-President. The methods for systematic inquiry include user testing, action research, mixed-method/experimental research and survey research. The group is affiliated with the Carnegie Foundation's Academy for the Scholarship of Teaching and Learning, and with emerging Canadian initiatives to apply the research expertise of faculty in enhancing learning and teaching. Dr. Vivian Schoner, Strategic Consultant, provides cross-discipline, course-based consultation and support for faculty researching teaching and learning in their classrooms. Katrina Strampel, Research Associate, assists with research design and implementation for multiple projects with faculty and external organizations. Faculty members are also assisted by instructional experts and academic support staff in their departments, the Teaching Resource Office (TRACE), the Centre for Learning and Teaching Through Technology (LT3) and the Office of Distance and Continuing Education. UW is a member of the Carnegie Academy Campus Program. It gives practitioners an opportunity to examine how they are teaching, look at ways to identify and recognize quality teaching and improve the quality of teaching. As well, the Carnegie Scholars Program brings together outstanding faculty committed to investigating and documenting their learning experiences in a variety of different contexts - academic, workplace and community - to demonstrate competency in a given domain. Students learn skills in these different contexts, and the electronic portfolio (ePortfolio) provides a comprehensive means to articulate, integrate and connect their learning in many different ways. This allows them to both “show” and demonstrate what they know to the world. In terms of professional practice, such as accounting, ePortfolios provide students with ways to document and demonstrate their competency in skills that their profession/program has deemed to be important. The aim of the study is to follow students from academic to work terms and back to track and document how their portfolios evolve over time.

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Management of Technology
e-learning program evaluated

Dr. Clifford Blake, Management Sciences, is evaluating Waterloo’s innovative Management of Technology Master’s Program offered through the Department of Management Sciences, Faculty of Engineering. Co-investigator is Dr. Vivian Schoner, Research Associate Professor, St. Paul’s United College at UW. The program is offered through the Internet using live interactive digital streaming media designed to facilitate instruction, students’ individual and group learning, and general communication. Students remain in the workplace for the duration of their studies. The purpose of the project is to obtain comparative data on student, faculty and workplace-based perceptions of the e-learning experience to inform areas of the program needing changes or adjustments to the structure or process.

Researching educational practice in professional communication

Dr. Catherine Schryer, Rhetoric and Professional Writing in the English Department, and Dr. Marlee Spafford, School of Optometry, investigate the interface between communication and education in professional contexts. They study patient–clinician communications in optometry. Dr. Schryer is the principal investigator in studies supported by the Social Sciences and Humanities Research Council to look at the role of case presentations in the training of health-care practitioners. As well, she has examined the relationship between literacy and educational practices in a veterinary college and professional training with respect to the communication of negative information in the workplace. A well-published qualitative researcher, Dr. Schryer provides assistance with grant proposal development for T-BRG members on request.

Studying a practicum experience in Sexuality, Marriage and the Family

Dr. B.J. Rye, Human Sexuality-Psychology, St. Jerome’s University at UW, is designing and pilot testing a practicum experience in Studies in Sexuality, Marriage and the Family (SMF), followed by an assessment of the learning outcomes. With co-investigator Dr. Maureen Drysdale, Psychology, this involves a review of the practicum components of similar Canadian undergraduate family studies-based and sexuality-based programs. Also to be developed and offered is a pilot practicum course and an evaluation of the learning outcomes of the students, and implementing a permanent practicum course in the SMF program. The course will provide students with the opportunity to engage in the transfer of learning between theories presented in the classroom and the practical application of the theories in a placement setting. Consequently, students who take the practicum course would develop and strengthen their ability to apply theoretical knowledge.

Study aims at aiding new accountancy students

One of the most difficult concepts consistently identified by students in first-year financial accounting courses is the cash-flow statement. Professors Grant Russell and Bob Sproule, both School of Accountancy, have created and implemented a cash-flow statement learning object focusing on one often-challenging segment. It is yielding field test results for the learning object usability and effectiveness of an introductory accounting course. After course completion, results will be evaluated to determine the learning impact. Successful validation will lead to the provision of the learning object as a teaching resource for all introductory financial accounting courses. The long-range plan is to pursue the implementation of other learning objects focused on difficult concepts within accounting courses.

Dr. Marlee Spafford and Dr. Catherine Schryer investigate communication and education.
INNOVATIVE WATERLOO

Exploring ways to increase learning while reducing student workload

A Teaching-Based Learning Group project led by Dr. Mat Schulze, with Dr. Grit Liebscher and Dr. James Skidmore, all of Germanic and Slavic Studies, is investigating ways to reduce student learning time by 10 per cent to 20 per cent. This would be achieved through the use of learning designs and state-of-the-art information and communication technologies in the teaching of written communication in a German course. The goal is to implement new learning designs and record student results. This would include their contribution to online discussions, class notes, quiz answers, essays, etc. to determine gains in learning in the course. It would also determine the possibility of gains for students in other courses, such as German Thought and Culture, and for application to other Waterloo programs. As well, it should save instructors time through the effective use of new technologies, such as tablet computers in a wireless environment. This would utilize new ways of distributing and sharing learning resources with no photocopying of handouts or copying from slides, for example. It would result in an increase of faculty-student interaction in the media-rich learning environment.

Research into effectiveness of software for literature students

A project by Dr. John North, English, is comparing student users versus non-users of a literature software package. The goal is to establish empirical evidence for the effectiveness of this software for student learning. The package, provided by Pearson Prentice Hall and used by Dr. North’s classes, is keyed to the Department of English’s recommended handbook, the Little Brown Compact Handbook. It provides a pre-test – exempting students from modules of areas in which they are already proficient – instruction, exercises, post-testing and automated grading. The software offers superior instruction through exercises and multiplicity of examples. It relieves the literature professor of a huge burden while providing a daily profile of class progress. Dr. North is also writing a course in literature, directed to non-English majors from across campus, on Short Story and Drama. Selections for this hybrid course offered together with the software package are from better-known and older contemporary writers.

Interactive online tutorial assistance in Electrical and Computer Engineering

Dr. Carol Hulls, Electrical and Computer Engineering (ECE), is studying ways to demonstrate that using web-based instruction promotes active learning and enables students to exercise different learning styles. Dr. Hulls developed a low-cost, small-scale system comprising a set of interactive tutorial modules with accompanying self-check quizzes that complements traditional teaching methods and improves learning outcomes for students. The key to the system design is limiting the type of tutoring and focusing on the key instructional challenges needing improvement. Students’ quiz performance data was logged and cross-referenced with student grades and analyzed. The data shows that student learning outcomes had improved compared to students who did not use the online tutorial system and in comparison to the historical mark trends in previous years. Dr. Hulls’ study has been accepted for publication in a forthcoming IEEE (Institute of Electrical and Electronics Engineers) Journal.

Other research projects

- Dr. Paul Malone (with co-investigator Dr. Vivian Schoner) is using visual organizers to support the learning of complex conceptual material. The project compares two types of strategic learning practices – knowledge maps and matrices – for their impact on learning complex conceptual content in humanities courses.

- Dr. Roger Suffling is researching learning outcomes for students presented with a technical material learning task. In the study, students use a textbook and an interactive software package designed as instructional materials, with learning outcomes measured by quiz scores.

- Dr. Jay Thomson is interested in the preparation and delivery of teaching materials using electronic-based technologies. A member of the Centre for Applied Health Research, he has arranged the integrative seminar in Kinesiology for new PhD students that explores issues in science such as working in a multidisciplinary department.

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