Experimental Study Group

The Experimental Study Group (ESG), now in its 39th year, continues to offer innovative opportunities in teaching and learning to a variety of MIT undergraduates, faculty, staff, and alumni. In keeping with our original mission, ESG provides first-year students at MIT with personalized instruction in the core subjects within a close-knit community environment. This instruction includes flexibility in pace and scheduling and small classes where students are encouraged to ask questions and get to know fellow students and instructors. Over the years, students have consistently said that ESG's small group learning and community atmosphere were some of the most rewarding aspects of their MIT education.

Each year, ESG offers approximately 40 undergraduates the opportunity to assist in some aspect of teaching at ESG. All student instructors receive midterm and end-of-term evaluations from freshmen and meet regularly with staff members for supervision. New student instructors participate in a weekly teaching seminar run by senior ESG staff. Experienced student instructors who have demonstrated excellent teaching skills are able to develop their own pass/fail seminars under faculty supervision or work relatively independently in teaching core subjects.

Over the past 20 years, ESG has served as a center for educational innovation in the undergraduate program by offering a series of hands-on, interactive seminars in a variety of subjects that are not otherwise offered at MIT. These seminars provide all MIT undergraduates with the opportunity to participate in the ESG style of learning (small, interactive classes). Non-ESG students who take these seminars frequently say that these seminars are the only opportunity they have had since their freshman year to participate in a small interpersonal class with a hands-on focus. This year we were able to run 13 seminars through a combination of funds from the dean of the School of Science and our own alumni. We are strongly committed to continuing these seminars and promoting their growth by working closely with various parts of MIT, outside sources, and our own alumni to secure more permanent funding for these seminars.

Student Statistics

Sixty-one freshmen were enrolled for one or more terms in ESG this year, with another 33 students waitlisted in the fall term. Sixty-seven percent of our students were female, 20% were underrepresented minorities, and 20% were international students. In addition to these students, we enrolled 27 students in our teaching seminar, 21 upperclassmen in one of our core subjects, and 103 students in our undergraduate seminar program (80% of whom had never been in ESG as freshmen). Forty-two undergraduates served as teaching assistants, graders, and student instructors. These upperclassmen collectively maintained an impressive 4.8 grade point average.

Staff and Faculty

ESG's administration was headed by mechanical engineering professor Alexander Slocum and associate directors Dr. Peter Dourmashkin and Dr. Holly Sweet and included program coordinator Graham Ramsay. The physics staff was headed by Dr.

Dourmashkin and included Toby Ayer ’96, David Custer ’83, and Dr. Sahana Murthy, a specialist in physics education research. This past year was the last year for Toby Ayer who will start this fall as the physics director at Salisbury School, a preparatory high school in northwestern Connecticut.

The mathematics staff was headed by Dr. Jeremy Orloff and included Dr. John Lewis and Dr. Gabrielle Stoy. The chemistry and biology offerings at ESG were headed by Dr. Patricia Christie. ESG’s School of Humanities, Arts, and Social Sciences staff included Mr. Custer, Dr. Lee Perlman, and Dr. Marc Graham.

Academic Initiatives

Undergraduate Seminar Series

Because of its small size and experimental educational focus, ESG provides an ideal environment in which staff, faculty, alumni, and students can develop new subjects and new approaches to existing subjects. This year we continued the ESG seminar series with 12 seminars, more than a quarter of which were developed and run by undergraduate students under staff supervision. Seminars offered for the first time this year included Think Tank (Zahir Dossa ’09), Mathematical Physics and Group Representation Theory (Dr. Dourmashkin), Chinese Culture (Kim Dietz ’09), The Coming Years (James Rising ’04), and American Photographers and Their Influence (Mr. Ramsay and Theresa Mislick).

Under the guidance of Elizabeth Chadis, fundraising officer for the School of Science, ESG initiated the first phase of a fundraising campaign to raise $500,000 over a five-year period to endow the ESG seminar series. This phase consists of raising $250,000 from several lead donors. As of June 30, 2008, $125,000 has been raised from five-year gifts of $2,500 or more from the following ESG alumni: David Henkel-Wallace ’86, Ian Eslick ’95, Gregory Moore ’73, and Professor Slocum ‘82.

Interdisciplinary Subjects and Projects

In fall 2007, Mr. Custer taught 21W.732 Introduction to Technical Communication. This class was coupled with a mechanical engineering design seminar taught by Dr. Marc Graham, a former graduate student in the MIT Department of Mechanical Engineering. Students worked in small teams to create products of their own design and learned to write with passion and ownership. Because of its success, this class will be offered again in fall 2008.

Dr. Christie cotaught a seminar in spring 2008 on the Chemistry of Sports with triathlete Stephen Lyons. In collaboration with the MIT Department of Athletics and Physical Education, physical education points could be obtained by attending biweekly triathlon-specific workouts throughout the term and completing the Mooseman Triathlon in Wellington State Park, New Hampshire, in June 2008.

Over the past three years, Dr. Perlman has been experimenting with combining humanities classes with sciences and technical classes. In fall 2007, he taught SP.2H3 Ancient Philosophy and Mathematics. In spring 2008, with funding provided by the MIT Energy Initiative, Dr. Perlman codesigned and taught 10.04J/24.114J A Philosophical

History of Energy along with Professor Bernhardt Trout from the Department of Chemical Engineering.

With funding from Undergraduate Advising and Academic Programming, Mr. Ramsay and Dr. Sweet developed a pilot project in summer 2007 to assist freshman advisors in incorporating more experiential activities in their fall-term advising seminars. Material they developed was based in part on the seminar SP.240 Composing Your Life, which they taught at ESG over the past four years. Feedback about the pilot project was positive and the program will be continued in future years. The material from SP.240 has been turned into a book, *A Creative Guide to Exploring Your Life: Self-Reflection Using Photography, Art, and Writing*.

Pedagogical and Curricular Innovation

In summer 2007, Dr. Dourmashkin and Dr. Murthy began a two-year collaboration with professor John Belcher (MIT) and professor Carolann Koleci (Worcester Polytechnic Institute) on a project supported by the National Science Foundation titled "Force Field: Electricity and Magnetism Visualizations for Introductory Physics." During the 2007–2008 year, Dr. Dourmashkin continued his work on physics education reform with professor Eric Mazur at Harvard University.

In spring 2008, Dr. Stoy set up a problem class each week for 18.02 Calculus, which allowed for in-depth discussion of problems by the whole class, led by a senior teaching assistant. The students said in their end-of-term evaluations that they really enjoyed these problem sessions and their performance improved, as evidenced by higher scores on quizzes and exams.

Staff Publications

In March 2008, Dr. Sweet and Mr. Ramsay completed their manuscript *A Creative Guide to Exploring Your Life: Self-Reflection Using Photography, Art, and Writing.* This book is based on an ESG seminar (SP.240 Composing Your Life), which has been taught at MIT by the authors for the past four years. The book will be published in December 2008 by Jessica Kingsley Publishers and is the first book to be published in the ESG Book Series. With funding from the D'Arbeloff Foundation, Dr. Perlman is completing a book about Greek mathematics and philosophy based on a class he has developed and taught at ESG for the past three years.

Dr. Murthy's paper entitled "Peer-assessment of Homework Using Rubrics" was accepted to the 2007 Physics Education Research Conference Proceedings, American Institute of Physics Conference Proceedings, Volume 951.

Staff Presentations

In July 2007, Mr. Ramsay traveled to Denmark and Sweden on an ESG-sponsored project, presenting a three-way collaborative project between a writer (Dr. Alice Flaherty), a composer (Graham Ramsay), and a performer (organist Heinrich Christensen). The work (entitled "Jacob Versus Angel") toured six cities and illustrated the ESG model of peer-reviewed, interactive collaboration that bridges various disciplines to create a single, multidimensional, and cohesive work.

Mr. Custer presented papers at several professional conferences during the year. These papers included "What to Know Next—What the Climbing World Doesn't Know but Might Want to" at the Climbing Wall Summit and "The Behavior of Dynamic Ropes: International Mountaineering and Climbing Federation Standards for Climbing Equipment" at the Association for Challenge Course Technology symposium.

In January 2008, Dr. Dourmashkin gave three talks in Chile about active learning, TEAL (Technology Enhanced Active Learning), and ESG. These talks took place at the University of Chile (Santiago), Catholic University (Santiago), and Universidad Técnica Federico Santa María (Valparaíso). In March 2008, he was invited to Tokyo to give talks about studio physics at University of Tokyo, Komaba, and at Aoyama Gakuin University. In June 2008, Dr. Dourmashkin gave a series of five workshops in Australia about TEAL at the University of Queensland (Brisbane), the University of Melbourne, RMIT University (Melbourne), the University of Wollongong, and the University of Technology, Sydney.

In August 2007, Dr. Murthy presented a paper titled "Interplay of Research and Development: A Case Study in Integrating Visualizations and Simulations into a Reformed Curriculum" with Professor Carolann Koleci at the Foundations and Frontiers of Physics Education Research Conference at Bar Harbor, Maine. Dr. Murthy presented an invited poster "Technology-Enabled Active Learning: Learning in More than One Dimension" at the New England Faculty Development Consortium conference in November 2007. In January 2008, Dr. Murthy gave a seminar at the Indian Institute of Technology in Mumbai, India, on "Interplay of Technology and Pedagogy in the Learning Process."

In June 2008, Dr. Perlman organized a conference with the Institute for the Study of Nature at MIT ("Who Won the Scientific Revolution?") and presented a paper at that conference titled "Theaetetus and Irrational Numbers."

OpenCourseWare

ESG has sponsored 15 different subjects that now appear on MIT's OpenCourseWare (OCW) website (ocw.mit.edu/OcwWeb/Experimental-Study-Group/index.htm). One of these subjects (SP.287 Kitchen Chemistry) has recently been highlighted in the OCW section on "Stories," describing how a mother used the material in Kitchen Chemistry to home-school her daughters in chemistry principles.

Awards

In September 2007, Dr. Dourmashkin received the Buechner Teaching Award from the Physics Department at MIT. Seven of the May 2008 MIT Phi Beta Kappa award winners were ESG alumni: Marcelo Alvisio, Raja Bobbili, Jeremy Hurwitz, Nikhil Khanna, Juan Prajogo, Kah Seng Tay, and Bo Zhao.

ESG gave its own set of awards in May 2008, including the Peter and Sharon Fiekowsky Community Service Award (for outstanding contributions to the ESG community) and the Todd Anderson Excellence in Teaching Award (given to graduating seniors who have demonstrated excellence in teaching at ESG over a sustained period of time). Both

Mr. Fiekowsky and Dr. Anderson are graduates of MIT and have established funding for annual ESG prizes in these categories. Winners of the 2008 Fiekowsky award included Mindy Eng '10, Christina Johnson '11, Carmel Mercado '09, and Christopher Moses '09. Winners of the 2008 Anderson award included graduating seniors Marcelo Alvisio, Jeremy Hurwitz, and Dennis Perepelitsa.

Alumni Involvement

The ESG alumni steering committee is headed by Richard Hilliard '76 and includes Ian Eslick '95, Peter Fiekowsky '77, David Glazer '81, David Henkel-Wallace '86, George Hu '89, Andrea McGimsey '87, Greg Moore '73, James Rising '03, Jocelyn Rodal '06, and Matthew Wilbert '80. The committee met several times during the year to give input to the ESG staff about a variety of issues, including finding ways to fund the ESG seminar series, organizing reunions, and reviewing current educational policy and initiatives. Two new ESG alumni (Raja Bobbili and Jeremy Hurwitz) were added to the steering committee in June 2008. In spring 2008, ESG continued its highly successful student–alumni seminar dinners, where alumnus Dr. Alan Millner met weekly with 8.022 students to discuss practical applications of physics principles.

Faculty Advisory Committee

Members of the ESG faculty advisory committee included professor Robert Silbey (chair), professor John Belcher (Physics), professor John Guttag (Computer Science), professor Hazel Sive (School of Science), professor Charles Stewart (Political Science), professor David Vogan (Mathematics), and professor Graham Walker (Biology). Ex officio members of the committee included professor Kim Vandiver (former ESG director) and professor Slocum (current ESG director). The committee meets once or twice a year to provide oversight for the ESG program, including staffing and funding issues, educational policy, and exploration of academic initiatives for the program.

New Initiatives for 2008–2009

Professor Slocum has been very active in the MIT Energy Initiative this year and is leading the ESG staff in a drive to bring the theme of "Energy Study Group" to ESG. Based on a proposal that Professor Slocum and the ESG staff wrote, the Energy Task Force has committed two full-time graduate teaching assistants to work with ESG staff in the 2008–2009 academic year to develop energy-related context problems and examples to be tested in the general institute requirements (GIRs) taught in ESG. Once refined, the materials can be used in GIRs in the regular curriculum to help better prepare and motivate freshman for possible selection of the new minor in energy that MIT is planning to offer starting in fall 2009. Integration of the new material developed and tested at ESG into the regular curriculum GIRs is made possible primarily because ESG instructors are members of the School of Science and work closely with the School of Science professors in charge of the GIRs.

Conclusion

We are dedicated to offering undergraduates opportunities to teach and learn in a collaborative, interactive environment. We are proud of our history of educational experimentation, including our seminar series and publication of books based on materials

developed at ESG. In the coming year, we will continue to work on increasing faculty and alumni involvement with ESG and to look for ways to export successful ESG educational experiments to the regular curriculum and to educational settings outside MIT.

Peter Dourmashkin
Associate Director
Senior Lecturer in Physics

Alexander Slocum
Director
Professor of Mechanical Engineering

Holly Sweet
Associate Director
Lecturer

More information about the Experimental Study Group can be found at http://web.mit.edu/esg/.