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Collaborative Learning

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Janet Peterson, assistant professor of health and human performance, and Will Lynam '06, right, monitor the flexibility of firefighter Dale Mount as part of a health study and fitness program Lynam designed for the McMinnville Fire Department.

Collaborative learning

Learning can occur in many places – in a fire station, behind a camera, on paper with crayons. Linfield's rich tradition of collaborative research, supported by a Collaborative Research Endowment built by gifts to the college, is a learning ground for both students and faculty. Here, six among the many projects are featured, providing a glimpse into a creative environment that challenges the intellects of teacher and student.

Teaching healthy living

Clip on a pedometer, grab a water bottle and get ready to move if you plan to keep up with Janet Peterson.

Peterson, assistant professor of health and human performance, is a health advocate with a penchant for fitness. In an increasingly sedentary world of online shopping, elevators and extended commutes, Peterson lives what she teaches her Linfield students each day.

"Just move," she said. "Take any opportunity you can to increase your physical activity."

Since arriving at Linfield in 2003, Peterson has intertwined this philosophy and her enthusiasm for fitness into a variety of community health programs, most of them involving students.

One such program is Blood Pressure Friday, held each week during the academic year usually from noon to 1 p.m. in the athletic complex, during which students offer free blood pressure checks to the public. Not only does the program provide a valuable service to the community, but also it gives students experience taking blood pressure.

Peterson's concern for obesity in children prompted her to start Kid Fit, an education program focusing on nutrition and activity for children.

"Prevention is key," said Peterson, who ran the pilot program at Linfield last year with Kendra Victor '05. "As a nation, we're starting to treat obesity and inactivity, but we need to focus on preventing it for the next generation."

Never one to let a teachable moment slip by, Peterson discusses health and nutrition while walking during the Walk and Talk program, which she launched in 2004. Last year, a Linfield student who showed up to every weekly session lost 30 pounds.

"I love seeing changes like that," Peterson said. "Simple changes like increasing physical activity and healthy eating – that's really all it takes."

Peterson has also been active in the Yamhill County Obesity Forum, sponsored by the Yamhill County Coalition on Physical Activity and Nutrition. She helps with the local Soroptimists' Women's Health Day and presents wellness programs to community groups.

At times, it seems Peterson's energy and ideas exceed the number of hours in the day. But she somehow finds time for all the projects.

"It's not hard to do when you love something," she said. "The students are the key. I couldn't do this on my own."

Peterson oversees dozens of students as they pursue research and internships, constantly looking for ways to engage them in health-related projects. For example, Will Lynam '06, a volunteer McMinnville firefighter, is working with Peterson on a health study and fitness program uniquely tailored to the local fire department.

Amy Hammons '06 spearheaded a pedometer program for which she has organized a number of walks. Eric Hefferon '06 has spent the past two years researching body fat analyzers and presented findings at the Northwest American College of Sports Medicine conference this spring and at the June national meeting.

"She brings up great questions and sparks my curiosity about other aspects of the research," said Hefferon, who plans to attend graduate school in physical therapy.

Peterson's strong belief in students underscores her teaching philosophy.

"If I do preventative care myself, I can only reach a certain number of people," she said. "But if I teach others how to do preventative care, I can reach thousands and millions, potentially. It's very cool."

Lost in translation

Scott Smith and Tatyana Aleksandrova '07 spent much of last summer thumbing through the pages of dictionaries – some in English and some in Russian.

They were searching for just the right words, nuances and phrases to bring precise meaning from one language to another. Smith, assistant professor of history, with the help of Aleksandrova, a Russian native, is translating *Memoirs of a Terrorist,* a controversial book written in 1909 by notorious Russian radical Boris Savinkov.

Savinkov's book, which recounts how he organized a number of high-profile assassinations, provoked a storm of controversy and has been an important source for historians exploring the inner life of Russian terrorist groups before the Revolution of 1917.

"This book is a vivid account of these terrorists living at the edge," said Smith. "It demonstrates their fanatical hatred for the old regime and the degree to which they're teetering on the edge of psychological instability."

The Russian text was translated into English in 1931, but that version, which Smith sometimes uses in his teaching, is out of print and not easily obtained. Smith wanted to start with the original text and translate it himself, to better understand the book.

The native Russian language skills of Tatyana Aleksandrova '07 proved invaluable to Scott Smith, assistant professor of history, who is translating *Memoirs of a Terrorist,* a controversial Russian text. Smith hopes to gain a deeper understanding of the book through the process.

Smith sought the assistance of Aleksandrova, a student from Ashgabat, Turkmenistan, to help him with the project. As an international student whose native tongue is Russian, Aleksandrova understands the importance of language. She jumped at the chance to take on a Russian history project while developing her English skills.

"Having a native speaker who can pick up subtleties of Savinkov's word choice and with whom I can discuss the fine points of translation has been invaluable," Smith said. The two worked separately but met regularly to discuss their progress.

Before coming to Linfield College in 2002, Aleksandrova spent a year in Dallas as an exchange student hosted by Valenta Moorman '94 and her family. After Aleksandrova returned to Turkmenistan to finish high school, Moorman encouraged her to continue her education at Linfield.

"To go back to the United States to go to college was always my wish," said Aleksandrova, who also speaks German and will earn an accounting degree in December.

For Smith and Aleksandrova, the challenge is more than simple translation. Although it's relatively easy to convert a Russian text into English that is comprehensible, it's infinitely more difficult to create English writing that reads like literature while remaining faithful to the Russian version. Aleksandrova spent about two hours translating each page.

"Savinkov's writing is very precise," Aleksandrova said. "For me, it was difficult to convey that depth into the same amount of words in English. I can describe it in a paragraph, but to say it in a sentence was difficult."

Last summer while in Moscow to complete paperwork that will allow her to apply for her U.S. citizenship, Aleksandrova located some of Savinkov's early writing in a 1917 Russian periodical at the State Public Historical Library. The memoir, an unexpected addition to Smith's research, provides valuable insight into the mind of a terrorist.

Smith will continue translating the book and hopes to ultimately publish it, along with an introduction analyzing the content.

Digital dilemmas

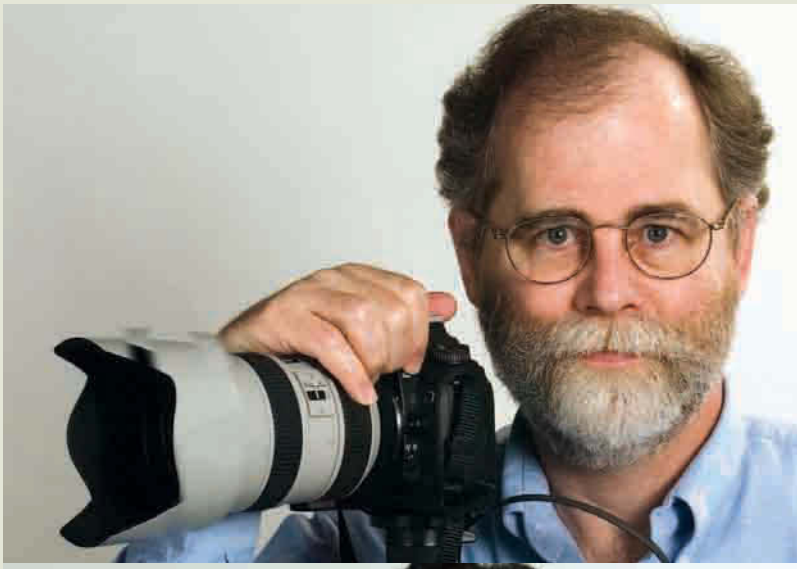
Just how much can a photographer manipulate an image without actually manipulating the news? That was at the heart of a project that drove Brad Thompson, assistant professor of mass communication, and Caleb Bushner '06 to survey members of the National Press Photographers Association (NPPA) on the ethics of photojournalists in a digital age.

But it was a love of photography and some long conversations outside the classroom that really sparked the idea for the project.

Thompson is a former reporter and editor and a photographer in his own right. He became interested in the topic while teaching a photojournalism course and in talking with Bushner, a former photo editor of the *Linfield Review* who just completed a photo internship at the McMinnville *News-Register.* They found they had similar concerns about how much is too much when it comes to manipulating news photos.

Bushner, a political science and philosophy major from Mill Valley, Calif., stumbled into photography and didn't take it seriously until he began working for the *Review.* When he learned that a photojournalism course was being offered during January Term, he met Thompson and the two began discussing ethical issues relating to digital photography.

"It was serendipitous," Bushner said. "I was thinking about writing about photojournalistic ethics for my philosophy thesis and Brad was talking about some of the same issues, and we decided to submit a



Brad Thompson, assistant professor of mass communication, and Caleb Bushner '06 combined their interest in photography for a survey of photojournalists on the digital manipulation of photos.

(collaborative research) proposal. It's a real testament to professor-student relationships at Linfield."

Photojournalistic ethics have come a long way, but controversies still erupt periodically, Thompson said. Some publications have actually moved elements in photographs to make a more dramatic photo or to change an image from horizontal to vertical.

"The fundamental principle of journalism in a democratic society has to be that you are telling the truth," he said. "If we in our writing and in our pictures are not telling the truth, then the people who rely on us to give them the information to vote, choose leaders, select policies, are basing their decisions on bad information. We wanted to see how far truth could be stretched photographically before photographers said enough is enough."

More than 1,000 photojournalists responded to the survey, which showed that although photographers will agree to some leeway on changing cover photos, they are opposed to almost any changes in news and feature photos.

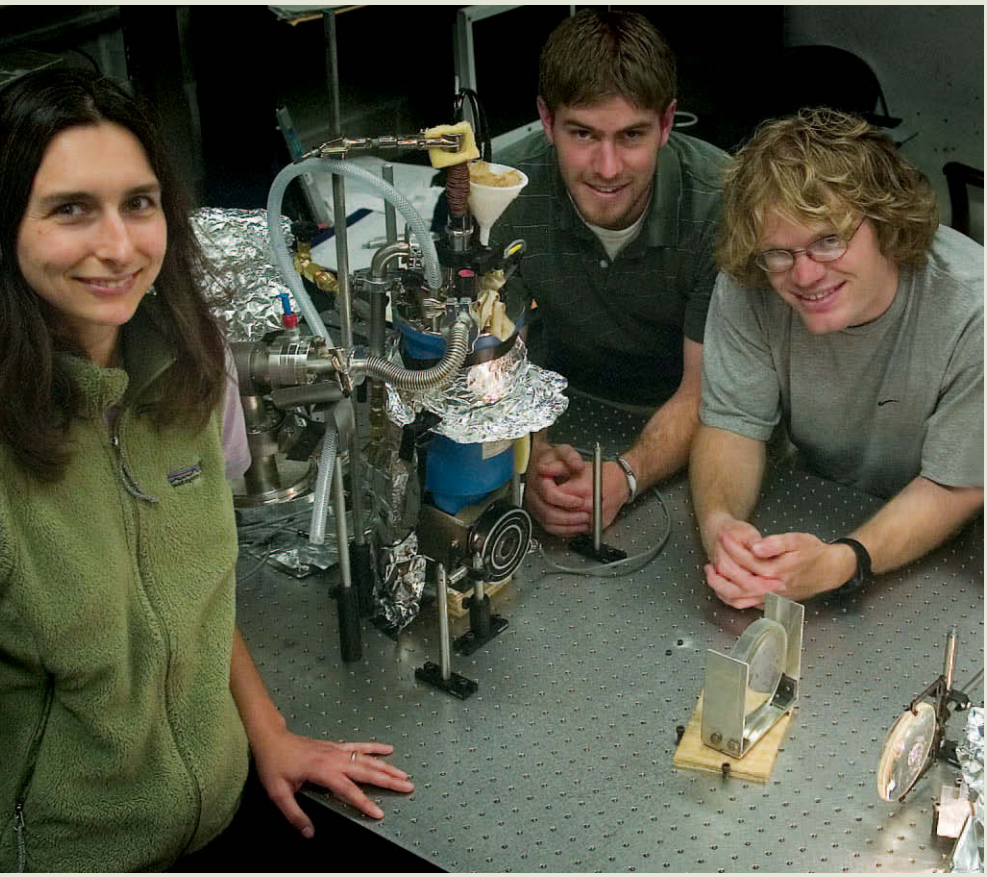
For example, the majority will allow some lightening and darkening of an image, but not enough to change or hide details. The majority also agreed a photo could be sharpened and that red eye could be fixed, but they were opposed to removing skin blemishes. They overwhelmingly said that elements should not be removed from a photo, nor should they be moved to allow the photo to fit a specific space or size.

"Not everything is black and white," Bushner said. "People have their own ideas of how things should be done, but it's never really been discussed. As the technology becomes more available, I think this becomes a bigger concern."

Although the survey results speak well to the ethics of today's photojournalists, the real value isn't in the answers, but in the conversations sparked in newsrooms, with art directors, editors and publishers, according to Thompson.

"It's important to keep this conversation going," he said. "It's easy for one person to pontificate on what is acceptable. But I don't think that's the way ethics works. Ethics bubbles up, it doesn't come down from on high. We have to agree as a community on what is ethical."

Harnessing the sun



Independent research projects are an important prerequisite to graduate school, according to Jennifer Heath, left, assistant professor of physics, shown here with Todd Curtis '07, center, and Jed Rembold '07.

For someone fascinated by sunshine, Jennifer Heath spends much of her day in a dimly lit basement laboratory.

Working with electronics, liquid nitrogen, a beam of light and three Linfield College students, Heath, assistant professor of physics, is studying solar energy.

"It's out there being unused, shining down on buildings and roads and everything," Heath said. "There's really no reason not to use solar power."

Heath and Todd Curtis '07, Jed Rembold '07 and Jeff Baker '08 are testing solar cells, devices that generate electricity from sunlight, to identify the most efficient and cost-effective solar energy sources and learn more about them.

With the decline of nonrenewable resources, solar power is increasingly viewed as a major source of energy for the future, Heath said. Rembold agrees.

"As research continues, the power potential of these cells will continue to rise and the cost will drop," he said. "I believe this research contributes a small part to the global investigation of solar cells."

They seem to be on the right track. The solar cells they are studying use thin

films of material to reduce manufacturing costs. The very best traditional thin film solar cells made of amorphous silicon, such as those in calculators, can be up to 11 percent efficient. But the best copper indium diselenide cells Heath and her students are studying can have efficiencies as high as 19.5 percent, providing nearly twice as much power from the same amount of sunlight.

"That's a big difference," Heath said. "We're interested in understanding the properties of this material and what's unique about it."

That's more easily said than done, considering the parts of the cell they are looking at are microscopic – the size of a hair divided 50 times. Students use a microscope and bright light to take measurements. By varying the temperature from a frigid -321 F up to room temperature, it's possible to identify defects that reduce efficiency. They are also experimenting with adding different alloys to the material, to make the solar cell more productive.

Throughout the process, students target questions about the material. Often, one question leads to another, a creative aspect crucial to undergraduate research, Heath said.

"It's important that students get a sense of what it means to ask questions and explore scientifically the answer to a question," she said. "Often in the classroom, students learn about things that are already known. It's only when they have a project of their own that they have to figure out how to make these discoveries."

Students have also built equipment and programmed computers to control instruments for the experiments. Curtis likes the hands-on research and has learned to work with unexpected results.

"In research you are continually faced with problems and setbacks that you have to overcome," said Curtis, a physics and mathematics major, and next year's student body president.

Students are also learning the value of studying an area of research they believe in, similar to what Heath has done.

"A long time ago, I decided I wanted to do something that might contribute in some way to solar energy," Heath said. "It's important to me to study something that is both interesting from a fundamental sense, and also has societal implications."

Isn't it semantic?

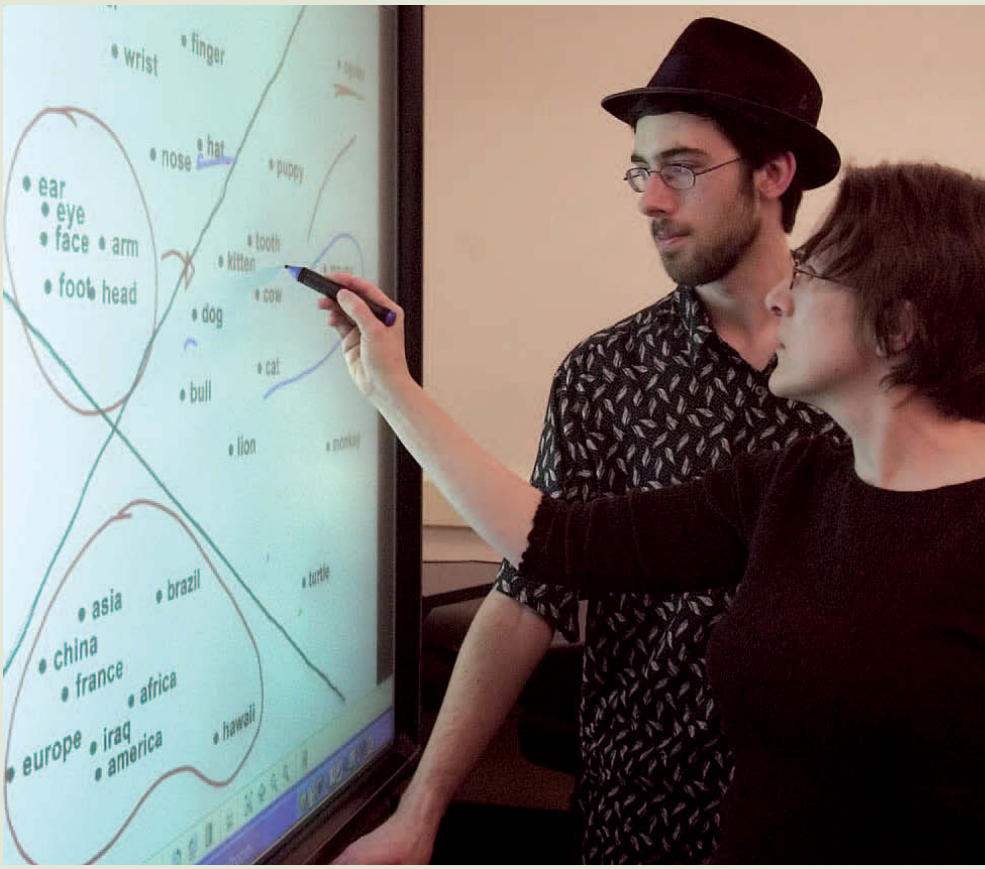
Kay Livesay and Phillip Duggan '06 seem unlikely research partners.

Livesay is an assistant professor of psychology with a research focus on semantics. Duggan is a computer science major with little previous interest in psychology.

But their collaboration expanded Duggan's idea of computer science, opening up new career possibilities, while helping Livesay broaden her research.

Livesay's work focuses on semantics, the study of meaning, with particular emphasis on language processing and computer models of how word meaning is represented. That could help shed light on such issues as differences between the lexicons or "mental dictionaries" of men and women or changes in word usage marked by events such as an election or Sept. 11, 2001.

Until recently, the size of a language sample – or corpus – that could be analyzed by any one researcher was subject to the limitations of real time and human capabilities. With computers, it is now possible to analyze a corpus of



Kay Livesay, assistant professor of psychology, and Phillip Duggan '06 work with a matrix he created with a computer program to record how often any two words occur together in a sentence.

previously unimaginable size, giving scholars greater confidence in the validity of their conclusions.

Enter Duggan, who first tackled the research as just another computer project.

"But the more I looked at it, the more I saw how it might actually impact computer science," he said.

The first step was to program a computer to record how often any two words occur together in a sentence. From a corpus of some 90 million words, Livesay and Duggan used the program to extract the 70,000 items that occurred most frequently, yielding a matrix of 70,000 x 70,000 words. It would be impossible to print a matrix of this magnitude, let alone go through it manually to ferret out word proximities, but Duggan's program accomplishes the task with relative ease.

"The matrix allows us to calculate the distances between words," Livesay said. For example, the computer will record the fact that "cat" and "dog" are often found close together in an utterance, and also occur with many of the same other words, such as "pet" or "furry." In contrast, "green" and "ideas" would rarely be found in close proximity, nor would they share co-occurrences with other words.

"These distances can tell us something about how we might represent language in our mind," Livesay explained.

To create the matrix, Duggan had to learn two or three new computer programs and write software to do the computations.

"Phillip has been an immense help and driving force in this project," Livesay said. "To be honest, the project would not have gone forward without his expertise and dedication."

Duggan has since become interested in computational psychology as a result of the research and has considered pursuing it in the future.

"There are so many applications and tie-ins to more interesting ways of looking at things," he said, including applications to artificial intelligence, computer understanding of language, the understanding of learning disabilities and improved SPAM filters.

The games people play

When Dustin Toci '06 and Kira Durand '07 signed on for summer research in the Linfield College Mathematics Department, they were given instructions to draw pictures and play games.

But the summer stint provided much more than amusement.

The two worked with Chuck Dunn, assistant professor of mathematics, to learn about competitive graph coloring. Graphs in this area of mathematics don't chart data, such as finances or population growth. Rather, they are collections of dots and lines. Toci and Durand played games with these graphs to learn about their properties, and along the way, gained a deeper understanding of math.

Their work did not involve a typical game board. Instead, starting with a sheet of paper randomly covered with dots and lines, Durand and Toci took turns coloring the dots. The only rule is that adjacent dots cannot be the same color. One player bets that the graph can be completely colored using only a predetermined number of colors, and wins if the bet proves correct. If more colors are required, the other player wins. How many colors does the first player need to win?

Such a premise may seem simple enough, but the solutions can be quite complex. It took mathematicians more than a century before Haken and Appel solved the Four Color Theorem, a closely related problem in 1976.

Toci and Durand had only a summer, but they set out to determine the characteristics for certain graphs that would require only two or three colors for the first player to win. They developed mathematical strategies, then tested them by playing the game. Ultimately, they classified the graphs based on the outcome of their play and proved what characteristics were needed to win with two colors. They presented their findings at Linfield and Portland State University.

"You approach it from a logical standpoint," said Toci, a math and finance major. "You analyze each graph that you're playing on and see how the properties influence the outcome of that specific game."

Their results thrilled Dunn.

"Problems in graph theory can look simple at first glance but turn out to be very difficult," Dunn said. "This isn't material undergraduates normally work on. I was especially pleased that when they hit a roadblock, they asked a related question and branched off into another direction."

The experience proved useful for Durand, also a math major, who took part in the Budapest Semester in Mathematics program in Hungary this spring.

"I gained a new sense of independence after my summer work," Durand said. "I learned to ask questions

Chuck Dunn, assistant professor of mathematics, and Dustin Toci '06 test a mathematical strategy using competitive graph coloring skills they studied over the summer. They presented their findings at Linfield and Portland State University.

on my own, not just attempt to answer only the ones given to me as homework."

More than expanding the students' knowledge of graph theory, both agreed the hands-on research experience helped solidify their plans for the future. They both hope to pursue graduate studies in mathematics.

"It helped me to understand better what I want to do," Toci said.

Though Dunn said research in this particular area of graph theory may ultimately be used in optimization applications, it could be some time before practical applications are found, if ever. Still, for pure mathematicians, those who ask open-ended questions from within mathematics, the application is not necessarily the goal of the research.

"Math is an axiomatic system that builds on itself until it becomes this giant tree with different branches of knowledge," Toci said. "It's every mathematician's impulse to add to that body of knowledge."

– Stories by Laura Davis, Peter McGraw, Mardi Mileham