REINVENTING EDUCATION

RESEARCH TRANSFORMS K-12 LEARNING
Boise State celebrated all things Shakespearean during the opening of a month-long display of William Shakespeare’s First Folio — a centuries-old leather-bound volume containing 36 of his plays, including 18 that would otherwise have been lost. Boise State was the only Idaho location selected for the Folger Shakespeare Library’s national traveling exhibition marking the 400th anniversary of the playwright’s death.

FAIRE PLAY

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Boise State is a Carnegie doctoral research university. With more than 23,000 students, it has the largest graduate school in the state of Idaho and grants about 45 percent of all bachelor’s degrees conferred by Idaho public universities each year. Its longstanding teaching mission and cutting-edge research program work hand in hand to provide the academic programs and innovative solutions that the modern economy demands. Learn more at www.BoiseState.edu

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A UNIVERSITY ON THE RISE

As readers of this magazine have seen for several years, Boise State University takes its research mission seriously and we are proud of the work done daily by our world-class faculty and their undergraduate, master’s and doctoral students. Our efforts were recognized last year by the nation’s premier college classification system when Boise State was designated a doctoral research university by the Carnegie Classification of Institutions of Higher Education. That major milestone marked a significant transformation of Boise State’s graduate and research efforts — a trajectory nearly unmatched in all of higher education.

I was pleased to see Boise State’s distinct path attract global attention when in 2016 a London-based strategic consulting firm, Firetail, named us one of the 20 universities in the world best positioned to challenge the higher education establishment on a global scale. And don’t forget that U.S. News & World Report named our College of Education one of the top 75 graduate schools of education in the United States. It also is the fastest rising in the rankings.

While our materials science work, cybersecurity partnerships and multi-faceted efforts to fight and prevent cancer get many of the headlines, the transformational and relevant research coming from our experts in the education fields promises to make a difference for generations to come. In these pages, you will find how Boise State’s research mission is having a direct impact on the lives of students and teachers around the country.

Boise State truly has become a metropolitan research university of distinction, in no small part due to the efforts of you, our strongest supporters.

Thanks, as always, for all that you do — and Go Broncos!

- DR. BOB KUSTRA, PRESIDENT

RESEARCH RECORD

STABILIZING EXPANSIVE SOILS BENEATH U.S. ROADWAYS

The United States spends billions of dollars annually repairing and maintaining roadways built on expansive soils, including transportation corridors in Idaho. Past attempts to solve the problem include pre-wetting, moisture barriers, mechanical compaction, chemical stabilization and innovative pavement design.

Dr. Bhaskar Chittoori is working on an innovative — and more sustainable — approach to the problem. The technique, called microbial-induced calcite precipitation, stimulates bacteria in the soil to produce calcite, which then strengthens the soil. While the technique has been used in the past, mostly in sandy soils by introducing bacteria into the soil, Chittoori’s approach is unique.

Instead of introducing new bacteria into the environment, he and co-principal investigator Dr. Malcolm Burbank from CDM Smith propose stimulating already present bacteria using clay soil as a natural incubator. Encouraging bacteria to reproduce by “feeding” them nutrients will prompt them to precipitate calcite, which then changes the physiochemical behavior of the soil.

The work is funded by a grant from the National Academies of Science.

BUILDING A BETTER KID-FRIENDLY SEARCH ENGINE

Ask kids a question, and they’ll likely turn to the internet to find the answer. But how easy their search is, or how appropriate the information they retrieve, depends a lot on how well they navigate major search engine sites.

Despite being digital natives, children often have trouble navigating sites like Google, Bing or Yahoo — sites designed with adults, not children, as their primary users. Often the content identified is unsuitable to children’s interests or reading levels.

Boise State computer scientist Dr. Sole Pera plans to change that with software modules designed as search engine add-ons aimed at children. The project is being funded by a National Science Foundation Computer and Information Science and Engineering Research Chair Initiative grant.

“Even though children are increasingly active internet users, few designers have considered their particular goals, or how best to direct them to the age-appropriate content they seek,” she said. “Unfortunately, their lack of skill in formulating adequate queries or identifying suitable retrieved resources can result in poor outcomes.”

That lack of skill encompasses a number of factors, including a limited vocabulary, poor spelling, or the inability to identify appropriate key words or phrases. And although search engines often suggested query phrases, children often ignore those. They also are more likely to navigate to the first item on their result list instead of identifying the most appropriate sites.

The project will look at how to reorganize or filter results and will weed out inappropriate content. Sites like Google Safe Search touch on some of these issues, but don’t look at the relevancy of what kids are searching for or the age of the child.

Using Common Core standards, her team will develop software to identify the likely search intent given a child’s natural language or key word query, suggest queries based on key words and phrases in children’s vocabulary lists, literature, content written by other children, and subject areas appealing to youngsters. Results will be filtered to meet readability and suitability levels for children in grades K-9.

“We want to teach children how to search, but don’t want to reinvent the wheel,” she said. “We have all the resources and they are great, but they don’t serve the target audience.”
When Kendra Noneman officially started as a full-time Boise State materials science major in fall 2016, she already had tucked away more than a year of experience as a researcher in a university lab.

Just before the start of her senior year at Eagle High School, Noneman approached professor Eric Jankowski about the possibility of working in his Computational Materials Engineering Lab. Although she didn’t have any experience, and in fact knew only a little bit about what his lab did, she did know she was interested in materials science, she really liked working with computers and she was willing to learn.

“He saw my potential, and took me through each step, like learning programming language and how to use software in the lab,” she said. “He was great about it.”

Her hard work paid off. The day after her high school graduation, she hopped on a plane to the National Center for Supercomputer Applications as part of a prestigious Blue Waters Internship for undergraduate students. The yearlong program trains 20 students each year as supercomputer researchers, engaging them in petascale computing projects. The “peta” in petascale means “one quadrillion” or 10^15, and refers to computing power: Petascale projects require more than one quadrillion multiplications or additions to be performed each second to get answers.

Following an intensive two-week onsite workshop, Noneman is now back in Boise working on modeling fullerene molecules as part of a project titled “Self-assembly of small-molecule semiconductors.” Jankowski’s lab figures out how to arrange molecules to give materials desired properties, particularly as they relate to plastics used in solar panels.

“Now that I’ve completed the supercomputing institute, I’m using simulations, improving on them, and then running them on the supercomputer,” Noneman said. “Thanks to the internship, I’m able to use a lot of resources from the University of Illinois.” The Blue Waters supercomputer located there is the fastest supercomputer on any university campus.

Noneman already is looking ahead and hopes to continue on to graduate school after earning her bachelor’s degree, eventually earning a Ph.D. that will allow her to work in project management in industry.
Learning math is as simple as 1-2-3. Even primary school kids can grasp the basics, given the chance. But you won’t find Dr. Jonathan Brendefur drilling 6-year-olds on times tables. Instead, he’ll more likely encourage them to play with wooden blocks and use mathematical language to describe what they see as a subtle way to introduce mathematical concepts.

Brendefur is a professor of mathematics education at Boise State University and director of the Initiative for Developing Mathematical Thinking. IDMT currently hosts two grants: A U.S. Department of Education Mathematics and Science Partnership award that works with elementary and middle-school teachers and staff, and a grant from the Idaho State Department of Education to provide mathematics professional development to thousands of K-12 teachers and administrators across the state. Idaho standardized testing begins in the third grade, but preparing kids to be analytical thinkers starts as early as kindergarten. That’s why Boise State educators are actively seeking to better understand how children learn math and science, and how the many new teachers the College of Education graduates each year can be better prepared for the classroom.
While teaching math once focused primarily on numbers and symbols, educators now know that spatial reasoning — the ability to think about objects in three dimensions and draw conclusions about them — also is a critical component in mathematical thinking.

“Spatial reasoning helps us investigate and solve complex problems,” Brendefur said. “For instance, could you think about a rectangle, mentally dissect it diagonally, then rotate the top triangle 180 degrees? Are you able to then see that the area of a triangle is half of its length times its width (because it is half of a rectangle)?”

Letting kids manipulate objects is a crucial first step in getting them to visualize those objects as pieces of a math puzzle. The same general hands-on concept applies to science teaching, where engagement is supplementing, and even taking the place of, textbooks.

“We know that it’s not just the content that matters, it’s the engagement,” said Dr. Julianne Wenner, an assistant professor in the College of Education. “It’s important to think about how to engage kids and help them understand why something works the way it does.”

As a former K-12 teacher, Wenner noted that science can appeal to many students who may not otherwise feel successful in the classroom. “There are kids who don’t memorize or test well, but they can do science,” she said. When science is taught well, it encourages a way of thinking and approaching the world that lets students pursue a thought rather than being told what to think.

Wenner and colleagues Sarah Anderson and Sonia Galavaz have been working with students at Garfield Elementary School near the Boise State campus. Their project, funded by the NASA Idaho Space Grant Consortium, aims to make science more meaningful for children both inside and outside of the classroom.

G-FORCES (Garfield Families Optimizing Regional Connections and Engaging in STEM) provides resources such as an annual family science night, backpacks filled with supplies for science activities kids can check out and do at home with their families, and lists of local family-friendly resources like the Discovery Center of Idaho, the Boise Astronomical Society or the World Center for Birds of Prey.

“G-FORCES helps families see they don’t need a special degree to talk about science,” Wenner said. “Kids can ask questions like ‘Why do tree leaves turn colors?’ or ‘Why does a hot air balloon rise?’ and then find the answers.”

Science education assistant professor Dr. Sara Hagenah argues that a critical part of this learning process involves how those questions are framed. Where teachers used to be the ones asking questions, educators are now looking at what happens when students assess what they know about a subject and then ask questions based on what they don’t know.

For instance, students discussing the implications of a scientific idea might ponder how it taps into a naturally occurring phenomenon. How does the Earth’s tilt affect how we experience seasons vs. people in Australia? If the Earth’s tilt were changed, would that affect our seasons? How?

By stopping to consider what questions they have about a specific phenomenon, students are motivated to find evidence to support scientific hypotheses.

“This leads to students talking about rigorous scientific ideas,” Hagenah said. “It allows teachers to be responsive to student ideas rather than just asking students for a right (or wrong) answer to a question.”

Furthermore, Hagenah believes these are skills that can be taught to new teachers. “Teacher candidates practice how to facilitate this type of learning in our teacher education programs,” she said. “University students can walk out and be ‘expert-like’ teachers who know how to elicit student thinking and build rigorous science explorations.”

One way for them to do that is to not be afraid of looking outside of the classroom for answers, said associate professor of education Dr. Leslie Atkins Elliott.

Elementary students studying the path of the Sun might wonder what that would look like if they were at the North Pole. And what would a functional sun dial for the Pole look like?
“What makes science boring for students is when they assume that every question has answers that will be provided in the lab, in the back of the book or in the lecture,” she said. “That restricts what counts as a good question, what can count as evidence, and where students expect to see and use scientific ideas.”

Instead, Atkins Elliott said it’s important to encourage the belief that science is creative and relevant to everyday life. Inspired by the maker movement, she regularly sends education students to the MakerLab in Albertsons Library to learn how to construct their own materials that can help them support or dispute scientific claims. She also wants them to consider how, by “making” artifacts, students actively construct their own scientific ideas.

For instance, elementary students studying the path of the Sun might wonder what that would look like if they were at the North Pole. And what would a functional sun dial for the Pole look like?

“If they have to physically make something that works, they will have an understanding of the deeper, conceptual kinds of questions students might ask,” Atkins Elliott said.

But how do you get teachers on board with these more interactive learning styles? It helps when they can see results.

Dr. Keith Thiede, associate dean of the College of Education, worked on a recent project aimed at helping elementary school teachers more accurately monitor kids’ learning. The project was funded by a $1.2 million grant from the U.S. Department of Education.

“We showed that teaching using the Developing Mathematical Thinking framework of instruction, developed by Brendefur, helped teachers much more accurately monitor their students’ learning, which helped them target instruction at levels better tailored to the needs of students,” Thiede said. “Perhaps most importantly, this approach to teaching mathematics has led to significantly greater gains in achievement.”

Mathematics educator Dr. Joe Champion said that teachers around the state have come to equate the ideas of modern best practices for teaching mathematics in the early and middle grades with Mathematical Thinking for Instruction, the signature course designed and delivered by DMT to nearly all teachers in Idaho.

To date, more than 13,000 educators have taken the course, and Champion said that data shows this has made a profound impact on teaching statewide.

““This has given the teaching community a shared understanding, a shared language for talking about students’ thinking and learning, and an almost unheard-of widespread appreciation for why the ‘tried-and-true’ traditional ways of teaching mathematics need to adapt to the new sets of knowledge and skills needed for success in our 21st century economy,” he said.

Dr. Michele Carney, associate director of the Initiative for Developing Mathematical Thinking, notes that professional development goes hand in hand with assessment.

“We have good work in professional development, but not good measures,” she said. “We need better assessments at both the teacher and student levels.”

Carney, whose work focuses on data analysis, said it’s important to make sure that kids cannot only solve a problem, but conceptually understand ideas. “It’s about engaging kids to use math in meaningful ways,” she said.

“When mathematics is taught well, kids shouldn’t have to ask why they need to know it. How it is taught makes it useful or not useful in life. A student’s ability to perpetually reason is a huge indication of future success.”

For Brendefur, that process can’t start soon enough. “By fourth grade, there’s already a difference between those kids who do math and those who don’t,” he said.

And with so many future jobs tied to the ability to analyze data, it’s more essential than ever for teachers to find ways to engage kids in analytical thinking. Until that happens, he’ll continue reaching out to local teachers and kids, one building block at a time.

“If math is just calculation, then we have electronic devices to help us with that. But mathematics is more about spatial reasoning and problem solving. Math gives us a way of describing what we are seeing in the world around us,” he said. “It’s not just algorithms, it’s understanding that everything in our environment is mathematical and then doing something with that knowledge.” 

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ALLISON CORONA PHOTO

BOISE SCHOOL DISTRICT PHOTO
EdTech Program Gives Students the Technology Resources to Become Better Teachers

By CIENNA MADRID

Technology can be a powerful educational aid. However, endowing a classroom of students with new Apple iPads or Microsoft Surfaces won’t automatically make them better learners, or even more receptive to learning.

“It’s the effective implementation and use of technology, combined with teacher training, that can make a difference in students’ lives and how they learn,” said Dr. Brett Shelton, head of Boise State’s Department of Educational Technology. “But if one of those pieces is missing — if, for example, teachers are not provided enough training or institutional support — technology won’t fix problems in the classroom.”

In other words, when placed in untrained hands, technology is just an expensive paperweight. Fortunately, for more than a decade, Boise State’s EdTech department has offered graduate programs for teachers and other education professionals geared toward meeting this increasingly urgent need to support traditional teaching methods with emerging technologies.

The programs offered aren’t just for computer science teachers. They apply to educators in all disciplines because of their focus on integrating technology as a learning aid in the classroom.

“The programs offered aren’t just for computer science teachers. They apply to educators in all disciplines because of their focus on integrating technology as a learning aid in the classroom,” Shelton said.

Since the early 2000s, there has been a national push to equip educators with emerging technology training, as students will need these advanced skills to succeed in our increasingly technologically-based society. Boise State was an early adopter of this movement.

The university formally launched its EdTech program in 1997. Since then, hundreds of similar online educational technology degree programs have launched at public and private universities across the country. Yet Boise State’s programs remain among the largest in the country, with 400-500 students actively enrolled. In addition, its programs are nationally ranked in the top 20 percent of graduate programs in education, according to the 2017 U.S. News & World Report.

“Our motto is, come find out why we’re the biggest,” Shelton said. “It’s because of the level of instruction and support we provide, but we tell people, ‘come see for yourself.’”

Dr. Dave Mulder, an assistant professor of education at Dordt College in Sioux Center, Iowa, applied to Boise State’s EdTech Ed.D. program in 2012 after hearing glowing reviews from other colleagues in his field.

“I looked at half a dozen different programs at different institutions, and felt strongly drawn to Boise State,” he said. “Everyone I talked to who was familiar with Boise State spoke so highly of the faculty in the Department of Educational
Technology, I felt confident that it was an up-and-coming program. This has absolutely proven to be the case!”

The department currently offers a doctoral degree and two master’s degrees – a doctor of education (Ed.D.) in educational technology, education specialist (Ed.S.) in educational technology and a master of educational technology (MET). The program also offers graduate certificates in technology integration, online teaching and school technology coordination, and educational games and simulations.

All of the EdTech program courses are completely online, with no in-person campus visits required. Courses are interactive and practitioner-based, meaning that Boise State instructors expect their graduate students to begin integrating new technologies into their respective schools and classrooms as they learn it. To support the program’s remote learners, academic advisors are available online daily from 7 a.m. to 6 p.m. Mountain Time.

“It’s that kind of integration and support that makes us so popular with our students,” Shelton said. “We don’t rely on gimmicks. We have a relatively low tuition cost for our students and our own graduates are our best endorsements for our program.”

Shelton also credits the program’s success to Boise State faculty who continually research and test new ways of keeping students engaged in online learning formats, and students who come to their virtual classes eager to learn.

“The way you structure an online class is so different from a face-to-face class; it requires engagement in order to succeed,” he said. “You don’t see extensive lectures in our online classes. That’s what bores people.”

“One of our biggest challenges is staying abreast of emerging technologies, to test and evaluate their effectiveness… additionally we research in what ways and under what circumstances students learn.”

Shelton explained that this learning format mimics medical field training in many ways, as it has proven to be a successful learning pathway. In this format, instead of passively reading materials or attending lectures, students are presented with a problem, conduct research, compile possible solutions, implement a solution, check its success in addressing the problem and then redesign the solution if necessary.

“We’re implementing this method to teach coding and that’s something that hasn’t really been done before,” Shelton said. “But we’re not afraid to try those things to figure out what works and what could work better.”

Along with teaching, the EdTech program plays an equally vital role in research and development.

“One of our biggest challenges is staying abreast of emerging technologies, to test and evaluate their effectiveness,” Shelton said, “additionally we research in what ways and under what circumstances students learn.”

This involves testing the effectiveness of new technologies such as mobile devices, learning applications and internet-based programs before they hit the market and providing designers with feedback. “The department supports this important work with grants from the National Science Foundation, among others.”

“I have always considered myself a ‘techie teacher,’ but I am definitely more critical of my own use of technologies for teaching and learning as a result of studying in this program,” said Mulder. “I have come to realize that while the allure of a new technology might temporarily increase motivation for students, novelty is not always a benefit for learning. Teaching with technology is nothing new; a pencil is an educational technology! But mindfully selecting the best technology to support teaching and learning is essentially important.”

The department’s willingness to boldly explore new teaching formats and test new technologies – in essence, it’s willingness to fail – has instead lead to great success. The department graduated its first class of doctoral students in fall 2016.

“We have the largest number of doctoral students enrolled of any program at Boise State,” Shelton said.

Almost 20 years ago the department launched its first program with one full-time staff member. Now it employs 13 tenure-track and clinical professors as well as a variety of adjunct professors and lecturers.

But Shelton is determined to ensure the growth doesn’t end there. While the department has achieved national success, administrators are working on further cultivating its growth here in Idaho. Currently, only 20 percent of EdTech students are based in Idaho. In order to increase those numbers, the department created a $1,000 Idaho teacher scholarship for teachers at any level who have earned their undergraduate degree at an Idaho institution or are currently employed as a K-12 or higher education teacher in the state. The department also has partnered with the Boise State Alumni Association to offer a 15 percent discount to all Boise State alumni.

Shelton said that part of the responsibility of being an outstanding Idaho program is ensuring that all Idaho teachers have the chance to be outstanding as well. “We’re working to make the EdTech programs offered at Boise State so evident that with that.”

“Twenty years ago the idea of letting people earn degrees online without stepping foot inside a classroom was ridiculous,” Shelton said. “No one could have predicted it. But you can’t predict what success will look like and we’re fortunate that the faculty and staff at Boise State embrace change and are willing to try new things in education. We’re rare in that outlook, but it’s an outlook we’d like to make as famous as the Blue Turf.”

One of our biggest challenges is staying abreast of emerging technologies, to test and evaluate their effectiveness... additionally we research in what ways and under what circumstances students learn.
Dr. Lindsey Turner knows that healthy kids are better learners and that’s why she works every day to improve children’s health, as well as their academic outcomes.

Turner joined Boise State in 2014 as a research associate professor in the College of Education. Previously, Turner held a similar position as a research scientist at the Institute for Health Research and Policy at the University of Illinois at Chicago. In that role, she was a project director on the Bridging the Gap Research Program — a long-running project funded by the Robert Wood Johnson Foundation to examine how policies can improve student health and wellness across the country. Building on that work, Turner has continued to conduct research on student wellness in her new home at Boise State.
Soon after joining Boise State, Turner founded the Initiative for Healthy Schools in the College of Education. The initiative has grown rapidly and is now home to 10 projects focused on wellness and academics.

“We focus on a variety of topics that help schools create healthy environments, including good nutrition, physical activity, and social and emotional programming,” Turner said. “Kids learn best when they are healthy, safe and engaged, and we are studying how to best create those settings.”

The projects at the Initiative for Healthy Schools include several research studies on these topics, as well as collaborations with local schools and districts to help them implement programs and then evaluate their outcomes. Turner also works with several teams across the country who are conducting rigorous large-scale research programs on school wellness, including collaborations with the University of Maryland, University of Illinois at Chicago and Emory University.

One of Turner’s research projects here in the Gem State is the Physically Active Classrooms with Energizers (PACE) project, which is studying the implementation of brief physical activity breaks in local elementary school classrooms. With funding from the Institute for Education Sciences (part of the U.S. Department of Education), the PACE team works with local teachers to learn more about how activity breaks throughout the day can help students stay on-task and focused on learning.

Turner said PACE project researchers are interested in learning more about what works well for teachers, and testing out supports to help teachers add these breaks into their day. “Other research has shown that these brief breaks help kids stay focused and also to stay more physically active during the day, which are
both important outcomes," Turner said. "What we're hoping to do with this project is to learn directly from teachers about what helps them use these breaks more effectively, then we'll create a toolkit that can be shared freely to support teachers all across the country."

Another initiative project focuses on school nutrition. The research conducted by Turner and her colleagues from the national Bridging the Gap project has helped shape policy around school nutrition, including the revision of national standards for school meals.

The Healthy, Hunger-Free Kids Act passed by the United States Congress with bipartisan support in December 2010 spurred many changes in school nutrition. Each year, more than 30 million U.S. students in grades K-12 receive lunch through the National School Lunch Program. Turner has been studying how meals served at schools across the country have become healthier as a result of those new school lunch standards, including the addition of more fruits and vegetables. Some of that work has been published in top journals, entered into the Congressional Record and featured by media outlets including TIME, CNN, The New York Times and The Wall Street Journal.

As Turner notes, "the changes in school nutrition stemming from the Healthy, Hunger-Free Kids Act have been enormous, benefitting millions of children and teens. This is one of the most profound public health success stories of the past decade."

In addition, Turner's ongoing work on school nutrition is documenting the ways that policy changes have made school meal programs more accessible for many lower-income students.

"School meal programs are a crucial part of the hunger safety net in this country," she said. "By ensuring that all kids have access to a healthy breakfast, these programs help kids start the day ready to learn. School nutrition programs are a key part of a healthy school environment."

Dr. Rich Osguthorpe, dean of the College of Education, said Turner's research serves as a great example of why the college has experienced a recent rise in national rankings. "Dr. Turner is engaged in cutting-edge research on what works best to optimize every child's opportunity to learn in schools. Her commitment to improving children's health and to studying the intersection of wellness and educational outcomes is exemplary," Osguthorpe said. "Her outstanding scholarship represents the type of high-level, externally funded research that makes Boise State's College of Education the fastest-rising graduate school of education in the country."

The Boise State Initiative for Healthy Schools doesn’t stop at the door of the classroom. Dr. Lindsey Turner and researchers from across the country are helping students and teachers get their hands dirty by creating school gardens and increasing learning outcomes at the same time.

In research published in the December 2016 issue of the Journal of School Health, Turner and her team analyzed nationally representative data from more than 5,000 elementary schools and showed that during the 2013-14 school year, 31 percent of schools had a garden, more than double the 12 percent of schools from 2006-07.

Turner credits this increase to the encouragement of several agencies and organizations across the country, such as the United States Department of Agriculture, which has been a strong supporter of school garden programs. Partnerships with local and regional nonprofit organizations also have helped more schools create gardens on their campuses.

"An increasing amount of research is demonstrating the benefits from school garden programs for kids, including better nutrition knowledge and healthier food choices, increased physical activity from working in the garden, and higher test scores in science," Turner said.

Turner notes that this last point is very important for school administrators who are looking for innovative ways to help engage students in science. Turner and her colleagues in science education at Boise State are looking into ways to develop ongoing partnerships with Idaho schools to study those benefits in science achievement.

The Journal of School Health research was conducted with Dr. Meghan Eliason, a former elementary school principal and assistant professor in the College of Education at Boise State, along with Anna Sandoval and Dr. Frank Chaloupka at the Institute for Health Research and Policy at the University of Illinois at Chicago.
Early Intervention is Key
By Sherry Squires

When a child is first learning to read, there are some natural stumbles. Sounding out words takes time and can be frustrating. But knowing whether a child is experiencing the typical struggles of a new reader or something more — a learning disability — has long been a challenge.

Diagnosing a reading disorder such as dyslexia traditionally has relied on a reading test. But results are often difficult to interpret. Maybe the student just needs a little individualized attention, or a bit more practice. Maybe it’s best to wait and see how they do.

“Unfortunately, that is in direct conflict with what we know about early intervention,” said Dr. Evelyn Johnson, a professor of special education at Boise State. “If we can get them help right away we have a much better chance of keeping their reading proficiency at grade level. When we delay intervention the child’s reading achievement gap increases, and it becomes harder to overcome.”

New research by Johnson may help make diagnosing dyslexia much less of a guessing game.
SPECIAL EDUCATION

For Johnson, school was a refuge. Johnson was a good student and got a lot of support from teachers, which helped offset some negatives in her life at the time.

“School should be a place of validation and support and caring for every child, regardless of who they are and what they come to school with,” she said. “Special education is a place where that matters the most, and that’s why I entered the field.”

Idaho has held pretty constant with about 10 percent of its student population needing special education services. The national average is about 12 percent, with a lot of variability across states. Special education teachers are in high demand in every state and U.S. territory.

As schools moved to inclusion models, it changed the way we prepare special education teachers for their jobs. Becoming a certified special education teacher in the ’70s or ’80s meant a teacher specialized in a particular field, such as reading, or working with visually or hearing impaired students. But today’s special education teachers are more generalized in their training because they will work with students with a variety of disabilities.

“Instead of going deep, we go broad,” Johnson said. “That makes sense, but the downside is special education teachers don’t have the opportunity to develop really strong deep expertise in any one area.”

A hearing impairment or visual impairment can be easy to detect, but learning disabilities are more subtle. If a teacher isn’t particularly well versed in understanding possible indicators, a child’s struggle is sometimes thought to be a lack of motivation or laziness. Johnson said. That leads to frustration and sometimes avoidance, or negative behaviors from children whom learning needs are misunderstood. For all involved — child, parent and teacher — it’s a difficult process.

THE MAZE

Before joining Boise State in 2007, Johnson spent four years as a research associate for the National Research Center on Learning Disabilities. Three years ago, she teamed up with neurobiologist Dr. Lisa Gabel at Lafayette College in Easton, Pennsylvania. Gabel had been studying behaviors in mice related to the DCDC2 gene. The gene has been linked to visual processing and possibly to a greater susceptibility to dyslexia.

Gabel found that mice with a mutated DCDC2 gene did not perform as well as their counterparts on the classic Hebb-Williams maze, often used to test memory in animals. Gabel and Johnson set out to see if the maze might also predict reading disabilities in children.

They started with a small study of Idaho children ages 8-13, administering reading assessments and then having the children complete a virtual version of the maze. While their sample size was small, they did find strong correlations between children who struggled with their reading performance and also had difficulty navigating the maze.

“It’s interesting because the virtual maze is a non-language-based task, and one of the longstanding issues with dyslexia identification and intervention is that you tend not to notice the signs until the child starts learning to read. If a non-language test is able to predict their reading performance, it could serve as a potential early indicator,” Johnson said.

The researchers have connected with Yale Genetics Lab to analyze saliva samples from 5- and 6-year-old children in their latest study, looking for links between the DCDC2 gene, difficulty reading and trouble with the maze. Gabel and Johnson also have applied for a grant to expand their study, and Johnson is working with Dr. Brett Shelton in Boise State’s Department of Educational Technology on a grant to create a web-based maze that would be inexpensive and easy to share with parents and schools.

“We have only studied a small number of kids, so just like any research, we have to be cautious about how we frame the results,” Johnson said. “But early results from the study are showing that these connections hold.”

LEE PESKY LEARNING CENTER

In addition to her role as professor, Johnson also serves as executive director of the Lee Pesky Learning Center in Boise, an independent, non-profit special education collaborative with the university. The nonprofit organization aims to improve the lives of people with learning disabilities. Founder Alan Pesky sits on the board for the National Center for Learning Disabilities, the largest and most influential organization in the country in the area of learning disabilities. When he started the Lee Pesky Learning Center in 1997 there were two employees, today there are 32.

The center and Boise State’s College of Education enjoy a unique collaboration that allows master’s students the opportunity to get hands-on experience at the center, and chips away at a shortage of highly skilled teachers who are experts at early intervention.

“There is no other graduate program in the country that really does what we are doing,” Pesky said. “We’re putting the two important pieces that make up their graduate education together, the formal coursework and the opportunity to learn in an applied setting. They come out and work with children one-on-one. We can’t cure a learning disability because a lot of it is about the way the brain is wired, but we can give children the skills and the opportunity to fulfill their full potential.”

The partnership was featured in a National Public Radio story last January. Meagan Payne heard it and arrived at Boise State a few months later. Originally trained in criminal justice, she discovered a passion for special education and was thrilled to learn that she could earn her master’s degree at Boise State while working at the Lee Pesky Learning Center.

“All of the teachers come to the center with their own background experience, and I knew this would be an incredible opportunity to learn from the best,” she said. “I have worked with students with special needs in the past, but my work was almost entirely focused on dealing with challenging behaviors. This experience at the center has taught me the systematic, explicit ways of teaching that are most successful among children with special learning needs.”

The collaborative work between Boise State and the Lee Pesky Learning Center also means that new research findings quickly make their way to the students who stand to benefit. Dr. Brady Webb met Johnson while pursuing her Doctorate of Education in Curriculum and Instruction at Boise State. She now works at Lee Pesky Learning Center as a Boise State post-doctoral fellow in evaluation and intervention for learning disabilities. She collects data for the genetic component of the research and runs reading and virtual maze assessments in Idaho schools.

“My job is fascinating because I get to bridge theory to practice in such real time,” she said. “I’m already seeing the impact we’re having and hoping it gets to a point where we’ve got enough evidence to use these tools to identify learning differences early and to design instruction that meets students’ needs.”
Putting Innovative Math and Science Teachers in Local Classrooms

By CIENNA MADRID

While there has been a national push over the past decade to encourage students to study the subjects of science, technology, engineering and mathematics, otherwise known as STEM, local secondary schools have long struggled with how to best engage students in these hard sciences.

The reality is that there simply aren’t enough qualified applicants to fill the Treasure Valley’s growing need for STEM teachers.

Now Boise State’s IDoTeach program is providing a successful solution. IDoTeach is a pedagogical program designed for undergraduate students studying in STEM fields who wish to one day share their expertise in a middle- or high-school classroom.

“It’s an organized effort to provide concentrated teacher preparation specific to math and sciences,” explains Dr. Michele Carney, co-director of IDoTeach. “We want future teachers thinking about what it means to engage students deeply in math and science concepts and processes.”

Unlike traditional education programs where students work toward a degree in secondary education — essentially stressing the job of teaching over specific content — the IDoTeach program allows Boise State students to major in specific areas of science, technology, engineering or math while also earning their teaching certificate.

“The degree affords options,” said Dr. Laurie Cavey, who co-directs the program with Carney. “Most of our graduates choose to teach but they’re also prepared to apply for graduate school in their chosen field if they decide to take that route. Throughout the program our
teacher candidates are engaged in learning about teaching in their chosen field, from both the theoretical and practical sides of teaching."

Here’s how it works: Undergraduate science, engineering and mathematics majors sign up for IDoTeach, typically during their freshman or sophomore year. From that point onward, they concurrently take classes in their chosen STEM major as well as education classes taught by faculty from multiple colleges. Disciplinary coursework is blended with early inquiry-based teaching experiences led by these master teachers. What this means is that instead of learning to teach by opening a textbook and assigning reading, these future teachers are learning how to draw students into the hard sciences by posing thoughtful questions or designing experiments.

“Growing up, I would sit in a math classroom and write down everything the teacher wrote on the board,” explained Kelci Lester, a senior in materials science and engineering who plans on teaching after graduation. “Now math classes take a more hands-on approach with the students. The kids are given concepts or problems and they try and solve them without any direct teaching. This allows the kids to explore and truly understand what they are doing. In the end, you will always have some direct teaching where you guide the students in the right direction, but this method has the students actually thinking about what they are doing instead of blindly copying down notes.”

Recent IDoTeach graduate and current Capital High School math teacher Josh Watson agreed: “The biggest conceptual shift I’ve seen is the idea that teachers are more effective as facilitators than as lecturers,” he said. “Most of my classes when I was a K-12 student involved day-long lectures while taking notes. In the IDoTeach program, I was involved in many good discussions and activities.”

“Now math classes take a more hands-on approach with the students. The kids are given concepts or problems and they try and solve them without any direct teaching…”

“We’re trying to shift the culture of what it looks like to teach math and science,” Carney said. “It’s not about opening your textbook, reading it and saying, OK now I’m going to lecture … it’s more about engaging students in the practice of these subjects. It’s about helping students see themselves as mathematicians and scientists.”

Carney has two degrees in mathematics and a Ph.D. in math education, and has worked in teacher education for 14 years. She currently teaches math courses for the mathematics students enrolled in IDoTeach. Carney taught math in the Treasure Valley for years before earning her Ph.D. in education. The women see themselves as facilitators of educational change, but more than that, they are working in service to the school districts.

“We want to fulfill the needs of our local communities by providing them with great teachers,” Carney said. “It’s as simple as that.”

IDoTeach just celebrated its first class of six graduates, four of whom currently are working in local schools. “The program is still young, but it’s increasing both the quality and quantity of teachers we’re producing,” said Carney. She estimates 20 students will graduate from the program this year.

“Our goal is to get about 40 people per year graduating from our program to meet local demands. Our next step is thinking about how we recruit students who come from rural communities and want to return to them, as that is our biggest need in terms of secondary and elementary math and science teachers.”

IDoTeach is based on the UTeach STEM teacher preparation program created at the University of Texas, Austin. The program has been replicated on at least 50 college campuses across the country. Now in its fifth year at Boise State, IDoTeach is housed within the College of Education. However, Carney and co-director Cavey stress that the program’s success is due to its collaborative relationship with other colleges on campus as well as the science, math and engineering professors who agree to educate tomorrow’s STEM secondary teachers. The in-the-field teaching experiences that students are provided throughout the program also are vital.

“Going to elementary, middle and high schools to observe, co-teach and teach on their own is embedded all throughout the curriculum,” explained Cavey. “Instead of waiting to introduce our students to the classroom toward the end of their program, they start taking those courses right when they arrive here at Boise State.”

Carney and Cavey said local schools are eager to partner with their program. Each year, IDoTeach hosts a stakeholder meeting and invites local school administrators to attend and provide the program with feedback. That stakeholder meeting is growing in attendance every year. Recently, the program developed a partnership with Timberline High School for an intensive semester-long field-based classroom instruction project.

“Schools are interested in partnering with us because they want to hire these future teachers,” Carney said. “There still is a significant need at the secondary school level for these teachers, but we’re working hard on filling it.”
For nearly four decades, an aluminum dome has stood atop the tallest building on campus. No more than 20 feet in diameter, perched on top of the eight-story Education Building, it’s barely noticeable unless you know where to look. But from that vantage point, students and the Boise community alike can now see light years into the night sky.

That dome is the Boise State Observatory. It is undergoing a time of renaissance under the direction of Dr. Brian Jackson, an assistant professor of physics at Boise State.

Jackson joined the Boise State family in 2014 after spending time at the Carnegie Institution of Washington, University of Maryland and NASA’s Goddard Space Flight Center.

“The observatory was originally installed in the late ’70s and was hugely popular for many years,” Jackson said. Originally placed on top of the Science Building, it soon was moved to the much taller Education Building next door.

“Sometime in the mid-aughts there were a couple of break ins and it was largely unused for several years,” he said. “When I was interviewing for my position here at Boise State, the prospect of getting the observatory up and running again was brought up and frankly excited me quite a bit.”

Jackson knew getting the observatory back to its former glory would take some funding so he turned to Boise State’s crowdfunding platform, PonyUp, where his team raised $10,000 in just a few short weeks.

“Now that the money has been raised and the telescope has been mounted, Jackson looks to the future and into the night sky.

“We’re in a golden age of astronomy. The software and hardware that’s available to even amateur astronomers is better than it’s ever been and regular people across the planet with a passion for astronomy are contributing major discoveries all on their own”

Jackson said he plans to use the observatory for public outreach events and student research. The Boise State physics department is holding its regular astronomy outreach events on the first Friday of each month to explore ideas and concepts from beyond our planet.

“We’re currently developing the procedures to get people up to the roof to use the scope,” said Jackson. “The rooftop can only accommodate about 50 people at a time and of course, safety is our top priority.”

Once those procedures are hammered out, Jackson and his team will be able to bring student groups and the public up to the observatory to witness astronomical events in person.

Meet Dr. Brian Jackson and Dr. Elisabeth Adams*. They search for exoplanets so far outside the solar system you can’t see them with even a very powerful telescope.

These planets are very shy. Scientists only know they exist because they cast a shadow when they pass in front of a star, like a mosquito passing in front of a spotlight.

Jackson and Adams are specifically looking for ultra-short-period planets (USPs), which are so close to their stars they almost touch.

Jackson and Adams are here in the Milkey Way galaxy.

The planets orbit around Sun-like stars a million times further from the Sun than Earth.

Newfound exoplanet

Our solar system is here in the Milkey Way galaxy.

So far, they have discovered 30 possible planets circling far-away suns.

*Dr. Adams works for the Planetary Science Institute.

Jackson and his group use computers to sort through millions of data points from the NASA Kepler satellite launched in 2009 to learn more about space beyond our solar system.

Illustration by Ann Hottinger
Four hundred years after his death, Shakespeare’s words are still woven into our vernacular. Common phrases like “putting your best foot forward” and “breaking the ice” are derivatives of his work. Thanks to a unique Boise State project, Shakespeare’s work also has become familiar to about 1,000 Boise elementary school students.

English professor Dr. Matthew C. Hansen started the Shake It Up After School program in 2006, challenging students in his English 345 Shakespeare literature class to study and then teach a play to elementary children over the course of seven weeks. Dr. Hansen has partnered with several Boise elementary schools designated as Title 1, meaning they have high numbers or high percentages of children from low-income families. He draws about 100 fourth- to sixth-graders to the free, after-school program each year. During the past 10 years, young students have put on condensed versions of comedies and tragedies alike, from “A Midsummer Night’s Dream” to “As You like It,” “Macbeth” and “Hamlet.”

“I believe it gives them an outlet and an opportunity that otherwise isn’t there in the schools where I partner,” Hansen said.

Students also improve their public speaking and language skills and learning. To better quantify just how impactful the program has been, Hansen is exploring new methods of research while on sabbatical this year. Hansen’s college students earn an additional academic credit for the experience through the university’s Service-Learning program. Augmenting what they are doing in the classroom with a theater experience opens up the text for them in new ways, he said. For example, they must study Shakespeare deeply enough to help a young student learn to pronounce words and direct them on stage.

“The program builds community by having these students collaborate together, similar to what team sports do, but not all kids are cut out for or super excited about team sports. Team art fills that void.”

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Hansen has looked around but has yet to find a program like Shake It Up. It’s similar to an approach seen most often in medical education, where, for example, a nursing student is taught a procedure then under the supervision of a nurse or doctor teaches someone else. “It is rewarding to teach Shakespeare to undergrads but there is another incredibly rich and rewarding level of thinking about how these plays work for younger students,” Hansen said. “The conversations I get to have with 10-, 11- and 12-year-olds, I would not get to have if I was just in my office reading books about Shakespeare. I would be much the poorer as a result.”

Heath Kemper served as the student leader at Taft Elementary in spring 2016. “The experience of seeing elementary kids really get Shakespeare was so rewarding,” he said. “They learn more than their lines. We go through the language and discuss characters and character motivations, and because Shakespeare’s plays deal with universal emotions, even though the language is unfamiliar at first, students relate pretty readily.”

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By SHERRY SQUIRES

SHAKING UP LEARNING WITH HELP FROM THE BARD

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Histories of the Boise Valley are a veritable who’s who of early movers and shakers. Names like Morrison, Simplot, Albertson and Pierce dot places and spaces throughout the City of Trees. But the city wasn’t founded on wealth alone. Hidden in the shadows of the socially elite were the vulnerable and marginalized populations that helped define the valley — in good ways and bad.

The Other Idahoans: Forgotten Stories of the Boise Valley tells the stories of alternative cultures relegated to the fringes — the prostitutes of Levy’s Alley, Japanese immigrants working on the Oregon Short Line railroad, poor farmers struggling to scrape by, families touched by pandemic, women incarcerated for minor crimes, and miners betting personal safety against an ounce of gold. Through a series of short essays, their stories are told at last.

The book, edited by historian Todd Shallat, was collaboratively written by participants in Boise State’s annual urban studies field school, hosted by the School of Public Service. It is part of the Investigate Boise Community Research Series, which publishes fact-based essays of popular scholarship concerning the problems and values that shape metropolitan growth.

“Narratives bond us,” Shallat said. “But many narratives have been shut out of the historical record. That’s a problem because when we glorify success it hinders our capacity to deal with current issues. We wanted to look at those who didn’t make it and use their stories to make us think more deeply and understand the city.”

When Jacqueline O’Connor began working on her dissertation about depictions of madness in Tennessee Williams’s plays, she didn’t intend to make him her life’s work. She was an English major, after all, not a theater arts major. But while she has written about many other topics and authors over the years, she keeps returning to the man commonly recognized as one of the 20th century’s greatest playwrights.

“Everyone has a Tennessee Williams story to tell,” she said. “Not only have many of his plays been made into films, he also simply wrote so many plays that are still being produced. People want to know more.”

In addition to her dissertation and subsequent book, “Dramatizing Dementia: Madness in the Plays of Tennessee Williams,” O’Connor has spoken about Williams at conferences, lectured about fashion in the film “A Streetcar Named Desire,” written an essay on boarding houses in his plays, and more.

Because of her expertise, she was asked by colleagues at a summer National Endowment for the Humanities institute to talk about the author before a showing of “Streetcar” at the dorm where participants were staying. The institute was focused on “The Rule of Law: Legal Studies and the Liberal Arts,” and O’Connor began to wonder what Williams, a homosexual in an age where gay men were viewed with suspicion, knew about the law and how that was portrayed in his work.

After combing through many of his plays, letters and notebooks, O’Connor saw a theme emerging.

“His plays and stories are well known for interrogating identity,” she said, noting the strong link between law and identity. “The notion of privacy was a signature legal issue in his work — his characters often seek the right to be left alone and do in private whatever they choose to do.”

The many references to homosexuality and diverse sexualities O’Connor uncovered in Williams’s works and correspondence showed that he wrestled with the idea that, as a homosexual, he risked criminal prosecution under many United States laws.

O’Connor was in the process of revising the book as the U.S. Supreme Court was crafting its landmark decision striking the ban on same sex marriage. As she read over that decision, she said she was struck by the repeated use of the word “dignity” in the ruling.

“Many of Williams’s characters didn’t fit in one way or another,” she said. “That was a strong argument that all persons deserve to be treated with dignity within and beyond the rule of law.”

O’Connor’s research was supported by grants and fellowships from the Boise State Arts and Humanities Institute, the Idaho Humanities Council and the Harry Ransom Humanities Research Center at the University of Texas at Austin.

“Law and Sexuality in Tennessee Williams’s America” By Dr. Jacqueline O’Connor

“The Other Idahoans: Forgotten Stories of the Boise Valley” Edited by DR. TODD SHALLAT AND COLLEEN BRENNAN
The U.S. is in high cotton on the world stage thanks to its agricultural subsidies on this lucrative crop. Cotton brings in about $5 billion annually, and U.S. sales account for around 30 percent of the total export market globally.

But in 2003, Brazil called foul, claiming that U.S. subsidies gave it an unfair advantage that hurt developing countries by skewing the market. The World Trade Organization (WTO) ruled against the United States in both the original suit and an appeal in 2009. In 2010, the two countries reached a settlement agreement where the U.S. paid $300 million to the Brazilian Cotton Institute.

The story of that dispute and the ongoing effects of the United States’ cotton dominance is detailed in Meredith Taylor Black’s book “King Cotton in International Trade,” the only comprehensive study of the dispute.

Published in June 2016, the book evaluates the efficacy of the new trade system that grew out of the landmark agreement and its effect on global economies, offering legal, economic, political, historical and ethical analysis.

“Cotton accounts for 2 percent of the agricultural output for the United States, but more than 22 percent of all agricultural subsidies,” said Taylor Black, who holds a juris doctorate in addition to her Ph.D. in the area of WTO law. Because of the settlement, “billions now go to farmers as subsidies and to Brazil not to fight it. This defined a legal precedent regarding subsidies.”

Michael Allen and Justin Vaughn have boldly gone where no one has gone before, or at least, no political science faculty. Their book, “Poli Sci Fi: An Introduction to Political Science through Science Fiction,” is a collection of essays explaining core discipline concepts through the lens of popular science fiction films or television episodes.

The book’s emphasis on science fiction speaks to the popularity of the genre as well as to how a shared understanding of popular culture can be democratizing and make difficult concepts in politics and society more accessible.

The authors said there is a natural link between political science and science fiction. Both wrestle with phenomenon important to each individual life, and both provide unique perspectives to questions of power, justice and institutions we have — and should have — in society.

“Poli Sci Fi” tackles topics like beauracracy (“Futurama”), civil war (“Star Wars: A New Hope”), identity and race (“The Hunger Games”), inter-state relations (“Ender’s Game”), political ideology (“Divergent”) and gender politics (“Battlestar Galactica”), among others. Chapters were submitted by political scientists from across the country.

“Science fiction highlights how changing a variable or technology can affect how we behave as humans,” Allen said. “It makes us ask, ‘Is this how we expect humans to respond? Does it coincide with what we know?’”

The pair expect the book to appeal to students as well as general readers with an interest in political science, justice and a sense of adventure.

In an increasingly digital age, it’s no surprise that online dating sites are growing in popularity. A recent Pew Research Center poll showed 15 percent of adults say they’ve used the sites. But how do they work, and do they all work the same?

Dawn Shepherd, associate professor of English and associate director of the First-Year Writing Program, tackles these questions and more in her book that looks at online dating in relation to the larger culture.

In an age where more and more households are headed by single adults, Shepherd said that the idea of dating and marriage still gets people to think about adulthood and transitioning out of their parents’ homes. And the most popular sites are geared toward lifelong relationships, keeping at least the idea of marriage at the center of American culture.

Using the premise that we don’t really “search” for information on the internet, but instead are “paired” with relevant information, she delved into how questionnaires for various sites focus on different aspects of a client’s life and values, including how they describe themselves and how they establish and maintain information. As “matches” come in, how do people respond? And how do those responses affect future “matches”?

Shepherd compared various sites, such as e-Harmony and Match.com, to see what went on behind the curtain. Each site has unique values integrated into the questionnaire and varies in how search results are paired.

Student Success is at the Heart of Education Research

In today’s competitive world, it’s imperative that we prepare our kids to be independent and critical thinkers who not only know how to learn, but understand why it matters.

The United States has one of the highest high school dropout rates in the world, and the U.S. Department of Education reports that nearly half of those who graduate from high school and go on to college need remedial courses. The Program for International Assessment ranks the United States 27th out of 34 countries in math and 20th in science.

At Boise State, we believe that our kids deserve better. The research highlighted in this issue of EXPLORE magazine is helping to improve teaching and learning in K–12 classrooms, particularly in the crucial areas of science, technology, engineering and math. Currently, only 40 percent of fourth-graders are proficient in math. By the time they reach eighth grade, that number drops to 33 percent. We’re striving to change that.

Hard data shows that preparing future teachers to engage kids in the learning process, and making sure they understand what children need both physically and emotionally to be successful, can transform the educational process. The research coming out of our College of Education touches on all aspects of the learning process and is providing solid data to help inform important policy decisions.

I’m confident that with the help of these inspirational education researchers, our future is in good hands.

- DR. MARK RUDIN, VICE PRESIDENT FOR RESEARCH AND ECONOMIC DEVELOPMENT

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LAST WORD
The Big Picture!

Public policy doctoral student Krista Lyons traveled to Gorongosa National Park in Mozambique, Africa, to look at policies that could reduce the often fatal interactions between elephants and local farmers. Teaching more effective and efficient farming techniques, better managing park borders, and dealing with the culture of local poaching are examples of policy challenges that could make a difference for large game.