When a diploid cell divides via meiosis, it splits into two diploid cells and then into fourhaploid cells, leaving half the number of chromosomes from the parent cell. In mitosis, a diploid cell divides into two identical diploid cells, which have the same number of chromosomes as the parent cell.

At least that sounds about right.

New Project Builds STEAM for Middle School Education

This concept can be quite a confusing one to students at Alexander Middle School in New Marshfield, Ohio. And for teachers at Alexander, meiosis, and mitosis is one of the most difficult subjects to teach. For some reason, many students have a hard time grasping the two processes.

However, these cell division processes are clear to Josh Schendel, as they rightfully should be. After all, Schendel is pursuing a master's degree in computer science in the Russ College. For a science guy like him, these concepts should come easy. That's why he's the perfect candidate for the task of teaching difficult science concepts to middle school students.

Schendel is one of eight Russ graduate student fellows led by Chang Liu, assistant professor in the School of Electrical Engineering and Computer Science (EECS); David Chelberg, EECS associate professor; and Teresa Franklin, instructional technology associate professor in the College of Education. The group is participating in an innovative program to teach math, science, and technology to students at six Appalachian middle schools. The three-year project, titled Science and Technology Enrichment for Appalachian Middle-Schoolers (STEAM), is funded by a $1.67 million National Science Foundation grant, one of the largest ever in Ohio University history. The grant is part of the NSF's program to place graduate teaching fellows in K–12 education.

The fellows each spend 10 hours a week working in class with a teacher. After the student fellows head into the classroom, science at the six schools won't be such a stumper.

Yet the fellows' solution to teachers' woes does not come from your typical textbook or worksheet; it comes from something that is much closer to the students' interests—video games. "Video games are increasingly becoming a part of the lives of younger kids," Schendel said, "but teachers don't understand how to use video games to teach. Kids want video games, and they want interactivity."

Athens Middle School teacher Mary Ann Hopple describes some of her challenges as a teacher.

However, don't expect to see the Mario Brothers drinking milk with Louis Pasteur; these video games are original creations by the fellows, who are using games to not only educate the students in science, math, and technology topics, but to also engage and interest them in these fields. "Instead of wasting their time with video games, let students learn by playing educational video games," Liu said.

One interactive feature a video game might employ as a learning tool is an expansive, 3-D world that the children can explore. A game titled *River City*, developed by a team of Harvard University and Arizona State University professors and students, employs the interactivity paired with learning technique and serves as a model for the STEAM researchers. In *River City*, players must solve the mystery of why so many residents of this 19th-century town have health problems. By finding clues and hints, formulating and testing hypotheses and developing experiments, players learn about biological, ecological, and epidemiological subjects. "They're exploring for themselves rather than being told to do things," Chelberg said.

If *River City* sounds too much like "edutainment" to appeal to some students, there will be more virtually adventurous games, such as a program teaching properties of volume and mass that enables players to crash a car into different objects in order to see the properties' reactions.

Other programs will apply constant reinforcement by asking many questions to help students master easier concepts before moving on to more difficult ones. This type of variance among the video games is a highlight of STEAM. "Not all students learn in the same way," Chelberg said.

In fact, because of the students' individual learning behaviors, one goal for the STEAM team is to utilize, and adapt, various teaching methods to tailor to different students' needs. The games will not only emphasize individual work, but also will encourage collaboration and aid the development social skills by requiring students to share information, work in teams, and help one another on assorted tasks. "We need to give them something they can identify with," said fellow Mark Smearcheck, B.S.E.E. '06. "It will be a lot easier to get them interested in math and science with this approach."

Smearcheck believes it is especially important to attract more females to the field. In his graduating class of about 45 electrical engineering students, only three were female. Chelberg says the adaptive and variant teaching methods of the video games will enable the teachers and researchers to draw females and other students who are typically uninterested in math and sciences into those fields.

"It's going to attract more kids," said fellow Bruce Bilyeu, B.S.C.S. '06. "Kids would much rather play games than listen to a teacher."

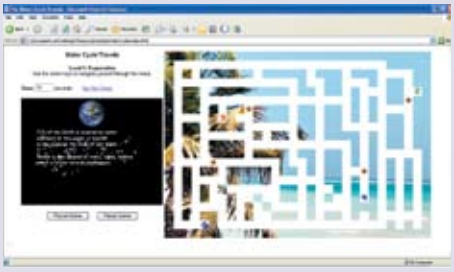
The students will not only become more proficient in math and science topics, but will view the fellows as mentors. "Students will see a younger person doing research who will hopefully serve as a role model and inspire them to pursue careers in science," Liu said.

According to Franklin, getting students involved in these topics early is crucial. "Developing a strong foundation in science, math, and technology in the middle school grades is extremely important in supporting the continuation of the study of science in high school and college," Franklin said. "This digital curriculum containing simulations and real-world problems will lay the foundation to foster the development of future scientists."

For the fellows, this capacity to harvest more scientists, mathematicians, and engineers is the most rewarding aspect of the project. "The first thing that stood out to me is that we can use our skills to help kids," Bilyeu said.

But the middle school students are not the only ones who are learning—their teachers are attaining new and innovative teaching methods, ones Chelberg believes schools and teachers across the country will adapt in the future. "The next generation of teachers is going to want to find tools such as these and will be much more comfortable using them," he said. "We have a great ability to influence the students and open up their minds to the possibility of jobs in engineering and science. They can see that they can actually 'do' science."

Sounds like a good time to be a middle school student.



Early versions of the STEAM project video games.

The Road More Traveled

Frequent travelers along the expressways and highways in Ohio are all too familiar with one thing: barrels. But despite their bright color, they are not barrels of fun—they are construction barrels. Upon spotting one of these barrels, which can be done from nearly a mile away, motorists know to expect trouble. The orange cylinders line up single file as if they are formally inviting drivers to lane closures, detours, or some other construction obstruction.

However, the number of barrels—and hopefully the number of highway headaches—will soon be reduced as a result of research by the Ohio Research Institute for Transportation and the Environment (ORITE).

ORITE recently received a "pooled fund study" award of $1.3 million from several state departments of transportation (DOTs) and the Federal Highway Administration (FHWA) to investigate procedures for designing and constructing long-lived pavements—that is, pavements that can handle more traffic over a longer period of time with less maintenance.

A pooled fund study asks researchers to explore a topic of national interest. In this case, ORITE researchers will study pavements in Ohio and New York, making study results relevant to design and construction in several regions.

This study also aims to improve construction processes. "Better construction processes reduce construction delays and enable a road to reach its full design life," said ORITE Associate Director Shad Sargand, who is leading the study with J. Ludwig Figueroa, professor of civil engineering. "Our goal is to improve state specifications for design and construction—and not just Ohio's."

ORITE researchers have collected data on U.S. Route 23 in Delaware County for 12 years. Data collection will continue at U.S. Route 30, a test road near Wooster, Ohio, and various pavements in Athens, Delaware, Meigs, Logan, and Stark counties.

To test various climate regions, similar studies will take place in Olean and Rochester, New York, where roads are subject to more freezing, thawing, and road salt.

Researchers will monitor various environmental factors and the number and weight of vehicles using the roads. Periodically, researchers will perform detailed inspections of the pavements and will perform forensic studies of some failed sections, to determine why they failed.

"We are examining a good range of environments that will affect these pavements," Figueroa said. "It will be applicable to many parts of the country."