



PUTTING AN END TO TRIAL-BY-FIRE TEACHING IN HIGHER EDUCATION

By Kaleigh Rogers

Dennis Kolosov had a pretty typical university experience. As an undergrad studying biology at York University, Kolosov had a mix of professors. There were the rare gems whose love of teaching was infectious, making it almost impossible not to learn. There were the mediocre profs who made an effort but fell short. And then there were the duds.

"I could clearly see they didn't care. They didn't want to be there. They hated every minute of it, and they made the students pay for it," said Kolosov. "They were miserable and they transferred that misery."

It's not that Kolosov had a uniquely bad crop of instructors: anyone who has attended university can attest that you're all but guaranteed to have professors who simply aren't good teachers. Yet it was those professors who, in a way, inspired Kolosov the most after he went from being a student to becoming a professor himself.

"I thought 'I never want to be a bad prof,'" Kolosov said. "I really didn't want to be the person who is miserable and makes his students miserable."

Now an assistant professor in animal physiology at California State University San Marcos, Kolosov made every effort during his graduate and postdoc studies to seek out chances to hone his teaching abilities. This included not only practicing teaching as a teaching assistant, but also learning evidence-based techniques for instruction through additional training programs. It wasn't always easy to find those opportunities — Kolosov credits supportive mentors who saw the value in teaching and encouraged him to improve those skills, as well as a bit of lucky timing. He said many PhDs can go through their entire education without so much as an afternoon seminar on how to teach.

Universities as an institution were founded on the veneration of higher learning, yet today the emphasis on

learning itself has eroded somewhat. For many professors, the focus leans heavily towards cutting edge research and publishing papers. When it comes to the act of teaching itself, those same distinguished academics often have less pedagogical training than a kindergarten teacher. This is especially true in STEM fields.

But there's a growing wave of change sweeping through post-secondary education, with more institutions requiring new hires to have demonstrated teaching skills, and innovative programs emerging to help the next generation of professors avoid that "transfer of misery."

A few years ago, PhD coach Jennifer Polk ran a revealing poll on Twitter. She asked her followers how much "teacher / pedagogical training" they received in grad school before actually teaching. Nearly half of respondents said they received no training at all, while only seven per cent said they received "great training."

Anecdotally, many academics will admit this as the norm, and it's been captured in published research as well. A 2005 survey of science postdocs found that 40 per cent had an interest in learning how to teach, though the majority had no teaching training whatsoever. A 2017 case study of university science professors found that they had little to no formal training in teaching, partly as a result of the fact that the institutions where they were trained "placed a greater emphasis on research activity than on teaching responsibilities." In an op-ed published in *Nature* in 2015, a group of science professors noted that prioritizing research over teaching was a big issue in STEM fields. At some institutions, principal investigators may even "buy out" the PhD students working in their labs from having to complete any teaching duties, in order to focus full time on research.

Maybe it's not surprising that research takes priority in the eyes of some professors, who would argue it benefits students because they get to learn from experts breaking new

ground in their fields. Under that worldview, teaching can be dismissed as an afterthought, neither difficult nor worthy of a great deal of attention.

Anyone can glance at a professor's output in academic journals and evaluate their value to the university. But are teaching accomplishments so easily spotted and rewarded?

"It's harder to quantify good teaching," said Pat Clancy, an assistant professor in the department of physics and astronomy at McMaster University. "It's really easy to count the number of papers that somebody is putting out or the number of research dollars that their grants are taking in. But it's tougher to do the same thing with teaching."

The result is often a "publish or perish" culture that can have a dramatic ripple effect on universities, all the way down to students, according to Mariappan Jawaharlal, the associate dean of the college of engineering and computer science at California State University, Sacramento.

"Students get frustrated so much, a large number of students who could have been fantastic in STEM fields actually drop out," Jawaharlal said.

Jawaharlal said this may be one contributing factor to the lack of women and people of colour in certain STEM fields. If you're already part of a minority in a classroom and are faced with a teacher who makes zero effort to reach you, it can become very discouraging, Jawaharlal said.

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The culture of deprioritizing teaching not only hurts students, but also sets future professors up to fail. Increasingly, post-secondary institutions not only favor hiring individuals with teaching training, they require it. And teaching-only positions are on the rise in universities across Canada. Without opportunities to learn practical



teaching techniques, hopeful professors are at a disadvantage in the already competitive job market.

Rather than receiving formal pedagogical training, the majority of professors are expected to learn through trial-by-fire. Many professors teach a full class for the very first time only after landing their first job. Over time, some may identify effective techniques through trial-and-error, while others will only fall into bad habits.

But it doesn't have to be this way. There's a flourishing field of research aimed at identifying how students learn, and the best ways to teach to target those learning styles. Discipline-based education research applies the scientific rigour of STEM research to solving these problems, and can provide practical lessons for burgeoning professors.

Take for example the "big three." These are three teaching strategies that in cognitive learning experiments have emerged again and again as some of the most effective ways to help students absorb and retain new information. Though the evidence supporting these techniques is robust,

they're deceptively simple in practice. There's retrieval practice — having students recall information from memory often, not just on a midterm exam. There's spaced practice, which is essentially breaking up study into many smaller intervals as opposed to one long cram session. And lastly, there's interleaved practice, where different concepts are taught concurrently, rather than in succession.

Despite how simple these strategies seem, they may not be intuitive to professors who haven't been exposed to the research, according to Faria Sana, an assistant professor of psychology at Athabasca University. Sana pointed to spaced practice in particular as something that goes against many instructors' instincts.

"When you distribute across multiple sessions, it becomes more effortful to retrieve information because you forget a little bit," Sana said. "We think that forgetting is the enemy of learning but it's actually the best friend. The more effortful the process is, the better you're going to learn."

This kind of research has given us a ton of insight into the best ways to teach to different student levels

and in different disciplines, but many professors are unaware it's even available. Jawaharlal went through the traditional trial-by-fire model of teacher training, and spent years trying to figure out the best ways to reach his students. It wasn't until later in his career when he became acquainted with pedagogical research that he realized it could have solved his problems a lot sooner.

There's clearly a need for better teacher training among postdocs, and a desire to learn among them.

"I didn't know. What I was discovering myself, on my own, was already well-established," he said. "It took a lot of effort for me to figure out things only to later find out we've known about these strategies for 50 years."

There's clearly a need for better teacher training among postdocs, and a desire to learn among them. There's also plenty of literature that can inform



Dennis Kolosov graduated from the McCall MacBain Postdoctoral Fellows Teaching and Leadership Program and is now an assistant professor at California State University San Marcos.

this training. All that's left is building a bridge between those postdocs and that research. At McMaster University, one of Canada's first programs designed to build that bridge is underway.

The McCall MacBain Postdoctoral Fellows Teaching & Leadership Program runs alongside a postdoc's other work, providing funding to relieve fellows of research obligations one day a week. Throughout the program, fellows are taught evidence-based teaching techniques, starting with the well-

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established building blocks, and then delving into cutting-edge research. Fellows are also taught how to give compelling presentations, how to write an op-ed for a lay audience, and are paired with experts to engage in education research of their own. One fellow this year, for example, is investigating how the students in the engineering department are dealing with the shift to online learning during the COVID-19 pandemic, and has already submitted some of that research for publication.

The opportunity to participate in education research serves two main purposes, according to Constance Imbault, the program manager and research coordinator of the McCall MacBain fellowship. For one, it demonstrates that the field is continuing to grow, and there are still plenty of unanswered questions. It also gives academics with different backgrounds the chance to learn how to set up a study involving



Constance Imbault created the McCall MacBain Postdoctoral Fellows Teaching and Leadership Program with colleague and professor Joe Kim.

humans — something geologists or mathematicians, for example, may not have ever had to do. But it also opens up a world of possibilities for these future professors to continue learning and contributing to the field of pedagogy throughout their careers.

"Let's say they end up getting a tenure-track position somewhere. They're doing their main research and teaching a class — that class can be used as another avenue for their own research," Imbault said.

The combination of an introduction to existing pedagogical literature, practical skills like presenting and writing, and the hands-on experience in learning research is a killer combo for creating confident, effective teachers. It demonstrates how creative programming can help bridge the gap between what we know about what makes a good teacher and the people who are actually being expected to teach.

And it was exactly what Kolosov was looking for — he completed the program as part of its first cohort, and says it allowed him to craft the kind of career where he can prioritize teaching alongside research, rather than having to choose one or the other.

"Teaching people in the classroom or teaching people in the lab, it's all interconnected," Kolosov said. "I like teaching. I don't want it to be undervalued." **M**

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