ADVERTISEMENT FEATURE

THE SCIENCE AND ART OF CHALLENGING ASSUMPTIONS

Some of the biggest discoveries in history have been made **WHEN RESEARCHERS CHALLENGED THE STATUS-QUO** – a lesson two Tokyo-based academics have taken to heart.

Scientific literature, and by extension, our understanding of the world is built on a complex web of assumptions. But progress in both the natural and human sciences, often demands questioning those assumptions and looking at existing theories with a critical eye.

Two Tokyo-based researchers are doing that, and making surprising discoveries related to fields as diverse as education theory and sports science as a result.

"I had a dream of instilling young people with an appreciation of the beauty of mathematics," recalls Waseda University's Noriyuki Inoue of his decision to train as a high school maths teacher. However, after six years of teaching, he had realized that focusing on mathematical theory alone was not enough to inspire students.

This realization sent him to the United States as a Fulbright scholar to retrain in educational psychology.

SHAPING THE MIND

Bridging theory and practice has always been a big challenge in the education sciences, says Inoue, now a professor at Waseda's School of Human Sciences. "There's this idea that it's just academic theory that's important for university researchers. Practice is seen as just belonging to practitioners," he explains. "I felt this was a disconnect with reality."

This was the beginning of Inoue's journey to action research — a methodology to pursue practice-linked theory building rooted in the context of the pursuit of change — and it wasn't a comfortable one.

In fact, he wrote a book chapter called 'Confessions of an Educational Researcher' that detailed how he, with his mathematics and engineering science background, overcame his cognitive dissonance about action research.

"I was very suspicious in the beginning. As scientists, we look at the universal truth — action research just didn't seem objective enough to reach such truth," he says. "But I came to realize we have to really think about the 'so what?' question in each context. If we intend to create a truly sophisticated model and make an impact on the real-life practice, we must think about how to make the model work in real life classrooms, schools and community organisations."

Bridging research and practice is what action research really aims at, explains Inoue. In the case of the education sciences, that involves "improving real-life practice through research that includes practitioners and schools, people who are inside the practice. And that's why it's called action research. It involves actions that situate the agents within the practice at the centre of the research process, taking in all the contextual setup."

It's an evolution that has changed the way Inoue approaches research and teaching. Now, he encourages students to think critically and challenge existing assumptions. He points to his work on the implementation of the new Sesame Street Curriculum in public elementary schools in Japan, which promoted the importance of putting teachers at centre of cross-institutional efforts to facilitate educational innovation and curriculum implementation.

"It's a very messy, muddy, swampy kind of area — but that's the nature of education, and that's what academics are for," he says.

EMPOWERING THE NEXT GENERATION

A new master's degree, Educational Innovation and Communication Studies (EDICS), with English as the language of instruction, was launched in September 2022 at Waseda's Graduate School of Human Sciences. The two-year degree includes academic coursework and a research thesis. Students complete coursework in the same sequence as their peers to facilitate discussions and collaborative learning.

Noriyuki Inoue, who teaches several research seminars in the course, says the program will help graduate students champion new forms of education in real life practice contexts as well as take advantage of contemporary wisdoms from diverse fields of social science.

But higher education doesn't have to be the final landing place for course participants. "I want graduates from this course to become competent and wise professionals in the area that they want to pursue," he says. "We place an emphasis on examining assumptions and critically challenging existing approaches to improve practice." He hopes that graduates will be well prepared to excel in any sphere that deals with humans and society.

▲ Noriyuki Inoue is teaching several courses in Waseda's new Masters programme.

▲ (Left) Yasuo Kawakami measuring musculotendinous structures by ultrasonography. (Right) Three-dimensional representation of a human body generated by Kawakami's team reconstructed from magnetic resonance images.

SHAPING THE BODY

Challenging assumptions is something that Yasuo Kawakami, a professor of biodynamics and the director of the Human Performance Laboratory at Waseda, is also very familiar with. Where Inoue focuses on how we learn, Kawakami has been working to transform our understanding of how we grow and move.

"I'm a former rower, a middle-aged man, and a father to a growing child — so I'm particularly fascinated by the impressive ability of skeletal muscle to adapt," says Kawakami, who is also part of the university's 'Health Promotion: The Joy of Sports and Exercise' research group. This group is one of seven academic units under the 'Waseda Goes Global' project, tasked with boosting the university's status as an international collaborative research centre.

Skeletal muscles are those with fibres attached by tendons to our bones. There are more than 600 types in the human body, including abdominal, hamstring and bicep muscles.

"The prevailing view of skeletal muscle was that they individually contribute to movements, such as a finger moving for example," says Kawakami. So he and his team conducted *in vivo* imaging of people jumping, running and walking to test this assumption. What they discovered was a complete surprise.

I THINK THIS WILL BE A MAJOR TOPIC IN FUTURE MUSCLE MECHANICS STUDIES.

"We found that individual muscle-tendon units were connected anatomically and mechanically through fascial connections inside and outside of the muscle — so individual muscles are not really 'individual'. The human body takes advantage of this to save redundancy controlling more than 600 muscles separately. This indicates that the musculoskeletal system should really be treated holistically," he says. "I think this will be a major topic in future muscle mechanics studies."

Another aspect of Kawakami's research that overturned existing assumptions focuses on muscular growth and development, particularly in children.

"Children about 3–5 years old have a surprising amount of potential in terms of body resources and functional capacities," he says. "They have relatively large musculature in the lower extremities, in the quadriceps in particular," and can produce a surprising amount of force for their size.

In a 2021 study in *BMC Pediatrics*[1], Kawakami and colleagues compared the muscle growth and functional development of children aged 3-5 and 6-8 years to adults, revealing that "children are not simply a small-scale version of adults, neither morphologically nor functionally," he says. This may have implications for how we can hone our body's abilities as we develop.

Kawakami says he is passionate about showing that conditioning the body is an important activity for everyone — not solely for people who love sports.

Both Inoue and Kawakami have shown the rich benefits to research that can come from thinking outside the box. ■

REFERENCES

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