

INNOVATIVE EDUCATION DRIVES ADVANCES AT WASEDA UNIVERSITY

Japanese higher education institutions are not well known outside the country. Waseda University in Tokyo is resolved to change that and is implementing a plan to transform itself into a stellar global university within the next three decades.

"Yes, it's a lofty goal, but with determination, we can achieve it," says Aiji Tanaka, who assumed the Waseda presidency in 2018.

Asked how Waseda hopes to achieve this, Tanaka says the answer is to employ an innovative strategy that also makes use of unique aspects of Japanese culture. The strategy he's advocating has two pillars: systematization of courses and syllabuses, and recruitment of top faculty members both domestically and overseas who can conduct outstanding research and teach well.

Before becoming president, Tanaka was dean of academic affairs and vice-provost, and introduced such changes as systematic course numbering, student evaluation of lecturers and courses, a restructured tenure-track system, and a program of international academic recruitment, building an educational framework new to Japanese universities. Regarding systematic course numbering, Tanaka says, "By streamlining the number of courses, the university is able to combine those that overlap. This helps not only students but also faculty, because they will have more time to enhance the level of research and quality of education they provide."

When it comes to recruiting outstanding scholars, Waseda is seeking younger academics—both Japanese and foreign—who display great potential. And as for attracting better-known scholars from abroad, the university has hatched novel recruitment plans, such as the Joint Appointment System, which bring them to Waseda for short periods to teach and conduct joint research with Waseda's faculty. "In this way, we can create a course taught by several outstanding scholars working in rotation," explains Tanaka. "The students, the scholars, and our own faculty all gain greatly."

Another innovation is the *zemi* (short for seminar) system of teaching. It brings together a group of undergraduate students in their junior or senior year who study and research as a group under one professor for two years. The *zemi* style can also be applied at the graduate level, allowing a mix of Master's and doctoral students to learn together. This approach teaches the value of teamwork and collaboration, while working under a single mentor helps create a sense of bonding.

Waseda's determination to become an internationally respected university coincides with the Japanese government's efforts to upgrade



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and internationalize selected universities by funding a multimillion-dollar program called the Top Global University Project. In its bid to participate, Waseda drew up a plan dubbed "Waseda Goes Global," an initiative to accelerate the international mobility of its students and researchers, and to build a worldwide academic network that is open, dynamic, and diverse.

"Waseda Goes Global prioritizes funding for seven model research units, each established around fields of study we are particularly strong in," says Tanaka. "These fields, which consistently rank highly in the QS [Quacquarelli Symonds] World University Rankings annual report, are global Japanese studies, positive/empirical analysis of political economy, health promotion, information and communications technology [ICT] and robotics, energy and nanomaterials, mathematics and physics, and global Asia studies. We hope that our initiative will have a spillover effect in other fields as well."

The initiative was accepted by the government in 2014, and Waseda was placed in the highest category of universities to receive funding from the government project. Subsequently, Waseda has made great strides in internationalizing itself. The number of foreign students enrolled in the 2018 academic year reached almost 8,000, representing 125 countries, exemplifying Waseda's success at boosting admissions of both undergraduate and graduate students and making it one of the leading universities in Japan for attracting students from abroad.

"In these ways, we've begun the journey to become a top global university," says Tanaka. "It may take us a couple of decades or more, but get there we will."



Kan Hatakeyama (center) and Niccolo Giannetti (right) share with Hironori Kasahara how their research could help address the issue of pollution.

THEORETICAL AND APPLIED RESEARCH HELP CUT POLLUTION

Pollution is a global problem that requires global solutions. At Waseda University, researchers are addressing this important issue on multiple fronts.

Next-generation batteries

Kan Hatakeyama, an assistant professor in Waseda's Department of Applied Chemistry, is researching more eco-friendly, plastic batteries. He is using electrically conducting polymers to develop batteries that are flexible, transparent, and rechargeable. The materials in these new devices—which can be designed to be biodegradable—might one day replace the toxic and environmentally harmful chemicals in today's batteries.

Hatakeyama and his colleagues have already developed the world's thinnest battery: a 1- μm storage device that powers a pocket calculator. They have also developed an ultrathin, rechargeable, stretchable device using organic polymer nanosheets, which can be attached to the skin for biomonitoring purposes.

"Previous biomonitors were too thick and toxic to use on the skin," says Hatakeyama. "We've developed a power source from redox-active organic polymers just 100 nm thick, which can work even when attached to a finger joint."

Hironori Kasahara, senior executive vice president for research at Waseda, says that if Hatakeyama and his colleagues are successful in developing such batteries, it would dramatically impact the electronics industry, enabling new applications like roll-up displays and wearable electronics as well as storage devices attached to solar cells.

The secret to efficient heat control

Research conducted by Niccolo Giannetti, an assistant professor at the Waseda Institute for Advanced Study, could also benefit the environment. He is working on mathematically and physically modeling heat-pump systems to gain a deeper understanding of their theoretical underpinnings.

"Heat pumps control the flow of heat in industrial processes and also in our homes for thermal comfort," explains Giannetti, who is from Italy. "Working as air conditioners, they extract heat from our homes when it's too hot, or warm them up when it's cold."

Giannetti notes, however, that there is a gap between the technology of heat pumps and the underlying theoretical knowledge, resulting in inefficient design and operation. Designing factory equipment based on a strong theoretical

grounding would better address waste-heat recovery and reduce CO₂ and pollutant emissions, he explains. He analyzes and models heat-pump systems to generate design formulas that engineers can apply to improve efficiency and reduce pollution.

The research of Hatakeyama and Giannetti encompasses just some of the projects taking place at Waseda's Energy and Nanomaterials Model Unit and at the Mathematics and Physics Model Unit, respectively.

Competition vs. collaboration and mentoring

When Hatakeyama studied abroad at Texas A&M University as a Waseda graduate student, he was struck by how intensely U.S. students competed against each other.

"Competition is good, but for me, collaboration and mentoring work even better," says Hatakeyama. "And it helps not only academically but also in our daily lives." He prefers the Japanese way of *senpai-kouhai* (senior-junior mentoring).

Giannetti also finds Waseda's emphasis on collaboration stimulating. His lab is partnering with government research institutes and other universities in Japan as well as universities in Europe, the United States, the Philippines, Indonesia, and Malaysia. He also enjoys the weekly visits from retired researchers in different Japanese industries who lecture on their experiences.

"In terms of research, I could hardly ask for more, given all these opportunities," says Giannetti. "I feel like I'm exposed to research from everywhere."

"Collaborative research is a feature of Japanese academia, and of Waseda in particular," says Kasahara. Moreover, Waseda takes a flexible approach to research in that graduates and researchers can collaborate with industry to address societal needs, creating products that people around the world will find useful. "This helps produce a good spirit in the labs and allows researchers to enjoy their work," he adds.

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