# Student-oriented University Education

In an era in which science and technology are developing at an ever-accelerating pace and society and industry are each changing rapidly, what is required of today's university education to ensure that students are able to make optimal use of what they learn in their working lives and their social activities, and enjoy long and satisfying careers? What role should universities play in realizing student-oriented education? In this issue of *My Vision*, we introduce guidelines formulated by Japan's educational authorities and initiatives being undertaken by some of the world's leading universities in order to advance thinking regarding the ideal direction for future university education in Japan.

## About this Issue

### How should universities change?
### – We must produce inventors and entrepreneurs

**Yasufumi Kanemaru**

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Chairman and President, Group CEO, Future Corporation

Keywords…Subjects students excel at / Subjects students like, students with earning power, universities with the ability to make profits, governance reform, fusion of industry experience and academic excellence in top management

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### Student-oriented University education

What is student-oriented university education for the digital era, and what should universities do to realize it?

#### Fostering human resources to drive Society 5.0

**Yoshimasa Hayashi**

Minister of Education, Culture, Sports, Science, and Technology

Keywords…Society 5.0, recurrent education, basic mathematical literacy, programs that span the sciences and the humanities, major and minor subjects

#### What and how should we teach in the digital era?

**Martin Williams**

Pro-Vice-Chancellor (Education), University of Oxford

Keywords…Ability to take on unfamiliar intellectual challenges, ability to rigorously evaluate arguments and evidence, learning to adopt an intellectual approach, tutorial-based instruction, blending of innovation and tradition

#### Towards education that responds to and develops students' entrepreneurial spirit

**Shigeru Miyagawa**

Professor, Massachusetts Institute of Technology, Project Professor, The University of Tokyo

Keywords…Desirable specialization, use of online learning, flexibility of education, just-in-time education, entrepreneurial spirit

#### Our extensive campus serves as a testbed for new technologies

**Subra Suresh**

President and Distinguished University Professor, Nanyang Technological University, Singapore

Keywords…Internationalism, ability to adapt to uncertainty, translation of knowledge into forms that benefit industry, government and society, tight interconnection between learning and research

#### Students' success requires integrating learning with the real world

**Ben Nelson**

Founder & CEO, Minerva Schools at KGI

Keywords…Impactful leaders, integration of learning with the real world, relevancy, adaptability

**About this Issue**

# How should Universities Change?
## – We must produce Inventors and Entrepreneurs

### Yasufumi Kanemaru

Representative Executive
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### A Japan that is clearly Declining

Today, as the Heisei era draws to a close, Japan's decline is evident to all. Japanese companies have disappeared from global market value rankings. In the field of scientific research, the number of papers published by Japanese researchers has declined dramatically – the situation is such that the British journal *Nature* recently published a special feature on the crisis in Japanese research. Japan has become a nation in which innovation is dead.

Japanese incomes are also extremely low in comparison to the standard in other advanced nations. Companies, fearing that they would lose consumers, have turned to cutting prices, and the entire nation is trapped in a deflationary mindset. Japan has become a cut-price nation.

The nations of the EU offer a stark contrast. The EU recognized at an early stage that it would not win out over emerging nations by means of price competition, and sought to escape the trap of cutting prices. Since 2000 especially, the EU has focused its efforts on education that fosters human resources able to adapt to a modern knowledge-based society.

### Breaking Free from the Focus on Input

Japan's greatest problem is its failure to break free of a focus on input. The more exhaustively we compile already existing knowledge, the more difficult it is to generate new insights, and output also declines. Japan's school education continues to resemble an outdated quiz program in which contestants compete on the basis of memory power.

In this issue of My Vision, Martin Williams, Pro-Vice-Chancellor (Education) of the University of Oxford, indicates that the purpose of education is "to instil in students a love of learning, the confidence to take on unfamiliar intellectual challenges, and the ability to rigorously evaluate arguments and evidence." This is exactly so.

Japan's schools focus on five main subjects; the students who possess superior memory power and hence excel at these subjects become the "elite," making careers as bureaucrats with central ministries and agencies or as employees of major companies. However, these human resources have little earning power. Possessing no entrepreneurial spirit, the Japanese-style elite devote themselves single-mindedly to seeking stable posts. Surely, though, designing a society in which the 90 percent of the non-elite could flourish with vigor would be more beneficial in increasing Japan's GDP?

### Fostering Students' Potential using a Variety of Metrics

Having positioned results in the main five subjects as the supreme goal for students, the Japanese school system continues to produce a large number of dropouts. However, we no longer have the leeway to allow this to happen.

Visiting an elementary school in Denmark that practices advanced education, I asked the principal what he considered the most important factor in education. His answer? "Not to hurt the dignity of the student." This school encouraged students to actively make use of the subjects in which they excelled – for example by having students who excelled in IT assist other students in using IT – in order to create relationships of mutual respect.

In Japan also, elementary and junior high school students should be helped to find the subjects in which they excel and to decide on their own path at an early stage. High schools and universities should change their subject portfolios to enable their students to learn practical subjects that will give them earning power when they enter society. Of course, not every student has a specific subject that they like more than others or in which they excel. Given this, it would be necessary for schools to constantly revise their curricula, anticipating the changes of the times in incorporating portfolios of subjects and courses that will allow students to earn a living if they specialize in them.

## Creating Universities that possess Profitability

In the case of universities, the viewpoint that a balance between fundamental and applied research is most important is strongly rooted, but a balance with academic subjects must also be considered. For example, despite the fact that Japan has been entirely left behind in the software field, university subject portfolios remain outdated and rigid. As a result, the number of students able to be accepted in each subject in engineering faculties is fixed, and some students are forced to major in subjects other than those in which they desired to major.

By contrast, Professor Shigeru Miyagawa of the Massachusetts Institute of Technology tells us that students of that institution are able to major in the subject of their choice, and that approximately 40% of all students specialize in computer science. MIT also has a keen focus on the fostering of an entrepreneurial spirit. Professor Subra Suresh, the President of Singapore's Nanyang Technological University, informs us that all students of NTU, irrespective of their major, are required to take a certain amount of subjects related to digital technologies. In both cases, the universities have adopted systems that allow them to respond flexibly to social change, and we can say that they have achieved a real balance. Ben Nelson, the founder of Minerva Schools at KGI, says of his institution's approach that "Unlike the narrow specializations at other institutions, which may impede students' future success because their skill sets are less adapt to change, Minerva students learn practical knowledge that can be applied across any field and within emergent categories across them." The fusion of diverse academic fields and digital technology generates inspiration, and this leads to the creation of new value.

A phenomenon that seems to crystallize these considerations was observed recently at Stanford University. Last year, a class on machine learning in the university's Computer Science Department attracted 1,000 students, the largest number for a single class in the university's history. Diverse majors were represented, with students from the university's School of Medicine, Graduate School of Business, and Psychology Department in attendance, apparently eager to seek out and study new fields. It is also often the case at Stanford that students from different areas of specialization work together in joint projects, allowing them to naturally develop the ability to cooperate across disciplinary boundaries. It is not uncommon for such projects to form the basis for a start-up.

In Japan itself, the cultivation of human resources looking towards Society 5.0 has commenced under the leadership of Yoshimasa Hayashi, the Minister of Education, Culture, Sports, Science, and Technology (*). Impetus is growing towards the realization of cross-sectoral humanities and sciences programs that transcend the frameworks of university departments and graduate courses.

The key to realizing profitable university management is bold governance reforms and the nature of the qualifications of top management. While the authority of university presidents has been increased in Japan, given that presidents are appointed on the basis of support from the university's academic staff, it is not an easy matter for them to exert leadership in reforms.

With regard to management qualifications, leadership of university organizations by personnel with actual business experience is also vital for university management. Symbolic of this is John L. Hennessy, who led Stanford University as its president for many years, announcing his retirement in 2016. In addition to being a first-rate inventor who developed a mechanism that forms the foundation of modern computer processors at Stanford, Hennessy was an entrepreneur who started a semiconductor company that has conquered the world. Because Stanford was led by an inventor and a business founder, the university's management has been in a different dimension to university management in Japan, where top management tends to be appointed from the ranks of dyed-in-the-wool academics. The same tendency can be observed among members of the university's faculty. It is not unusual for academics in Stanford's sciences departments to start businesses, and they are said to sometimes also act as investors. Individuals who fuse industry and learning within themselves lead education and research at the university.

Professor Shigeru Miyagawa points out in this issue that unless universities are able to respond to the expectations of their students, they can play no important social role. Universities must work to realize profitability. And they must foster students who possess earning power. What needs to be safeguarded are not the jobs of faculty members, but the future of students. It is necessary for us to once again remember this fundamental meaning of the university.

Mr. Kanemaru is NIRA's Representative Executive Officer and Executive Vice President, and the Chairman & President, Group CEO of Future Corporation, Inc. He also serves as the Acting Chair of the Cabinet Office's Council for Regulatory Reform.

# Fostering Human Resources to drive Society 5.0

**Yoshimasa Hayashi**

Minister of Education,
Culture, Sports, Science, and
Technology(*)

AI and other advanced technologies are today evolving at an unprecedented pace, and the advent of the "super-smart society" (Society 5.0) is on the horizon. Research has indicated that fully half of existing jobs may be replaced by AI or robots, but this does not mean unemployment – jobs that do not exist today will be created in their place. How can we look ahead to this new society? How can we foster the functions that will be essential to it? The role of education will be extremely important here.

To me, "student-oriented university education" would mean that students are able to explain what they learned and the qualities that they developed at university when they graduate and enter society. We demand of universities that they set explicit standards and conditions for the awarding of degrees. Against the background of the possibility that the human lifespan may reach 100, the enhancement of recurrent education has become an important topic, in government councils also. I myself took a degree mid-career, and based on that experience also, I think that essential value, in particular in recurrent education, should be placed on what skills universities are able to provide students with, and what skills the student is obtaining for what purpose.

Since autumn last year, we have been holding expert panel discussions regarding the development of human resources looking towards the realization of Society 5.0. These discussions have concluded that the three most important skills are logical thinking, the ability to communicate, and sensibility/curiosity/spirit of inquiry. Initiatives across the entire spectrum of education will be necessary in order to cultivate these abilities. At university, it will be necessary to make no distinctions between students specializing in the sciences or the humanities in order to establish a common foundation of basic mathematical literacy (for example in data science and programming). It will no longer be the case that humanities majors see mathematics as unnecessary for them, as has been the case up to the present.

Eliminating the barrier between the sciences and the humanities to allow students to master both, as in the American system in which students study multiple subjects and have majors and minors – this type of interdisciplinary education, which enables students to possess knowledge and ability in fields other than their major, will become increasingly important as interdisciplinary research increases.

Some universities are already undertaking reforms of this type, but the Central Council for Education is also discussing the realization of programs that span the sciences and the humanities and that also transcend the frameworks of university departments and graduate schools. Mechanisms enabling the flexible mobilization of educational staff will be necessary in order to realize this goal. Science and technology advance rapidly. Setting 2030 as our goal, it will be essential for us to start work immediately in those areas in which this is possible today.

Mr. Hayashi is a member of the House of Councilors. He has held a series of important government offices, having been successively the Minister of Defense, the Minister of State for Economic and Fiscal Policy, and the Minister of Agriculture, Forestry and Fisheries. In August 2017, he was appointed Minister of Education, Culture, Sports, Science and Technology (Minister in charge of Education Rebuilding). Following graduation from The University of Tokyo's Faculty of Law, Mr. Hayashi joined Mitsui & Co., Ltd. in 1984. He attended the John F. Kennedy School of Government at Harvard University, taking an MPA, and in 1995 was first elected to the House of Councilors, where he is now serving his fourth term. The government's Third Basic Plan for the Promotion of Education, passed in June 2018, projects Japan's transformation into a "super-smart society," and sets initiatives including the realization of next-generation education, the reform of graduate school education, and the promotion of further education for members of the workforce as important items on the education policy agenda.

(*) Title as of September 28, 2018

# What and How should we Teach in the Digital Era

**Martin Williams**

Pro-Vice-Chancellor
(Education),
University of Oxford

The rapid development of digital technology raises two key questions for us: how should what we teach and research adapt to this rapidly changing environment? and how can we use digital technology to enhance the way we teach?

On the first of these, Oxford University does not regard the advent of the digital era as fundamentally changing universities' role. Our educational objectives remain as they always have: to instil in students a love of learning, the confidence to take on unfamiliar intellectual challenges, and the ability to rigorously evaluate arguments and evidence. We believe these attributes will enable our students to thrive in a rapidly evolving world in which the more functional skills – digital or otherwise – will quickly become obsolete and need to be re-learnt.

So, while we have seen growth in courses such as computer science, engineering and biomedical sciences, our teaching in these subjects, as in others, has remained true to our ethos of emphasising a certain intellectual approach over the acquisition of knowledge and skills. It is also true that, while these subjects have grown, we have also maintained large courses in humanities and social sciences, which we find are equally valuable as training for bright, inquisitive minds, and equally open to innovation. Indeed, one of our strongest emerging academic themes is digital humanities, in which computer technology is used to enhance the research, analysis and display of texts, documents, artworks etc.

Turning to the way we teach, Oxford's response to the digital era has been relatively cautious and selective. In our core undergraduate programmes, we have stayed true to our belief that education works best when it is personal. Innovative use of technology is widespread, but it remains subservient to the personal educational experience. Central to our approach is the tutorial model of teaching, in which students meet with leading academics in groups of two or three, on a weekly basis. They undertake a substantial piece of independent work in advance of each tutorial, and explain and defend it orally for around an hour.

This is not to imply that Oxford values tradition approaches over innovation – the two should go hand in hand. Our tutorial model is well-suited to blended learning approaches, with information imparted electronically and independent, online research playing an important role, but small-group, face-to-face teaching remaining at the heart of the process. Thus, much of our interest in new technologies relates to how they can help us enhance our core subjects and teaching approaches rather than replace them.

Professor Martin Williams teaches in Oxford University's Department of Engineering Science. He holds a Ph.D. from Bristol University, and specializes in structural design engineering and structural dynamics. Over the course of many years, Professor Williams has served in a range of official positions related to the administration of the university, including member of the Council, Senior Proctor, and Chair of the Committee for the Proctors' Office. Since 2017, he has been Pro-Vice-Chancellor (Education). He has also served as Associate Head (Education) of the Mathematical Physical and Life Sciences Division. Oxford University was ranked number one in the world in the Times Higher Education University Rankings 2019, receiving the world's highest rankings in the "Overall" and "Research" categories. The university's tutorial system is a major factor in its ability to maintain its high academic standard.

**Expert Opinions**

# Towards Education that responds to and develops Students' Entrepreneurial Spirit
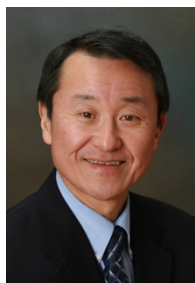
## Shigeru Miyagawa

Professor, Massachusetts
Institute of Technology
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The University of Tokyo

All students at MIT are able to major in the subject of their choice. Reflecting the fact that tech companies hold the top position in terms of market value, the number of students wishing to major in computer science and other electronic engineering subjects is increasing. Students majoring in computer science now represent 40% of MIT's entire student body. They seek employment in lucrative fields, and can expect to earn an initial average annual salary of US$88,000 following graduation.

Deluged by students, MIT's electrical engineering faculty are overwhelmingly busy in seeking to meet their students' expectations. Online education methods such as MOOC (large-scale online courses open to the public) are sometimes used for lectures to make it possible to respond to large numbers of students and reduce the burden on teaching staff. In the case of seminars conducted in small groups, graduate students (of which MIT has a large number enrolled) provide assistance to make it possible to respond flexibly to students' needs. MIT has around 1,000 full-time teaching staff, but tenure is offered only following an extremely rigorous review. The majority of teaching staff are employed under flexible conditions, and this also may be considered to increase the flexibility of MIT's education.

Some American universities, including MIT, have begun to introduce "just-in-time education." This is a style of education that teaches the students what they need to know to enable them to be what they want to be and create what they want to create in society. Many MIT students want to start their own companies after graduation, or join a start-up that has just been founded. To allow it to respond to the expectations of these students, MIT makes active use of internships, connecting students to the real world and offering them opportunities to test themselves. Venture capitalists are also permitted to visit classes, where they listen to student presentations and engage with students who have promising ideas. If universities are unable to respond to the expectations of their students, they will have abdicated any important social role. It is the entrepreneurial spirit that will determine the future.

I also work at The University of Tokyo, and I feel that there are significant differences between Japanese and American universities across the board, including entrance examinations, student aspirations, methods of education and approach to employment. And Japan is still practicing "just-in-case education" – a style of education in which student are taught what it would be beneficial for them to know "just in case." Japan should also make the transformation to a system of university education that instils and nurtures an entrepreneurial spirit in its students. The nation is surely capable of this – to leave things as they are is to not take advantage of the full potential of this nation.

In addition to teaching linguistics, his field of specialization, Professor Miyagawa is also involved in a wide range of activities that seek to improve the quality of higher education. He is a proponent of open education, and was one of the advocates of MIT's OpenCourseWare vision (commenced as a world first in 2002). Professor Miyagawa is also involved in the holding of MIT Innovation & Entrepreneurship Bootcamps throughout the world. MIT has been ranked number one in the QS World University Rankings, which are compiled from evaluations by more than 80,000 individuals involved with institutions of higher education, for seven consecutive years. The Guardian newspaper titled an article commemorating the founding of MIT "The MIT factor: celebrating 150 years of maverick genius."

# Our Extensive Campus serves as a Testbed for New Technologies

### Subra Suresh

President and Distinguished University Professor, Nanyang Technological University, Singapore

Singapore is a very dynamic city, and it is young. It is also a multi-ethnic, multilingual and multiracial society. NTU benefits from that dynamism. NTU welcomes talent and ideas from around the world, and we are very cosmopolitan, with more than 100 nationalities on campus. About two in three faculty members and graduate students come from overseas. University structures are often rigid. NTU is a young university, and we want to make sure it doesn't become too rigid, so that it can continue to be nimble and adapt to change.

In the relatively short period of time since its inception, NTU has gained a global reputation for attracting and educating top students who are adequately prepared with the potential to become productive citizens and leaders as well as decision- and policy-makers in academia, industry and government. This generation of young students is expected to work in a much more globalized society driven by digital technologies. They are likely to change jobs, and perhaps even professions, many times during long careers.

An NTU education is not intended solely to be a ticket to a career, but rather a training ground allowing students to acquire skills that will prepare them for lifelong learning and for adapting and succeeding in the face of uncertainty. Starting this year, all undergraduate students are offered a certain minimum set of subjects and courses related to digital technologies, including those who are arts or business majors. Students learn the material posted online before the class, so classroom time is better spent for discussion in small groups and for continuous assessment. In addition, our alumni receive course credits worth up to S$1,600 to enable them to take up online courses, for example, to up-skill and learn about new topics.

Because academia generally operates with a focus on the long-term, universities often bring a deeper and longer term intellectual perspective to many issues and problems that impact society. In this aspect, NTU has emerged as a globally recognized university that not only creates new knowledge at the cutting-edge of many intellectual disciplines, but also translates that knowledge into products, processes, tools and policies that benefit industry, government and society. We have also put in place mechanisms that make it easier for research discoveries and inventions from the university to be adapted by industry and startups as quickly as possible.

NTU has a 200-hectare campus which is regarded as one of the most beautiful university campuses in the world. The campus also serves as a testbed for new technologies such as those intended for environmentally friendly buildings for the tropics, clean energy sources and devices, and autonomous vehicles. We also partner with the Singapore government and industry. Many multinational companies have established corporate labs and joint research centres on our campus. One of our longest industry collaborations is the Rolls-Royce@NTU corporate lab focusing on aircraft engines and power systems. This year, we announced Alibaba's first joint research institute outside China, with NTU, in the area of artificial intelligence. In addition to partnerships with Singaporean companies, such as Singtel and SMRT, we have joint labs and collaborations with Delta Electronics, BMW, Volvo Buses, Siemens, and many others. This means that we can perform research within our campus on topics of industry relevance, and it provides our students and faculty with a unique opportunity to translate academic work into practical use. As NTU continues to grow as a great global research university, we place an equally strong emphasis on education and learning. At NTU, learning and research are very tightly interconnected.

Professor Suresh is a world-renowned engineer and scientist, in addition to being an innovator who holds 25 patents. He completed his Doctor of Science degree at MIT. Professor Suresh has held numerous positions, including Dean of Engineering at MIT, Director of the US National Science Foundation, and President of Carnegie Mellon University. He assumed his present position as President of Nanyang Technological University, Singapore (NTU Singapore) in January 2018. NTU Singapore has 33,000 undergraduate and graduate students in its colleges of engineering, science, business, humanities, arts and social sciences, and its Graduate College. The university's Lee Kong Chian School of Medicine was established jointly with Imperial College London. NTU Singapore is one of the world's leading educational institutions. In a joint survey conducted by Nikkei and Elsevier, NTU Singapore was ranked second in the world behind Microsoft Corporation for the greatest number of scholarly citations of articles in the field of artificial intelligence between 2012 and 2016.

# Students' Success Requires Integrating Learning with the Real World



### Ben Nelson

Founder & CEO,
Minerva Schools at KGI

To say that the world is changing quickly is an understatement. The digital revolution has transformed many sectors, including higher education. The role of the university, though, remains the same (though few institutions actually fulfill that role today): to prepare students to be impactful leaders in the world, regardless of their chosen path. What it means to "prepare students" is where the digital era has implications for the university — from the skills and content necessary for success to the actual method of instruction. Why, for example, should students sit in lectures passively failing to absorb content and regurgitating it on exams, when content is readily accessible on the web for a fraction of the price of tuition, if not for free?

This new reality, coupled with a wealth of research affirming that lectures are an ineffective way to learn, shows that universities would better fulfill their role if students spent class time engaged in active learning, developing skills and building practical knowledge. We've put this into practice at Minerva, where students prepare for class ahead of time using a variety of digital resources and media, so that classes — all of which are small, intensive seminars — are devoted to discussion, debate, and application.

Relatedly, we believe it's imperative to students' success that they are both exposed to thought leaders, meaningful innovators, and leading organizations around the world and have numerous opportunities to apply what they have learned in the real world. Location-based assignments are just one example of a concentrated effort to integrate learning with the real world, and are a required component of every Minerva course. Rather than merely reading about the latest advancements and innovations across sectors, students are exposed to them in-person, often with a hands-on opportunity to work with these organizations.

Furthermore, we ensure that what students learn is aligned with evolving needs of the modern workforce: relevancy and adaptability are especially critical in times of rapid change.

Unlike the narrow specializations at other institutions, which may impede students' future success because their skill sets are less adaptable to change, Minerva students learn practical knowledge that can be applied across any field and within emergent categories across them. For example, in Computational Sciences, the Data Science and Statistics concentration teaches students to analyze, design, and exploit the infrastructure and technologies required to harness massive amounts of data. These capabilities — extracting and exploiting insights hidden within "big data" — are broadly relevant to nearly every major organization in the world and are the basis for numerous growing industries.

We firmly believe imparting interdisciplinary, transferrable, practical skill sets and offering real-world experiential learning opportunities is the only way in which universities can uphold their fundamental promise to prepare students for the future. This is especially true in a world accelerated by digital transformation.

Mr. Nelson founded Minerva in 2014 to improve upon every aspect of higher education. Today, Minerva Schools at KGI is not only one of the world's most selective institutions, but represents one of the most diverse student bodies in the world, with over 60 countries represented. Classes are held on Minerva's Active Learning Forum, an advanced proprietary learning platform that allows students to engage in small, engaging seminars from anywhere with high speed internet. Prior to founding Minerva, Mr. Nelson served as CEO of Snapfish, the world's largest personal publishing service. Mr. Nelson's passion for education reform was sparked at the University of Pennsylvania's Wharton School, where he received a B.S. in Economics. After creating a blueprint for curricular reform in his first year, he became the chair of the Student Committee on Undergraduate Education (SCUE),the oldest of the university's student government bodies.