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National Institute of Informatics News

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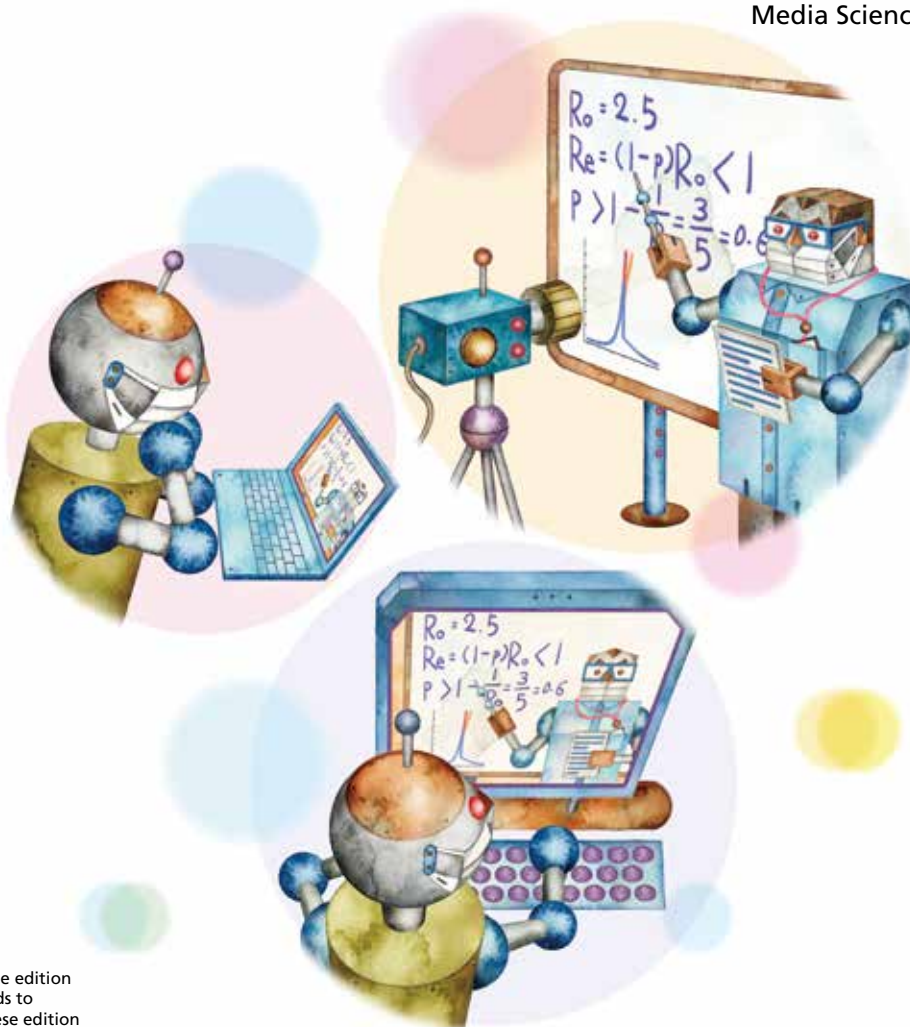
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Feature

Using IT to Combat COVID-19

Keeping Education and Research Up and Running



“Hybrid” is the New Normal! Benefiting from Both Face-to-face and Distance Learning

Sharing Online Class Experiences in Cyber Symposiums

KITSUREGAWA Masaru Director, National Institute of Informatics

Interviewer: **ASAKAWA Naoki** Editor-in-Chief, Nikkei Computer

In anticipation of the impact of the global COVID-19 crisis, KITSUREGAWA Masaru, Director of the National Institute of Informatics (NII), began considering the idea of an online academic conference as early as February 2020. Professor KITSUREGAWA has moved quickly to pave the way for online conferences and university classes. For example, since late March 2020 he has hosted a weekly “Cyber Symposium for Sharing Information on Distance Learning Efforts at Universities for the New Academic Year.” We asked him about the process leading to the establishment of online classes, the issues that have come to light, and education and research in the post-COVID era.

Leading the world in online conferences

— I understand that you began considering online conferences and classes in February 2020, when the quarantine measures for the cruise ship, *Diamond Princess*, were a hot topic in Japan. Please tell us how the online initiatives came about.

KITSUREGAWA Around January to February 2020, when the city of Wuhan in China was locked down, I was convinced that the disease would spread around the world, and that Japan was also in danger. A graduate from my lab who was teaching at a university in Wuhan gave me a first-hand account of the gravity of the situation.

The first conference we held online was the *12th Forum on Data Engineering and Information Management (DEIM2020)*, in conjunction with the *18th Annual Meeting of the Database Society of Japan (DBSJ)*, which ran from March 2 to 4. (See pages 8-11.) In late February, the DEIM2020 Executive Committee consulted with me about whether to go ahead with the conference. As DBSJ president, I emphasized that if anyone is able to hold an annual conference online now, it should be IT experts like us. So, I said that we should go ahead with the conference. For students, giving an oral presentation at an academic conference is a very important and memorable life experience. We could not deprive them of this op-



KITSUREGAWA Masaru

portunity.

We therefore set up a base at NII and rapidly put together a system for running online meetings using “Webex,” a video conferencing product by Cisco Systems. This was a quite revolutionary tool that enables the chairperson, presenters, and audience to access meetings from different locations. Our team, whose key members were YOSHIDA Naofumi (Komazawa University), YOKOYAMA Shohei (Tokyo Metropolitan University), and GODA Kazuo (the University of Tokyo), practiced running sessions repeatedly. To help chairpersons who didn’t feel confident using the technology, we made arrangements such as assigning students to support them.

The result was that we were able to run conferences without any major problems. When I told the executive officer of a huge Chinese academic society called China Computer Federation (CCF) about our online DEIM, he was amazed. He said that he hadn’t heard about online conferences in China. The CCF is a federation of IT societies, so if the CCF didn’t know of online conferences, it was very unlikely that other societies were holding them. The NII demonstrated that it could be done, so I think that we fulfilled this duty well.

Online conferences offer a range of benefits to the participants. For example, researchers with young children can attend conferences from home while caring for their children. Also, since there are no physical space limitations, all applications for the poster session can be accepted. Holding the DEIM

online allowed us to experience and envision the “new normal” of “cyber symposiums”.

Cyber symposiums for sharing failures

— Was the knowledge gained from online conferences applied to online university classes when the new academic year began in April?

KITSUREGAWA Yes. We thought that we could share our know-how by basically running a university “classroom” like an academic conference “session.” So, after a series of discussions beginning in March involving mainly the directors of the information technology centers of the seven former imperial universities (Hokkaido University, Tohoku University, the University of Tokyo, Nagoya University, Kyoto University, Osaka University, and Kyushu University), on March 26 we held a symposium for university stakeholders, focused on national universities. It was titled the “Cyber Symposium for Sharing Information on Distance Learning Efforts at Universities for the New Academic Year.” (See p.6-7.) We have continued to hold these symposiums every week. (See Fig. 1.) The first symposium was held two days after the Ministry of Education, Culture, Sports, Science and Technology (MEXT) issued a notice about distance learning on March 24.

In these online symposiums, I stressed that the participants should abandon the passive idea that they could just attend and absorb the lessons. The aim was to share the lessons learned by the first universities implementing online classes with the

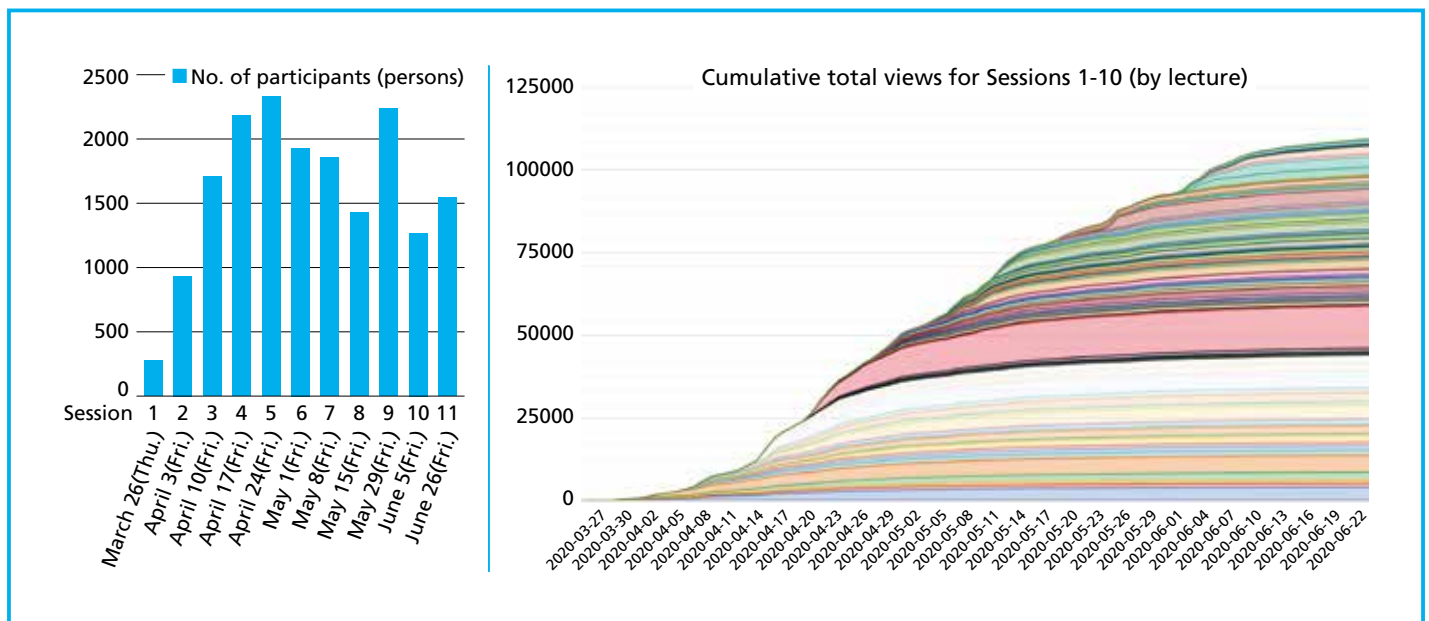


Fig. 1 No. of participants in the “Cyber Symposium for Sharing Information on Distance Learning Efforts at Universities for the New Academic Year” and cumulative no. of views of archived symposium videos.

The symposiums were held in real time by means of a web-based video conferencing platform. By the 11th symposium, the number of participants reached approximately 16,000. (See the bar chart above.) After each symposium, the lecture materials and videos were posted online. The total number of cumulative views of symposium videos up to the 10th symposium was over 110,000 (as of June 26, 2020). (See graph on right.)

spirit of “failing fast.” To begin with, since everyone is like a victim in these circumstances, it is unfair to criticize anyone who is unsuccessful in holding online classes. We wanted to foster an atmosphere that allowed everyone to feel free to challenge themselves.

There are 86 national universities in Japan and close to 1,000 private universities. Some of these universities have almost no IT-savvy staff. So, we firstly wanted to make sure that the pioneering national universities—those relatively well equipped with people, facilities, and IT resources—were the first to “fail,” so that the universities that followed them did not have to experience the same difficulties.

As it happened, very few universities were able to offer online lessons smoothly from the outset. Most started preparing in April and then commenced online classes after the holiday break in May. At the beginning there was much confusion. In fields other than science and engineering, where people are accustomed to using IT, such as in political science, law, and other fields of the humanities, it took time for know-how to get established.

For example, there was a TV report about a university that suffered a system outage during online classes due to a temporary overload of the cloud network. At the cyber symposium immediately after this report, we arranged for some people from the university to present the results of their investigation, examining what went wrong and whether the incident could have been avoided. It turned out that it was indeed avoidable. The problem was a lack of budget funds for expanding cloud capacity. It was very useful to highlight the existence of issues like this. I also believe that sharing such case studies encourages other universities to follow suit.

The number of participants in our cyber symposiums, which was about 300 for the first session, grew to around 2,000 by the fourth session. At the beginning, most of the participants were from national universities, but as participation grew, the proportion of people from private universities increased, and by May, they were the majority. Following each symposium, we posted videos and materials of all the presentations online. The total cumulative view count of our videos is over 110,000 (as of June 26, 2020). I think this indicates just how much interest there is in holding online classes.

Going on a “data diet” for the sake of elementary, junior high, and high-school students

Looking back over your online classes, what

kinds of advantages and disadvantages have become evident?

KITSUREGAWA Universities have conducted surveys of their online classes. The University of Tokyo found, for example, that students appreciated online classes more than teaching staff. For one thing, in face-to-face classes, students at the back of a large room or hall might be too far away to see the board

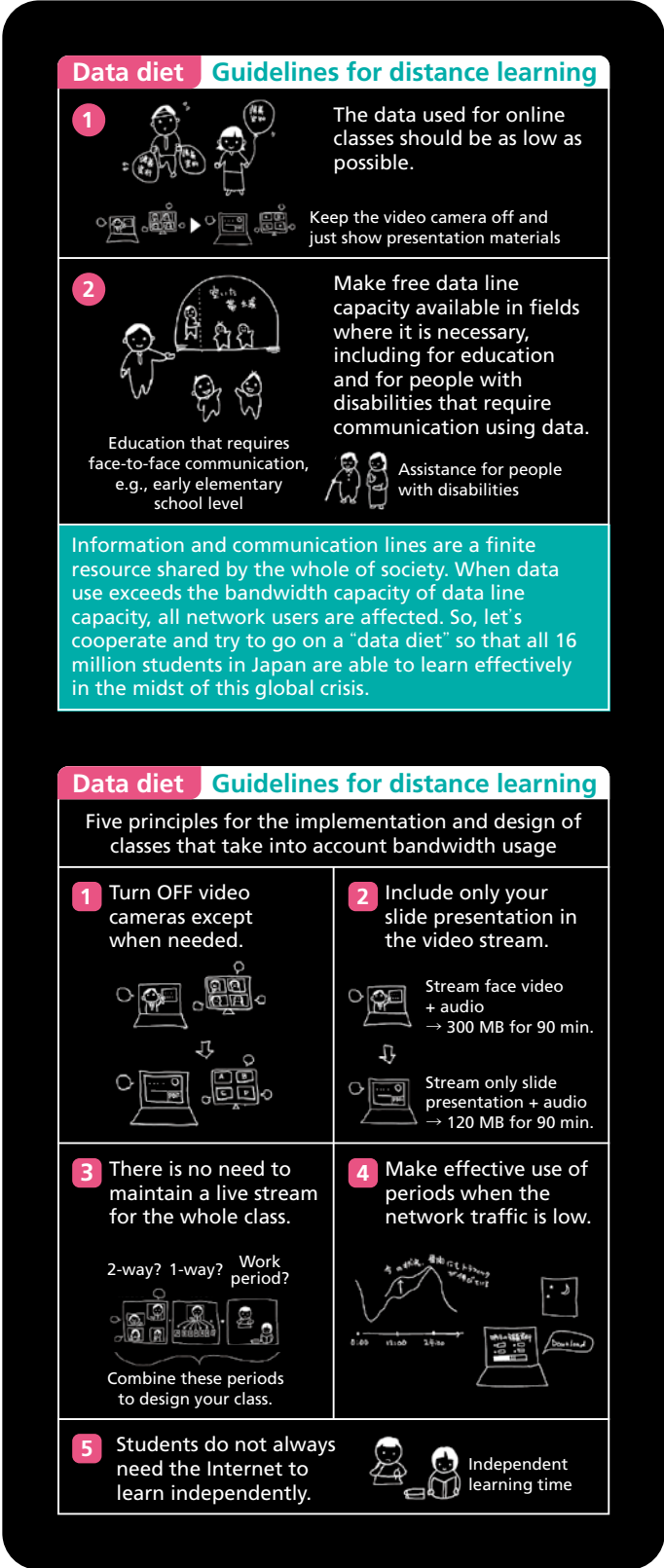


Fig. 2 Five principles for the implementation and design of classes that take into account bandwidth usage
An easy-to-understand summary of how to go on a “data diet”

or presentation screen clearly. In an online class, students have all the materials close at hand and they can freely and easily ask questions to the teacher via chat. It is likely that in the future, universities will deploy some kind of “hybrid” combination of face-to-face and distance learning.

However, there are still various challenges to be faced under a hybrid system, such as how to set up spaces for online classes on campus and how to grade students.

Another issue that came up was network infrastructure. The backbone, or main network “artery”, did not have any problems, but the network bandwidth at the level of local ISPs (Internet service providers) or apartment buildings, or Internet “capillaries”, was sometimes strained.

So, around May, we asked people to go on a “data diet.” (See Fig. 2.) The method is surprisingly simple. “Only share your slide presentation screen.” If you stream live video of your face or documents, the data traffic rises dramatically. But if you switch off the camera and just share your PC screen, you will use very little bandwidth. It’s comparable to sharing still images. One of the aims here is to free up bandwidth for elementary and secondary schools (elementary, junior high, and high-schools), which are also expected to make growing use of online classes.

The medium to long-term challenge —preparing the foundations

— **What is the situation with online classes for elementary, junior high, and high-school education?**

KITSUREGAWA Unfortunately, a survey by the education ministry (MEXT) shows that even under a state of emergency, 95% of schools did not conduct online classes. Put another way, only 5% of schools offered distance learning. On the other hand, most universities are capable of running online classes, so I think it is up to these institutions to help out elementary, junior high, and high schools.

Admittedly, however, there are some high hurdles to get over. The first of these is the hardware. Although the GIGA School Program, which provides one PC per student to Japan’s elementary and junior high schools, was given a revised budget of ¥400 billion this fiscal year, the supply of PCs and tablets has not yet caught up with demand. In any case, simply distributing hardware is not enough; we also need to train more teachers with IT skills. However, elementary and junior high teachers are too busy to learn about IT. We faced the very same problem when we provided electronic blackboards to every

school. The situation does not seem to have improved.

School network infrastructure is also an issue. NII participated in the survey together with MEXT. We heard that bandwidth can be very low at some schools, such as when the connection to the Internet runs through the network of a local government building.

Our next challenge is to see if we can connect these points in the Internet “capillaries” to SINET, the academic information network constructed and operated by NII. There are SINET access points in every prefecture, all of which are currently connected by 100 Gbps lines. In 2019 we also linked Tokyo and Osaka with a 400-Gbps transmission line. By 2022, all lines will be running at 400 Gbps. It is crucial to take advantage of this technology. At the same time, there are other developments, such as local 5G, which could be built within facilities on a spot-by-spot basis. What we need is to set up the right environment by making good use of wireless as well as wired networks.

Copyright and distance learning

— **To run online and on-demand classes smoothly, issues relating to the copyright of teaching materials needs to be resolved.**

KITSUREGAWA Right. Copyright law is another issue. Public transmission of copyrighted teaching materials in online classes or sharing of teaching materials during on-demand classes requires legal permissions. Thankfully, following an amendment to the Copyright Act in May 2018, copyrighted works can now be used for classroom teaching without the need to obtain specific permission, provided that appropriate remuneration is paid to the Society for the Administration of Remuneration for Public Transmission for School Lessons (SARTRAS). However, due to the COVID-19 pandemic disrupting the three-year grace period before the law went into full effect, the remuneration system has not yet been implemented, leaving educational institutions in a difficult position.

In light of this, on March 23 in the Concept Committee of the Intellectual Property Strategy Headquarters of the Cabinet Office, I stated the need to alleviate the copyright problem of online classes and on-demand classes even during the COVID-19 pandemic. Then, on March 30, the presidents of the former imperial universities and I jointly submitted a written request calling for the prompt implementation of a remuneration system for public transmis-

sion of copyrighted materials for classroom use. After discussions with SARTRAS, the Society granted a special exemption from paying remuneration for the public transmission of copyrighted teaching materials from April 28, 2020 until the end of 2020.

For the future, I believe that we should clarify the extent to which copyrighted works are used in the classroom based on data. To enable smooth use of copyrighted works, we then need to promote discussions to decide the appropriate amount of remuneration. So, it's not all bad. In a way, the COVID-19 crisis has accelerated discussions about copyright.

Education and research in the post-COVID era

— **Even if COVID-19 infections come to an end soon, I don't think things will return to how they were before. How do you see education and research in the post-COVID era?**

KITSUREGAWA Thanks to continuous improvements in IT infrastructure, we have seen regional governments actively implementing online classes. According to the chairperson of the Kumamoto City Board of Education, which introduced online classes at all of the city's elementary and junior high schools, one of the positive effects of online classes was that students asked more questions. Another benefit is that they allow truant students to participate in classes. The chairperson has stated that he wished to continue using online classes to help educate children who have difficulty with school attendance. As long as online classes have such positive effects on elementary and secondary education, we will continue to support them.

On the research front, COVID-19 has given rise to a whole new theme. Currently, the Japan Radiological Society and the NII's Research Center for Medical Big Data are jointly engaged in a study of CT images of "corona pneumonia." We have already collected CT images for about 200 cases. In the process of analyzing images, we are learning more about the unique characteristics of this pathology, including the fact that some patients may exhibit symptoms of corona pneumonia despite testing negative in PCR tests.

Furthermore, to investigate the performance of a contact tracing app, we worked with Kyoto University to see how Bluetooth communication was impacted when smartphones were placed in a pocket or positioned obliquely instead of facing each other squarely. We found that signal strength was significantly affected by posture and condition. This knowledge will be useful for mitigating the dangers

to public health when the second and third waves of infection arrive in the future.

In any case, in the years ahead, economic activities, medicine, science, education, and just about every other conceivable thing will become data-driven. When this happens, it will be vital to have a fully reliable academic data infrastructure in place. All kinds of technological development will be required for this. Some of the questions we need to answer are: How do we store data and analyze it using AI? How do we implement reliable endpoint security and other security measures? How do we process data in a decentralized manner, i.e., without storing it in a single place (federated learning)? And how do we process data in encrypted forms without disclosing the content (multi-party computation)?

As informatics researchers, this is where we need to focus our efforts. I hope to continue helping to ensure that we make effective and proper use of data.

Photography by FUJIYOSHI Takao

A Word from the Interviewer

I was impressed by Prof. KITSUREGAWA's idea (in the wake of the COVID-19 crisis) to try and quickly accumulate and share know-how with the spirit of "failing fast." The general approach in the IT world, which is to avoid failing at any cost, is an obstacle to promoting IT introduction. It's fair to say that to encourage digital transformation (or "DX"), companies, as well as the national government and local governments, all need to embrace the spirit of "failing fast."

ASAKAWA Naoki

Editor-in-Chief, *Nikkei Computer*.

Graduated from the University of Tokyo in 2003 with a Master's degree in physics, joined Nikkei Business Publications, Inc. in 2003, and completed an MBA at Bond University in Australia in 2010. Before assuming his current position, he worked as a reporter for Nikkei Electronics and *Nikkei Keizai Shimbun*.



Cyber Symposium for Sharing Information on Distance Education Efforts at Universities for the New Academic Year

<https://www.nii.ac.jp/event/other/decs/#12>:

You can view the presentation videos and some supplementary materials.

Session 1 (March 26)

"Efforts made by the University of Tokyo to commence online classes up to the present, the current state, and a proposal for collaborations between universities"

TAURA Kenjiro, Director and Professor, Information Technology Center, University of Tokyo

"COVID-19 response utilizing IT infrastructure at Nagoya University—from the viewpoint of online learning"

MORI Kensaku, Director and Professor, Information Technology Center, Nagoya University

"Domestic and overseas responses to the transition to online classes and Kyoto University's efforts"

OGATA Hiroaki, Professor, Academic Center for Computing and Media Studies, Kyoto University

"Explanations about copyright"

KISHIMOTO Orie, Division Chief, Copyright Division, Agency for Cultural Affairs

"Preparations for online classes at Kyushu University"

SHIMADA Atsushi, Professor, Graduate School of Information Science and Electrical Engineering, Kyushu University

"Various issues related to networks"

URUSHIDANI Shigeo, Vice Director-General and Professor, National Institute of Informatics

Session 2 (April 3)

"Securing learning opportunities by accelerating to build an environment for online classes at universities and technical colleges—response of the Higher Education Bureau of MEXT"

NISHIYAMA Takashi, Planning Officer, Technical Education Division, Higher Education Bureau, MEXT

"Support system and challenges for media classes at Osaka University"

TAKEMURA Haruo, Professor, Cybermedia Center, Osaka University

"State of online education implementation support at Hokkaido University"

SHIGETA Katsusuke, Associate Professor, Information Initiative Center, Hokkaido University/Deputy Director, Center for Open Education, Institute for the Advancement of Higher Education, Hokkaido University

"State of promoting online classes at Tohoku University"

SUGANUMA Takuo, Director and Professor, Cyberscience Center, Tohoku University

"COVID-19 response measures by Kyoto University for FY2020 classes"

KITA Hajime, Director and Professor, Institute for Information Management and Communication, Kyoto University

"Survey on network traffic in online classes using Zoom"

INOUE Hitoshi, Associate Professor, Center for Mathematics and Data Science, Gunma University

"Preparation for terminal use and remote implementation at Tokushima University"

MATSUURA Kenji, Director and Professor, Center for Administration of Information Technology, Tokushima University

"Shiga University's initiatives for online classes"

TAKEMURA Akimichi, Director and Professor, Faculty of Data Science, Shiga University

"Trial for online notification of new student account information"

UDAGAWA Mitsuru, Center for Academic Information Service, Niigata University

"Eavesdropping prevention and privacy protection in video conferencing"

KASHIWAZAKI Hiroki, Project Associate Professor, Center for Cybersecurity Research and Development, National Institute of Informatics

Session 3 (April 10)

"The experience of distance learning lectures"

TAURA Kenjiro, Director and Professor, Information Technology Center, University of Tokyo

"The state of networks with strained bandwidth"

FUKUDA Kensuke, Associate Professor, Information Systems Architecture Research Division, National Institute of Informatics

"Early enforcement of the 2018 Copyright Law amendment (Compensation System for Public Transmission for Educational Purposes)"

KISHIMOTO Orie, Division Chief, Copyright Division, Agency for Cultural Affairs

"The latest state of measures to promote distance learning at universities and technical colleges—focusing on emergency economic measures and the student communication environment"

NISHIYAMA Takashi, Planning Officer, Technical Education Division, Higher Education Bureau, MEXT

"Initiatives for elementary and junior high school education"

NAKAGAWA Satoshi, Special Inspector, Elementary and Secondary Education Bureau, MEXT

OGATA Hiroaki, Professor, Academic Center for Computing and Media Studies, Kyoto University

"Initiatives at Ritsumeikan University"

NISHIO Nobuhiko, Professor, College of Information Science and Engineering, Ritsumeikan University

"Seisa University's efforts to guarantee learning opportunities while looking ahead to university education after COVID-19"

KITO Shuichi, Vice President (in charge of education and research), Seisa University/Dean, Symbiosis Science Course, Seisa University

"Information security in distance learning"

KUMAGAYA Shinichiro, Associate Professor, Research Center for Advanced Science and Technology, University of Tokyo/Director, Disability Services Office, University of Tokyo

"Video conferencing software security"

KASHIWAZAKI Hiroki, Project Associate Professor, Center for Cybersecurity Research and Development, National Institute of Informatics

"Dealing with overloaded learning support systems—case studies at Kyushu University"

SHIMADA Atsushi, Professor, Graduate School of Information Science and Electrical Engineering, Kyushu University

Session 4 (April 17)

"Update on the Compensation System for Public Transmission for Educational Purposes"

KISHIMOTO Orie, Division Chief, Copyright Division, Agency for Cultural Affairs

"The importance of physical and mental care"

KUBO Chiharu, President, Kyushu University

"Ideal distance learning lectures in view of long-term operation"

TAKAKURA Hiroki, Director and Professor, Center for Cybersecurity Research and Development, National Institute of Informatics

"Internet traffic-related trends and securing a communication environment for student learning due to the growing impact of the COVID-19"

OMURA Shinichi, Director, Tariff Division, Telecommunications Bureau, Ministry of Internal Affairs and Communications

OOE Satoshi, Assistant Director, Computer Communications Division, Telecommunications Bureau, Ministry of Internal Affairs and Communications

"Dealing with overloaded learning support systems—case studies at Kyushu University"

SHIMADA Atsushi, Professor, Graduate School of Information Science and Electrical Engineering, Kyushu University

"LMS introduction efforts at Nagoya University Affiliated Upper and Lower Secondary Schools—in collaboration with the Information Technology Center at Nagoya University"

MORI Kensaku, Director, Information

Technology Center, Nagoya University
SANKODA Hiroaki, Vice Principal, Nagoya University Affiliated Upper Secondary School

WATANABE Takeshi, Senior teacher, Nagoya University Affiliated Lower Secondary School

NIWA Hitomi, Teaching assistant for informatics and science, Nagoya University Affiliated Upper and Lower Secondary Schools

TODA Tomoki, Professor, Information Technology Center, Nagoya University

“Bringing out the thoughts of learners in online classes—case studies at high schools”

SHIROUZU Hajime, Senior Researcher, Dept. for Elementary and Secondary Education Research, National Institute for Educational Policy Research

SAITO Moegi, Project Assistant Professor, Center for Research and Development on Transition from Secondary to Higher Education, University of Tokyo

“Reasonable considerations for online classes”

TANAKA Mari, Professor, Faculty of Arts and Science, Kyushu University/Professor, Division of Inclusion, Center for Health Sciences and Counseling, Kyushu University
YOKOTA Susumu, Associate Professor, Faculty of Arts and Science, Kyushu University/Associate Professor, Division of Inclusion, Center for Health Sciences and Counseling, Kyushu University

“Don’t overdo it and don’t aim for the same style: designing distance learning classes until things return to normal”

SUZUKI Katsuaki, Director and Professor, Research Center for Instructional Systems, Kumamoto University (President, Japan Society for Educational Technology)

“Construction and operation of individual specific support desk system for online classes implementation”

OZAKI Takuro, Lecturer, Center for Information and Communication Technology, Osaka Kyoiku University

“Preparation for online classes—field report”

OCHI Toru, Lecturer, Computing Center, Osaka Institute of Technology

Session 5 (April 24)

“On holding a conference”

KITSUREGAWA Masaru, Director General, National Institute of Informatics

“Greeting”

NAKAGAWA Takeo, Director General, National Institute for Educational Policy Research (also Visiting Professor, National Institute of Informatics)

“Updating Q&A on utilization of distance learning (administrative notice of University Promotion Division as of April 21)”

NISHIYAMA Takashi, Planning Officer, Technical Education Division, Higher Education Bureau, MEXT

“How to prevent collapse of distance learning support”

TAKEMURA Haruo, Professor, Cybermedia Center, Osaka University

“For faculty and staff who fear overloading of LMS”

SUGANUMA Takuo, Director and Professor, Cyberscience Center, Tohoku University

“Library management during the COVID-19 pandemic”

FUKAZAWA Yoshiaki, Director, Waseda University Library/Professor, Faculty of Science and Engineering, Waseda University

“School performance assessment based on class design: what changes and what stays the same with online classes”

YAMADA Masanori, Associate Professor, Division for Humanities and Social Sciences, Faculty of Arts and Science, Kyushu University

“Facing the current crisis”

NAGAO Makoto, former President of Kyoto University

“Implementation of group work in distance learning”

KOBAYASHI Shinya, Professor, Graduate School of Science and Engineering, Ehime University

KURODA Hisayasu, Associate Professor, Graduate School of Science and Engineering, Ehime University

ENDO Keiichi, Associate Professor, Graduate School of Science and Engineering, Ehime University

“Case studies: Ten distance learning classes”

TERAMOTO Atsushi, Professor, Faculty of Radiological Technology, School of Medical Technology, Fujita Health University

“Implementation of distance learning at National Institute of Technology, Tomakomai College”

MURAMOTO Mitsuru, Vice Principal (Academic Affairs Officer) and Professor, National Institute of Technology, Tomakomai College

“Report on implementation of joint high school–university programming practice with distance learning”

KUNO Yasushi, Professor, Division of General Education, University of Electro-Communications

AKAZAWA Noriko, Project Associate Professor, Division of General Education, University of Electro-Communications

Session 6 (May 1)

Program Part 1 Lectures

“Looking back on the late March symposiums and planning for future symposiums”

KITSUREGAWA Masaru, Director General, National Institute of Informatics

“Securing learning opportunities by accelerating to build an environment for distance learning classes at universities—outline of supplementary budget”

OCHI Yoshitaka, Director, Technical Education Division, Higher Education Bureau, MEXT

“Thoughts of copyright holders on the revision to Article 35 and a background to forum establishment”

SEO Taichi, Managing Director, Society for the Administration of Remuneration for Public Transmission for School Lessons

(SARTRAS)/Managing Director, Japan Photographic Copyright Association

“Implementation of Compensation System for Public Transmission for Educational Purposes”

KISHIMOTO Orie, Division Chief, Copyright Division, Agency for Cultural Affairs

“Supporting new students in online environments—initiatives of the (undergraduate) School of Electrical and Electronic Engineering, Kyoto University”

KITA Hajime, Director and Professor, Institute for Information Management and Communication, Kyoto University

“Dealing with new students regarding online lectures and admission rules”

YOTSUMOTO Yuko, Assistant Professor, College of Arts and Sciences, University of Tokyo

“University-wide efforts to support new students and to develop a support system at Osaka University”

MURAKAMI Masayuki, Professor, Department of Teaching & Learning Support, Center for Education in Liberal Arts and Sciences, Osaka University

“Online class evaluation for overcoming difficulties: basic perspectives and methods”

FUJIMOTO Toru, Lecturer, Interfaculty Initiative in Information Studies, University of Tokyo

“Handling of educational data”

YASUURA Hiroto, Director and Vice President, Kyushu University

“Distance education of SecCap, a course for training human resources in information security”

SONE Hideaki, Professor, Graduate School of Information Sciences, Tohoku University

“The current state and challenges in distance learning at high schools”

OHARA Tsutomu, Teacher, Tokyo Metropolitan Machida High School

“Library management in the COVID-19 pandemic: initiatives of national universities”

EGAWA Kazuko, Administration Director, University of Tokyo Library (Secretariat of Japan Association of National University Libraries)

“Recommending VR—VR lectures are no longer a hassle”

AOYAMA Kazuma, Assistant Professor, Virtual Reality Education and Research Center/Graduate School of Information Science and Technology, University of Tokyo

Program Part 2 Case Studies

“What and how should medical students study during the COVID-19 pandemic: Experiences at Nagoya University School of Medicine”

NISHIGORI Hiroshi, Professor, Center for Comprehensive Medical Education, Graduate School of Medicine, Nagoya University
KURODA Keisuke, Project Assistant Professor, Neuroscience Laboratory, Graduate School of Medicine, Nagoya University
KONDO Takeshi, Assistant Professor, Postgraduate Clinical Training and Career De-

velopment Support Center at Nagoya University Hospital/Nagoya University Hospital General Medicine
KIMURA Hiroshi, Professor, Dept. of Virology, Graduate School of Medicine, Nagoya University

"The project for fully online classes at Kanda University of International Studies (Innovation KUIS)"

ISHII Masaaki, Director, The Language, Media and Learning Research Center (LMLRC), Kanda University of International Studies

"Video information system for distance learning support at physical education universities, using sports video images"

KAKUTA Mitsugu, Associate Professor, Liberal Arts (university-wide), Nippon Sport Science University
WATANABE Iroha, Distant Lecture (video information technology) Support Teacher, Nippon Sport Science University (Faculty of Physical Education)
MIZUNO Masuhiko, Dean of the Faculty of Physical Education, Nippon Sport Science University

"Distance learning at Muroran Institute of Technology"

KUWATA Yoshitaka, Director, Center for Multimedia Aided Education, Muroran Institute of Technology

"State-of-the-art online classes at Aoyama Gakuin Junior High School using AI technology"

ANDO Noboru, Mathematics Teacher, Aoyama Gakuin Junior High School

"Conclusion"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

Session 7 (May 8)

"Request to go on a 'data diet'"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

"From MEXT"

MURATA Yoshinori, Director-General, Research Promotion Bureau, MEXT

"Domestic PC supply-and-demand situation and outlook"

TANABE Takefumi, Office Head, Software and Information Service Strategy Office, Commerce and Information Policy Bureau, Ministry of Economy, Trade and Industry

"Exercise protects our physical and mental health—report based on the physical characteristics of women"

SUNAGA Mikako, Professor, Faculty of Childhood Sport Education, Nippon Sport Science University/Manager, Study and Career Support Section, Student Support Center, Nippon Sport Science University

"Specific examples of designing online classes based on size"

KOGO Chiharu, Professor, Faculty of Human Sciences, Waseda University

"Let's try an online class using an LMS"

OGATA Hiroaki, Professor, Academic Center for Computing and Media Studies, Kyoto University

"Update on measures to promote distance learning at universities and technical colleges—cautions when implementing distance learning classes and the response of public universities to supplementary budgets"

NISHIYAMA Takashi, Planning Officer, Technical Education Division, Higher Education Bureau, MEXT

"Efforts to implement online classes at Kawasaki-Kita Senior High School"

SHIBATA Isao, Principal, Kawasaki-Kita Senior High School

"Challenges at university libraries in handling COVID-19 infection and future prospects"

HIKIHARA Takashi, Professor, Graduate School of Engineering, Kyoto University/Director, Kyoto University Library Network

"Conclusion"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

Session 8 (May 15)

"Introduction"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

"From MEXT"

TAGUCHI Yasushi, Director-General for Cybersecurity and Policy Making, Minister's Secretariat, MEXT

"Initiatives of MEXT for online learning in elementary and secondary education"

TAKAYA Hiroki, Director, IT Education and Foreign Language Education Office, Elementary and Secondary Education Bureau, MEXT

"Implementation and rules for distant learning at Hinode Gakuen Junior High/Senior High School"

TAKEYOSHI Noriyuki, Hinode Gakuen Junior High/Senior High School

"Accessible, at-home online classes (for example, mathematics)"

TAKEZAWA Mamoru, Teacher, Waseda University Senior High School

"Let's try an online class using an LMS (continued)—utilization of educational data"

OGATA Hiroaki, Professor, Academic Center for Computing and Media Studies, Kyoto University

"Online education at the Department of Computer Science and Technology, Peking University"

Zhenjiang Hu, Chair, Department of Computer Science and Technology, Peking University/Project Professor, National Institute of Informatics

"First day of school at Waseda University during the COVID-19 pandemic"

FUKAZAWA Yoshiaki, Director, Waseda University Library/Professor, Faculty of Science and Engineering, Waseda University

"Grade evaluation using Open e-Book Assessment"

Brendan Flanagan, Program-Specific Senior Lecturer, Academic Center for Computing and Media Studies, Kyoto University

"Support needed for childcare in coming

years under the Stay Home system"

YOSHIDA Sachine, Assistant Professor, Faculty of Medicine, Toho University

"Inter-university collaboration during the COVID-19 pandemic"

MONKAWA Toshiaki, Director and Professor, Medical Education Center, Keio University

"Distance learning at the Wakayama Faculty of Nursing, Tokyo Healthcare University"

KITAE Misako, Associate Professor, Wakayama Faculty of Nursing, Tokyo Healthcare University

"Conclusion"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

Session 9 (May 29)

"Introduction"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

"From MEXT"

YANO Kazuhiko, Deputy Director-General, Minister's Secretariat, Elementary and Secondary Education Bureau, MEXT

"State of efforts by MEXT to promote distance learning—focusing on administrative notice (May 15), Q&A update (May 22), and secondary supplementary budget"

NISHIYAMA Takashi, Planning Officer, Technical Education Division, Higher Education Bureau, MEXT

"How to reduce Zoom data traffic in online classes"

YOSHIDA Lui, Senior Lecturer, Center for Research and Development of Higher Education, University of Tokyo

"Online classes from the viewpoint of students"

TAKEI Yuna, 2nd Year Student at College of Arts and Sciences, University of Tokyo/UmeeT Editorial

"Possibility of building a student-centered online class support system and expanding it to other institutions"

SHIMADA Atsushi, Professor, Graduate School of Information Science and Electrical Engineering, Kyushu University
NOGUCHI Gaku, 4th Year Student, The 21st Century Program, Kyushu University/Co-representative, iQ Lab

"Are university libraries continuing to operate? Facing the spread of the COVID-19 pandemic"

KOJIN Sawako, Administration Director, Tohoku University Library

"Importance of data utilization in online classes"

MINOH Michihiko, Professor Emeritus, Kyoto University/Executive Director, RIKEN

"Distance learning, graduation thesis guidance, and career support for assuring the quality of university education"

MINAMI Meguru, Professor, Matsuyama School of Nursing, University of Human Environments
OKA Taeko, Professor, Matsuyama School of Nursing, University of Human Environments

"Task learning in 'don't overdo it' distance learning"

TOMURA Taro, Associate Professor, Acupuncture-Moxibustion and Sports Trainer Science, Faculty of Health Sciences, Kansai University of Health Sciences

"Rakugo"

HAYASHIYA Kikumaru

"Starting from what we can do—online training for teaching and administrative staff"

TSUNAGI Takashi, Planning and Coordination Supervisor, Education Policy Office, Miyazaki Board of Education
NAKAYAMA Ryu, Innovative Education Promotion Officer, Koyu Community Promotion Organization

"Distance learning initiatives at a public high school: results and challenges"

KASUGAI Yu, Teacher, Saitama Prefectural Kawagoe Minami High School

"Initiatives for online classes utilizing educational data at a public junior high school"

MIYABE Go, Teacher, Kyoto Municipal Saikyo High School Affiliated Junior High School

"Conclusion"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

Session 10 (June 5)

"Introduction"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

"From MEXT"

HAKUI Yoshinori, Director-General, Higher Education Bureau, MEXT

"Active learning application examples in distance learning"

HATA Nobuhiko, Professor, Harvard Medical School/Dept. of Radiology, Brigham and Women's Hospital

"Development of LINE Bot to distribute information on coronavirus countermeasures"

NAKAYA Yushi, 4th Year Student at School of Engineering, Tohoku University
TAKAHASHI Yusuke, 3rd Year Student at School of Engineering, Tohoku University
HIGUCHI Kenichi, 3rd Year Student at School of Engineering, Tohoku University

"Distance learning at Keio SFC and the results of a questionnaire survey"

UEHARA Keisuke, Associate Professor, Faculty of Environment and Information Studies, Keio University

"Experimental practical online trial lecture—a trial conducted by the Faculty of Environmental Engineering of the University of Kitakyushu"

YAMAZAKI Susumu, Associate Professor, Faculty of Environmental Engineering, University of Kitakyushu
TACHI Nobuyuki, Center for Embedded Computing Systems, Graduate School of Informatics, Nagoya University

"Completing Zoom classes at Charles University in Prague"

IWAMA Kazuo, Project Professor, Research

Institute for Mathematical Sciences, Kyoto University/Visiting Professor, Charles University in Prague

"Rakugo"

"Interactive online classes and lesson research in the COVID-19 pandemic"

SHIROUZI Hajime, Senior Researcher, National Institute for Educational Policy Research/Deputy Representative, New Learning Project Research Committee

"Online class initiatives in Kumamoto City that do not hinder children's learning"

SHIOTSU Akihiro, Kumamoto City Deputy Director of Education
HONDA Yuki, Deputy Director, Kumamoto City Education Center

"Initiatives for distance learning support at a school affiliated with the University of Tokyo"

ASAKAWA Toshihiko, Vice Principal, Secondary School Affiliated with the Faculty of Education of the University of Tokyo

"Online classes handled by teachers together"

OKAMOTO Hiroyuki, Assumption Koku-sai Junior & Senior High School

"Conclusion"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

Special Session: Open House 2020 (June 12)

"The 'new normal' for distance learning: large-scale (over 2,000 people) online symposiums that began in late March have now completed 10 sessions. The symposium organizers and people from MEXT discuss the future of education."

NAKAGAWA Satoshi, Special Inspector, Elementary and Secondary Education Bureau, MEXT
NISHIYAMA Takashi, Planning Officer, Technical Education Division, Higher Education Bureau, MEXT
TAURA Kenjiro, Director and Professor, Information Technology Center, University of Tokyo
YASUURA Hiroto, Director and Vice President, Kyushu University
KITSUREGAWA Masaru, Director General, National Institute of Informatics

Session 11 (June 26)

"Introduction"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

"From MEXT"

HISHIYAMA Yutaka, Director-General, Science and Technology Policy Bureau, MEXT

"Implementation of distance learning and development of next-generation online education system at North Carolina State University"

MATSUDA Noboru, Associate Professor, Computer Science Department, North Carolina State University

"Looking back on education utilizing ICT"

FUJIMAKI Akira, Vice President (Education and Overseas Students), Nagoya University

"Questionnaire survey regarding online

learning at Tohoku University"

MATSUKAWA Hideya, Lecturer, Institute for Excellence in Higher Education, Tohoku University

"Online class support using an introduction guide and FAQ at Hokkaido University"

SHIGETA Katsusuke, Associate Professor, Information Initiative Center, Hokkaido University/Deputy Director, Center for Open Education, Institute for the Advancement of Higher Education, Hokkaido University
SUGIURA Mayumi, Assistant Professor, Center for Open Education, Institute for the Advancement of Higher Education, Hokkaido University

"Distance learning initiatives in clinical training at a medical university—framework for constructing inference using simulated cases"

ATOMI Tomoaki, Professor, Department of Physical Therapy, Faculty of Health Sciences, Kyorin University

"Online regular examinations held at School of Medicine, Teikyo University"

EBATA Hiroki, Lecturer, IR and Medical Education Evaluation Office (General Medical Education and Research Center), School of Medicine, Teikyo University

"Manzai"

"Supporting student life in the COVID-19 pandemic—from the field of student counseling"

TAKANO Akira, Associate Professor, Center for Research on Counseling and Support Services

"Support method for hearing-impaired students and its applications"

YOKEMURA Taketoshi, Project Professor, College of Systems Engineering and Science, Shibaura Institute of Technology

"Starting digitalization initiative (Scheem-D) in university education"

NISHIYAMA Takashi, Planning Officer, Technical Education Division, Higher Education Bureau, MEXT

"Interactive online classes and examples of research for lessons during the COVID-19 pandemic"

IKUBO Shinya, Project Assistant Professor, Center for Research and Development on Transition from Secondary to Higher Education, University of Tokyo
MENDA Kumiko, Chief, Hiroshima Prefecture Akiota Town Board of Education

"Initiatives for online learning at Kansai Soka Senior High School"

TSUJI Seiichi, Teacher, Kansai Soka Senior High School

"Conclusion"

KITSUREGAWA Masaru, Director General, National Institute of Informatics

*In each lecture, presenters talked about the issues and experiences that they were facing at the time. For this reason, the content of presentations may be inconsistent with the current reality due to rapidly changing circumstances.

How We Organized a Cyber Symposium

The “Grand Experiment” of DEIM2020

MIYAZAKI Jun

Professor, Dept. of Computer Science, Tokyo Institute of Technology (DEIM2020 Forum Chair)

GODA Kazuo

Assoc. Professor, Institute of Industrial Science, University of Tokyo (DEIM2020 Executive Chair)

YOKOYAMA Shohei

Assoc. Professor, Faculty of System Design, Tokyo Metropolitan University (TMU)* (DEIM2020 Program Chair)

* At Shuto Daigaku Tokyo up to March 2020, when DEIM2020 took place.

YOSHIDA Naofumi

Professor, Faculty of Global Media Studies, Komazawa University (DEIM2020 Program Vice-Chair)

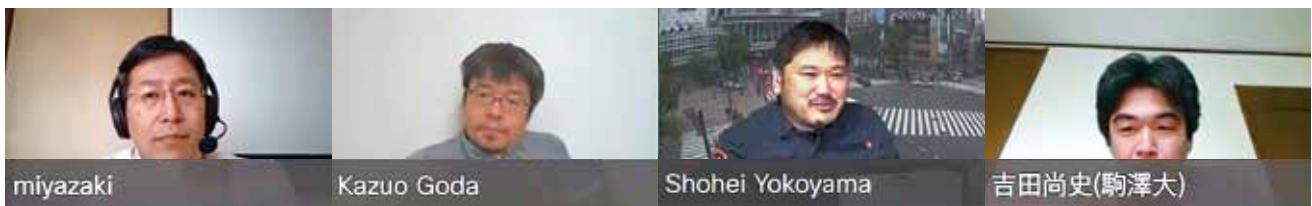


Photo 1 Due to COVID-19 restrictions, reporting was conducted online.

The 12th Forum on Data Engineering and Information Management (DEIM2020), which took place over three days from March 2 to 4, 2020, together with the 18th Annual Meeting of The Database Society of Japan (DBSJ), was the first ever large-scale online academic symposium held in Japan. A total of 563 people participated. There were 73 oral presentations and two interactive sessions. All went off without any significant problems. Remarkably, the symposium was held only two weeks after the decision to hold it online was taken. What enabled DEIM2020 to be so successful despite such a short preparation period? We asked the four people most closely involved in the planning and management of the event to look back on the challenges they faced. (See Photo 1.)

Due to the worsening situation, we almost gave up on holding the event at all

The Forum on Data Engineering and Information Management (DEIM), in conjunction with the Annual Meeting of the Database Society of Japan (DBSJ), is an annual training camp-style symposium aimed at fostering discussions and exchanges on a variety of research topics relating to data engineering and information management. It is jointly organized by the Special Committee on Data Engineering Research of the Institute of Electronics, Information and Communication Engineers (IEICE), the DBSJ, and the Database Systems Study

Group of the Information Processing Society of Japan. Each year, around 600 students, along with researchers from universities, research institutes, and companies participate in the symposium. Numerous papers in the fields of data engineering and information management are presented.

As in preceding years, this year's DEIM2020 had been scheduled to be held in the training camp format at Bandai-Atami in Fukushima. The unique feature of DEIM is that it allows participants to vigorously discuss and exchange information from morning until night in intimate, face-to-face settings.

The DEIM2020 Executive Committee began preparing for DEIM

2020 in April 2019. The event was scheduled to start on March 2, 2020, and the deadline for the call for papers was December 25, 2019. At this time, COVID-19 infections were already spreading in China, but it seemed that the impact on Japan would be minimal. The situation changed substantially around January 20, around the time that registration began. In Wuhan, China, infections were spreading rapidly and preparations were made to seal off the city. The first case of infection in Japan was also confirmed.

GODA Kazuo, an associate professor at The University of Tokyo who chaired the DEIM2020 Executive Committee, recalls, “At this

point, we had informed the registered participants and the organizers that the event would go ahead as planned, but meanwhile the Executive Committee was also starting to consider contingency measures. We thought that a training camp would present the 'Three Cs,' so we considered various other possibilities."

The spread of infection was accelerating day by day. Measures were taken to quarantine Japanese nationals returning from China on government charter flights and some companies were asking employees returning from overseas to isolate at home for a specified period of time.

In an email to registered participants on February 6, the Executive Committee stated that it intended to hold the event as scheduled at the designated venue, but that it would not accept anyone from China, due to the prevalence of COVID-19 there. "The DEIM is supposed to be very open, so restricting participation at this stage was a difficult decision," explains Prof. GODA.

The virus was now spreading throughout the world. An email dated February 14 reported that the organizers were in discussions with the conference venue (a hotel) and event support service providers about hygiene management. At this point, they still hoped to hold the conference at the venue and tried to ensure that students and researchers would not lose the opportunity to present their papers.

Finally, on February 17, the decision was taken to cancel the conference at Fukushima.

Professor Goda recalls, "We determined that there was a risk of an outbreak occurring at DEIM. The participants would feel anxious about catching COVID-19.

There was no way we could expose them to that danger, so we had no choice but to abandon the idea of holding the event in Fukushima."

"We can't deprive them of the opportunity to present their papers"

One of the factors behind the decision to cancel the camp was the outbreak of COVID-19 onboard the cruise ship, *Diamond Princess*, anchored off the coast of Yokohama. The risk of a similar situation could not be ignored.

Even so, the decision to cancel was a difficult one. DEIM2020 was set to be a massive conference, with over 500 people in attendance. The presentation program was finalized and most of the participants had already completed their registration and made travel arrangements to Fukushima.

In fact, the Executive Committee had been fully aware since late January that it might not be possible to go ahead with the conference in Fukushima. It had been preparing for various contingencies and consulting with the organizers, the conference venue, and accommodation facilities. NII Director KITSUREGAWA Masaru, who also serves as president of the DBSJ, suggested to DEIM2020 Forum Chair Prof. MIYAZAKI Jun of the Tokyo Institute of Technology that they should consider hedging the risk. "In cooperation with all the organizations involved, we were able to quickly decide to cancel the training camp event," notes Prof. GODA.

What troubled the Executive Committee most until the very end was the paper presentations. The idea of holding the event online was considered, but there was no precedent for holding such a large-scale symposium online. Also, since

presenting papers in a virtual (non-physical) setting was a strange concept to most people, it was also necessary to overcome this psychological barrier.

When faced with the Executive Committee's statement that "As conference organizers, we lack the infrastructure and experience to hold an online conference," Professor KITSUREGAWA lit a fire under the organizing team, saying "We can't rob students of the precious opportunity to present their papers. Right now, only IT specialists have the capability of organizing such a big online conference. If we don't take up the challenge, who will? So, together with NII, let's give it a shot."

Forum chair Prof. MIYAZAKI noted that there was a precedent to this situation, when the 2011 IEICE General Conference was unable to proceed due to the impact of the Great East Japan Earthquake. At that time, the papers were distributed as a collection. He says, "Initially, we even envisioned this same method. But we now had access to online technology, so we decided to give it a try."

The Executive Committee began to move quickly. Within just half a day, NII had formed a technical support team, dubbed the "DEIM Success Team." With the establishment of this emergency team, the two sides began pushing to make the online event a reality.

Yet there were only two weeks before the event. At that point in time, absolutely no technical preparation had been done for setting up and operating an online conference system. But everyone was driven by the desire to give the attending students the opportunity to present their graduation and Master's theses.

Regarding the situation, Profes-

sor MIYAZAKI comments, “At first, I doubted that we could hold even 10 or 20 percent of the symposium. We had so little time left. But, precisely because the situation was so difficult, it was important that an academic organization in the field of informatics take on such a pioneering challenge.” Characterizing this effort as a “grand experiment,” he set out on the task of preparation.

Professor GODA explains his state of mind at that time: “I was worried we would be flooded with complaints that we did something badly, or that we failed to do this or that. On the other hand, I was quite pleased about trying to do something ambitious that no one else was doing.”

Thus, a team of leading Japanese academics equipped with IT knowledge and expertise decided to take on the challenge of organizing Japan’s first ever large-scale online symposium.

A positive feeling after just three trials

After deciding to hold an online conference, the first task was to select a video conferencing tool. On February 20, in an online meeting connecting the NII conference room with the homes of core team members, a selection of different online tools were tested, including Webex, Zoom, Skype, and Amazon Chime. Based on the results, a decision was made to use Webex by Cisco Systems.

Professor GODA: “To be honest, none of the tools were really ideal, because none of them were designed for a large symposium. Although we did not evaluate every tool in great detail, we chose Webex because we were able to quickly find the functions we wanted and needed, like the admin’s simultaneous mute func-

tion.”

The first proof-of-concept (POC) trial began the very next day (Feb. 21). Approximately 50 people, including university students who planned to give oral presentations of their papers, connected online for about two hours for a mock session.

Professor YOSHIDA Naofumi of Komazawa University, who served as Program Vice-Chair, remembers, “At the beginning, I felt somewhat doubtful that we could hold an online symposium.”

Unfortunately, within a few minutes of the first connection Prof. YOSHIDA’s skepticism proved to be justified. One after another, students connecting to the conference for the first time excitedly announced their presence, and soon the session descended into chaos. Most had their video cameras and microphones activated, resulting in a cacophony of sounds.

Professor YOSHIDA feared that without a coordinator, the trial would end in failure, so he volunteered to take on that role. This move later proved to be one of the key factors behind the success of DEIM2020.

Professor YOSHIDA called on all the trial participants to begin by making sure to turn off the microphones and cameras on their devices. He then explained the basic rules for using the online conference system. For example, he pointed out that it would be difficult to proceed with the meeting and ensure sufficient bandwidth unless everyone except the current speaker kept their microphones and cameras turned off. Otherwise, the audio and video stream would be unstable. There was some technical information provided regarding the symposium, including instructions on how to share documents on the

screen. There were some complaints at this point, such as the inability of presenters to know how much time had elapsed during their presentations and the inability of participants to applaud presenters, but these were ultimately resolved. There was also a discussion on how to deal with possible difficulties, e.g., if a chairperson or a presenter is not present or ready at the session start time.

Prof. YOSHIDA: “It was a great thing for the students presenting papers to understand how to make a presentation and to learn that they could use the documents they had prepared as they are. By the end of the POC trial, we felt quite positive.”

A total of three trials were held. In the second one, on February 25, there were about 110 participants, including the lecturers who would chair the sessions, and two sessions were held simultaneously. At the third trial on February 28, about 120 people participated, and ten sessions were held simultaneously, as was anticipated for the actual conference. There was also some further technical verification concerning the network and system.

Prof. YOSHIDA: “Although we only contacted them the day before or even on the day, many people joined us for the trials. We want to express our gratitude for their help.”

The NII’s “DEIM Success Team” also collaborated extensively from the stage of the POC trials. They contributed by ensuring sufficient bandwidth and solving network security problems. Professor Miyazaki adds, “They mainly offered technical support from the network side. In addition to dealing with network bandwidth and security issues, they implemented certain functions that were lacking in the

Manuals and portal sites, the keys to success

This was distributed to all the chairpersons of conference sessions who play roles as facilitators, under the title “Information for DEIM2020 Online Conference Chairpersons.” The manual comprehensively explains how to prepare for and run conference sessions, covering pre-session preparations, invitations to participants, and time management. The chairpersons were able to refer to this guide to help them organize their sessions.

A total of 280 conference participants took part in the trials, but many of the other participants were using the online conference system for the first time. In fact, many had never attended any kind of large-scale online conference like this before. The aim of the manual was to help them participate and enjoy the conference without any stress.

important to the success of DEIM 2020, are now available on GitHub under the title, "Guide to Organizing DEIM2020 Online Conference." Already, this know-how has been used for organizing an online event at the National Convention of IPSJ.

Almost all of the scheduled oral presentations at DEIM 2020 were set to be held online, unchanged from the original schedule. The total number of scheduled oral presentations was 73, with up to 10 sessions held simultaneously. A mechanism to ensure that participants could easily join their desired session “venue” was needed.

Instead, a portal site listing the program timetable was created. (See Photo 2.) Associate Professor Shohei Yokoyama of Tokyo Metropolitan University, who served as the Program Chair, explains, “Participants could look at the timetable and click on the session they were interested in. Once they entered the session, they were able to participate in the conference and download papers by simply clicking. The opening session, attended by a large number of people, was livestreamed on both YouTube Live and LINE LIVE for easy viewing. In various ways, we tried to make it as intuitive as pos-

Thanks to this portal site, more than 500 people in all were able to participate in the sessions and download the materials they wanted without confusion.

Prof. YOKOYAMA: “We had been using off-the-shelf open source software packages until last year, but this year we rebuilt the systems incorporating 15,000 lines of code that we wrote ourselves. By developing these optimized systems in advance, we were able to deploy the portal site in just two weeks.”

Another initiative that cannot be overlooked is the reformatting of poster sessions and interactive sessions for the online conference.



Photo 2 DEIM2020 portal site. Participants can join any session they like with just one click.

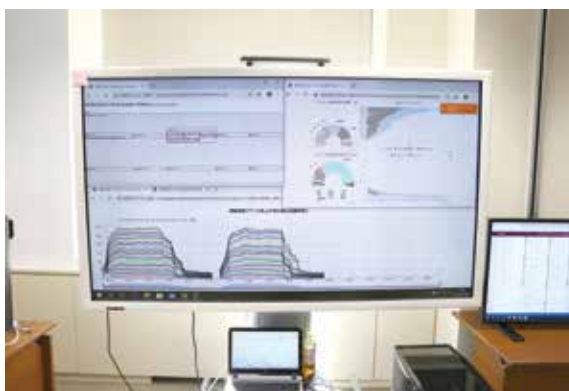


Photo 3
Technical support center
set up at NII (left) with
real-time visualization
system

In a typical poster session, a physical presentation poster is displayed at the venue. As the presenter stands by the poster explaining the contents to interested participants, there is discussion and information exchange.

“I wondered if it would be possible to maintain this basic concept,” says Prof. YOKOYAMA.

A dedicated portal for the poster session, displaying thumbnail previews of the posters, was created. Participants could click on any poster they wanted to download the PDF file. To enable active discussions, up to four people at a time could enter a chat room for each poster. In a sense, all the advantages of a real poster session were translated into an online format.

Appreciating the unique advantages of online meetings

On the first day of the conference, March 2, the nine core members of the DEIM2020 Executive Committee gathered at a conference room at NII in Hitotsubashi, Tokyo. The purpose of the meeting was to provide technical support and manage the overall running of the event. There were also about 20 support students and about 10 NII support team members. To ensure a safe environment to avoid the ‘Three Cs,’ a large room was prepared. (See Photo 3.)

Within the room, a system for

monitoring online participant activity was set up. Using 10 LCD monitors ranging in size from 40 to 60 inches, along with one very large LCD monitor (over 80 inches) showing an overview of the whole event, all conference sessions could be monitored in real time.

Prof. MIYAZAKI recalls, “We were very worried about how many people would attend and whether there might be problems. At the end of the trials, we only felt about 50% prepared. That’s how I felt on the morning of the conference.”

“We let the participants know that it was a ‘grand experiment.’ Even though we wanted the participants to be understanding and forgiving if something went wrong, we still felt worried,” says Prof. GODA.

There were no serious problems, however, and all sessions went smoothly. In a few cases, the chairperson was unable to log in due to a network issue, thereby delaying the starting time slightly. In other cases, a session had to be relocated to a “spare venue” due to an audio failure at the scheduled “venue.” However, no session had to be cancelled. On the whole, the online conference was well received by both presenters and participants.

Prof. YOSHIDA: “I was able to appreciate the unique benefits of online events. Some of the students who gave oral presentations

said they didn’t feel nervous at all, because they were able to do their PowerPoint presentations sitting at their PCs. Some participants commented that it was easier to see materials displayed on the PC in front of them, compared to a venue where they are projected onto a screen more than 10 meters away. Others found that asking questions via text chat was convenient.

On the second day of the conference, a large online get-together called “Banquet Online” was held. Though originally scheduled for one hour, it became so lively that it lasted three and a half hours.

Prof. GODA: “Informal discussions are an important part of symposiums and conferences. So, I felt that it was important to actively incorporate them into online discussions.”

Prof. MIYAZAKI: “Even after the COVID-19 crisis passes and physical conferences can be held again, it’s possible that they will be held in a kind of ‘hybrid’ format that includes an online component. This could allow busy academics to participate in events partially with their spare time. Some people are already requesting that we keep some of the online features.”

On the other hand, online conferences are not without challenges. Professor MIYAZAKI says, “Some of the professors who gave lectures mentioned that they could not see

the faces of the audience. This made it difficult for them to flexibly adapt the content and tone of their talks, or to make jokes in response to the audience. Also, some participants who were unable to ask questions during a presentation found it difficult to ask questions or talk with the presenter individually afterward.”

Prof. YOKOYAMA: “An important element of academic symposiums is being able to stay in the conference room after a presentation to exchange information and chat with various people. It was a pity we could not implement this feature.” This may be a challenge for the future.

One of the greatest benefits of online meetings is that it is easy to record and share sessions. All of the presentations at the recent symposium were recorded for technical verification, but there are currently no plans to publish them. It was apparently impossible to make the necessary arrangements for this during the two-week preparation period.

Prof. GODA: “People who would like to participate in different simultaneous sessions should be able to access the session recordings later. We would like to work on innovations like this that take advantage of the online format.”

Demonstrating literacy in online hosting

A large number of papers were presented at DEIM2020, in a way that demonstrated cutting-edge technologies in data engineering and information management. The event itself has now become a pioneering example of an online symposium and large-scale event. The success of the “grand experiment” ended up making a significant impact.

The Forum Chair, Prof. MIYAZA-

KI, awarded DEIM2020 a score of “80” (out of 100). He says, “Before the event started, I would say a score of about “50” but by the end I think we achieved a passing score.” It was a great achievement to clearly define the technical literacy requirements and this has laid the groundwork for further improvements and applications for various conferences. We were able to show that in order to organize and run a successful online symposium, it is important not only to have the right tools, but also to ensure that participants have the right mindset and technical preparation.

Prof. GODA: “We were able to start a movement that encourages other organizations to try holding large-scale online symposiums.”

Prof. YOKOYAMA: “It was a great achievement to put together a system and know-how as a package that can be easily deployed for other similar events.”

On the downside, Prof. MIYAZAKI explains that he deducted 20 points because of the difficulty of using the tool. “I would like to see tools that are easier to use, reflecting the feedback of users. There is room for growth in this area,” he says. Professor YOKOYAMA comments, “I would like to see improvements to the online conference system making it easier to use for symposiums and for schools.”

Professor MIYAZAKI also cites the close relationship between team members as a key to success. He says, “The members have established good communication with each other over many years, so the group was ripe for working together. This is one of the keys to our success.” Professor GODA adds, “We were able to build on the wonderful relationships formed by our professors to form a close-

knit team that enabled our success. It is up to us to see how we can now pass this on to the next generation.”

How will the results of this initiative shape the future? Professor GODA answers, “The core members are all researchers, and always willing and eager to try new things. We will keep on taking on new challenges, so that our project remains in beta version perpetually.” It appears that they are already thinking about their next move.

(Interview/Report by Katsuyuki Okawara)

MIYAZAKI Jun

Professor, Department of Computer Science, School of Computing, Tokyo Institute of Technology. Received his BEng in 1992 from the Tokyo Institute of Technology, and his PhD (Information Science) in 1997 from the Japan Advanced Institute of Science and Technology (JAIST). He is currently engaged in research on big data infrastructure and its applications.

GODA Kazuo

Associate Professor, Institute of Industrial Science, University of Tokyo. Received his BEng in 2000 and his PhD (Information Science and Technology) in 2005 from the University of Tokyo. He is currently engaged in research on system software for big data. Has been at his current position since 2019.

YOKOYAMA Shohei

Associate Professor, Faculty of System Design, Tokyo Metropolitan University (TMU). Received his PhD (Engineering) in 2006 from TMU. After working at Oriental Land Co., Ltd., National Institute of Advanced Industrial Science and Technology, and the Faculty of Informatics, Shizuoka University, has been in his current position since 2018. He is currently engaged in data engineering research.

YOSHIDA Naofumi

Professor, Faculty of Global Media Studies, Komazawa University. Received his PhD (Engineering) in 2001 from the University of Tsukuba. After working as a lecturer at the Graduate School of Media and Governance, Keio University, he assumed his current position in 2018. He is currently engaged in research on data engineering.

Benefits and Challenges of Bringing Online Lectures to the Whole University in the New Academic Year

How the University of Tokyo Moved Quickly to Run Online Classes

TAURA Kenjiro

Director, Information Technology Center, The University of Tokyo
Professor, Graduate School of Information Science and Technology, The University of Tokyo

While many universities were forced to postpone the start of classes in the 2020 spring semester due to the COVID-19 crisis, in April 2020, the University of Tokyo (Todai) was the first university in Japan to begin offering online lectures across the board. How did they manage to begin running those online lectures within the short period of time of 1 month? I interviewed Prof. Kenjiro Taura, Director of the University of Tokyo's Information Technology Center, a key figure behind this move to online learning.



TAURA Kenjiro

Received his PhD in Science in 1997 from the University of Tokyo. Worked at the University of Tokyo as a research associate from 1996, a lecturer from 2001, an associate professor from 2002, and a professor from 2015. Director of the Information Technology Center (University of Tokyo) since 2018. His fields of specialization include parallel processing, high-performance computing, programming languages, and systems software. He is engaged in research aimed at combining high-performance, large-scale parallel processing with ease of programming and use.

Using campus IT tools for online lectures

— Compared to other universities, Todai was quick to move to online classes. From the start of the new academic year, you were using a variety of tools for online lectures, including Zoom, Webex, and Google Meet. How did you manage this?

TAURA When we began considering online lectures in early March 2020, we were unsure whether we could do it, because we had no experience with large-scale web conferencing for connecting around 100 people at once.

Around that time, though, I heard that a database-related conference, DEIM2020 (held on March 2 to 4), was hosted completely online with over 500 participants. So, I began to think that perhaps we could manage it. Also, when I conducted a remote briefing session about online lectures for university teaching staff in late March, we didn't experience any problems; not even with 300 or 1,000 people connected simultaneously, let alone 100. This gave me even more confidence. And in fact, since the university-wide launch of online lectures in April, we haven't had any serious problems. There hasn't been a single system problem that has stopped all lectures.

The most important thing for implementing online lectures across an entire university is ensuring that only Todai students get the URLs needed to attend

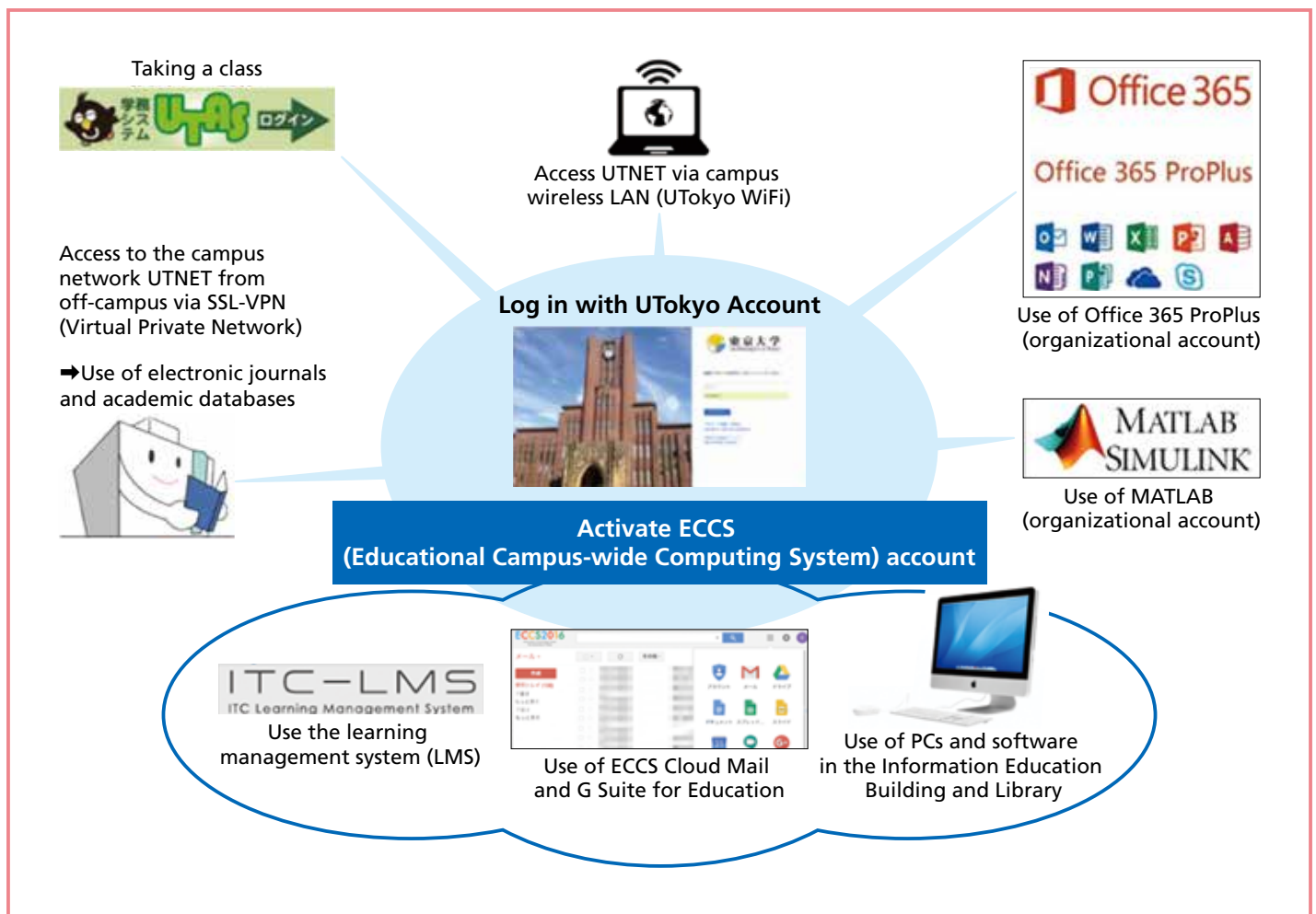


Fig. Educational IT system at the University of Tokyo

specific lectures. It was necessary to devise a way to securely communicate URLs to prevent outsiders (non-Todai students) from entering and disrupting lectures.

Todai utilizes two main IT tools for students: UTAS (UTokyo Academic affairs System) and ITC-LMS (Information Technology Center-Learning Management System). The former allows students to register for and view courses via the web, whereas the latter is for downloading teaching materials, submitting assignments, taking tests, and communicating or having discussions with teachers. By getting teachers to write the URLs for their online lectures with this system, the URLs can be securely distributed.

One way to prevent intrusion is to allow only users with Todai student email addresses to join the online lectures, but we anticipated that this might lead to problems if students try to access the lectures using a personal email address and fail to connect. We therefore decided not to make this one of the rules. Instead, we recommended that the students in each class be fully informed about the system and that the system be used only after it is clearly understood by the whole class.

— When so-called “Zoom bombing”[1] (disrup-

tion of Zoom meetings) became a hot topic in late March and April, Todai’s Information Technology Center immediately issued some guidelines for using Zoom securely. I expect that other universities found these guidelines useful too.

TAURA “Zoom bombing” was a hot topic in the U.S. and Zoom was even banned in some states. At that time, we thought it was important for us at the Information Technology Center to release a document quickly before there were widespread concerns. We issued our guidelines on April 6, 2020. These state that most intrusions can be prevented by setting a password for each lecture and by preventing the URL needed to join a lecture from being leaked to those outside of the class.

Another thing we considered when developing online lectures was support for first-year students who were just starting their university courses. Due to the outbreak of infection on campus, access to campus was strictly restricted from early April. This meant that many first-year students had never attended the university. At the same time, many were unaware of ITC-LMS and UTAS. Some students did not even have computers or Internet access, so we decided to lend them campus computers, which we

sent out by postal mail. We even sent out some mobile routers.

The secret of success for online lectures

— **What are some of the tips and know-how that teachers use for successfully running lectures using a tool like Zoom?**

TAURA When people think of an online lecture, they might imagine a lecturer in front of a blackboard with a video camera filming the lecture, like in the commercials for prep schools, but this is far from how these lectures are actually delivered.

Unless you wear a wireless microphone, moving around too much in front of the blackboard results in inaudible or poor audio because of the distance from the computer's microphone. Also, if you try to show all the text on the blackboard in a video stream, the characters will be too small to see clearly. To properly show all the text, you would need a dedicated cameraman, moving the camera and zooming in and out. It is simply unrealistic (laughs).

The best approach to giving an online lecture is to sit calmly in front of the PC and simply show your presentation slides using the screen sharing function. Students often comment that online lectures are better than looking at a presentation screen from the back of a large classroom because the materials can be seen more clearly on their own devices.

When it is necessary to write something on the board, like mathematical equations, I would recommend that teachers write with pen on paper and use an overhead document camera or webcam to capture what they write.

— **Are there any particular problems or difficulties with online lectures?**

TAURA The hardest thing for teachers is checking the reaction of students by their facial expressions. That's why at first I thought it would be hard for teachers to lecture without students in front of them. We even discussed the idea of inviting at least a small number of students to the classroom. Unfortunately, the COVID-19 situation quickly worsened, so that became impossible.

However, it is possible to use a text chat interface to make lectures interactive. This can actually make it easier to ask questions and in some cases lead to livelier discussions.

Something that is more difficult is seminar-style sessions with 10 to 20 students. Students find it difficult to fluently time the communications between themselves. We need to find some way to create an atmosphere that is conducive to active discussion.

Another major challenge that remains is assessment. How can we distribute exam questions online simultaneously and how can we monitor for cheating? It is unrealistic to expect a single teacher to monitor hundreds of students, so instead of exams we will probably have to base student assessments on the submission of multiple reports.

The difference with MOOCs is interaction with students

— **What is the difference between live online lectures like the ones you have implemented and a Massive Open Online Course (MOOC)?**

TAURA They both have the advantage that learning can be done from anywhere. Online lectures can also be recorded and later distributed, so just like with MOOCs, students are free to choose the time of study. However, in the case of both MOOCs and books in general, or any content that's just passively available, it is difficult for students to maintain a good learning pace unless they are exceptionally conscientious. I think there needs to be some mentoring or follow-up for students. Also, since MOOCs are not live—they are recorded in advance—they can be reshot. If there are a lot of retakes, due to verbal slip-up for example, it could take three hours to film a 30-minute lecture. This would be a big burden for teachers, and they may not feel very excited about recording.

Online lectures also have unique benefits that come with a live setting. You can see the reactions of students in real time through chat or other means, which is a big plus. The teacher can also get away with a few verbal slip-ups because the lecture is live, so they can save on time and effort. I imagine that many teachers have found that online lectures have gone more smoothly than they initially expected.

In any case, even if the COVID-19 crisis ends in the near future, online lectures will not disappear completely. I think that we will still be able to take advantage of their benefits and use them to some extent.

(Reporting and writing by Naoki Asakawa, Editor-in-Chief, Nikkei Computer)

Note

[1] A malicious action that disrupts an online lecture or meeting, e.g., by projecting pornographic or offensive videos or images using Zoom's screen sharing or chat functions.

How to Deal with Strained Network Environments

Support for Fast-growing, At-home Online Activities during the COVID-19 Crisis

FUKUDA Kensuke

Associate Professor, Information Systems Architecture Research Division
NII, Associate Professor, School of Multidisciplinary Sciences,
The Graduate University for Advanced Studies

The rapid increase in Internet data traffic due to the dramatic growth in telecommuting and home study has given rise to concerns about network load and capacity. Traffic began to increase markedly in March, when COVID-19 restrictions were beginning to impact daily habits. By May, peak weekday nighttime data traffic was 15% higher than in late February. Over the same period, total weekday daytime traffic was 50% higher.[1] As online education becomes more established in the coming months, this trend is likely to accelerate. Now that our social life is so heavily dependent on networks, we will need to make more effective use of network resources. We asked Kensuke FUKUDA, an associate professor at NII, about ways to address the problem of strained network environments.

Daytime data traffic increases with the growth in telecommuting

The spread of COVID-19 has led to growing Internet traffic. According to the Ministry of Internal Affairs and Communications (MIC), since April 2020, when telecommuting was first adopted in earnest, domestic Internet traffic has become about 10 to 20% higher during the day and 10% higher at night compared to in late February. According to NTT Communications, a major Internet service provider (ISP), daytime (9:00 a.m. to 5:00 p.m.) network usage rose sharply, especially on weekdays. It was estimated to be about 50% higher than in late February.

Minister of Internal Affairs and Communications Sanae Takaichi, stated, “Our communications network is designed to withstand peak usage. Although there is a discernible upward trend in data traffic during peak holiday nighttime periods, we do not anticipate any continuing problems.” Even during the Golden Week holiday period, when traffic was expected to increase sharply due to voluntary restraint (from going out), as a state of emergency had been declared across much of the country, there were no actual problems with the backbone network.

Prof. FUKUDA: “Daytime traffic has increased sig-



FUKUDA Kensuke

- Traffic for subscribers (nationwide)
- Growth in nighttime peak from early March was limited
- Daytime growth was large (impact of telecommuting/school closures)
- Average increase for popular services (Google, Amazon, Facebook, Apple, Netflix)

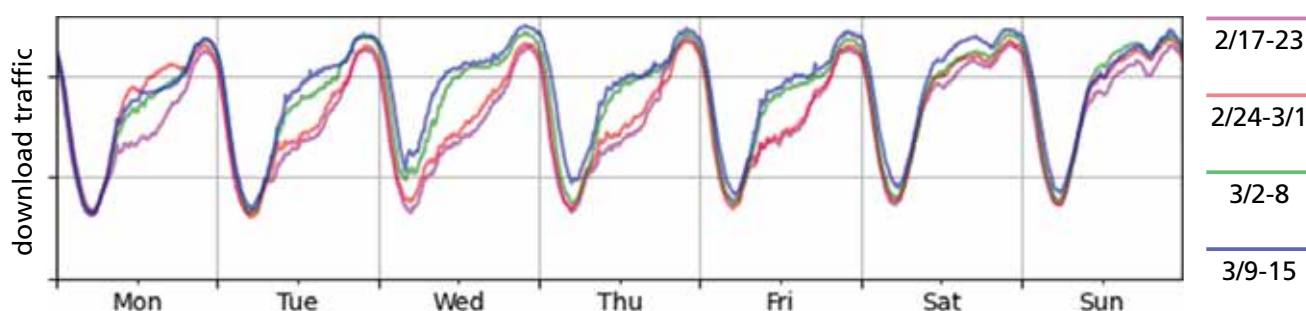


Fig. Change in data traffic (FLET'S)

Source: "Impact of COVID-19 on FLET'S Traffic" (IJJ Engineers Blog: <https://eng-blog.ijj.ad.jp/archives/5536>)

nificantly due to the fact that many people are working from home (telecommuting). However, nighttime traffic is only up about 10%, an increase that can be comfortably absorbed. Domestic data traffic has been increasing at an annual rate of around 15%. If we assume that ISPs are making capital investments based on this rate, we find that this increase is within the expected range. And the peak daytime traffic is not higher than peak nighttime traffic, which is what the system design is based on. So, there is no need to worry about the backbone network getting overloaded."

With regard to SINET, the academic information network built and run by NII, Prof. FUKUDA says that since April 8, it has seen a substantial increase in daytime traffic for video conferencing applications, as a result of the growing number of universities offering online education. However, there is still some capacity left on the line.

Mobile communications, on the other hand, have their own unique traffic pattern. In addition to a nighttime peak, there is also a peak shortly after midday. However, it is assumed that mobile carriers still have some spare capacity in their communications networks, because they have been offering additional data free-of-charge to make up for the shortfall in monthly capacity experienced by many students studying at home or receiving online education.

Disparity of communication environments is a challenge for online education

Despite all of this, network infrastructure cannot be said to be rock solid. The way people live and

work is changing dramatically and new lifestyles are taking shape in our society. Consequently, we are becoming more and more dependent on networks.

The same applies to learning. As long as this pandemic persists, students will be unable to attend school in the usual way and more universities will adopt online learning methods to compensate. Even after the pandemic ends, we can expect to see growing numbers of people using online education as a new style of learning in parallel with in-person learning.

Prof. FUKUDA: "It is very probable that universities will continue to take a "hybrid" approach to education. Lecturers will be expected to stream lectures online from home, and students without suitable Internet access at home will need to take lectures at the university. In the case of practical skills or subjects that require special equipment, lecturers could host the session online from any university with a suitable facility and equipment, while students attend from home."

Even if the network performance offered by ISPs and mobile carriers will remain stable in this new kind of society, Prof. FUKUDA still has concerns about securing sufficient bandwidth at the end nodes of networks, such as streaming servers and client devices in homes.

In the case of streaming servers, for example, if a university builds and operates its own system internally, it may not be able to stream class content online when network traffic is heavy due to concentrated demand. If there are fears that the resources within the university are inadequate, it may be necessary to consider using a Content Delivery Network (CDN)

[2] or a “hyperscaler” cloud service provider.

An even more serious matter is the need to ensure sufficient bandwidth on the client side. Most people are familiar with the experience of nighttime network slowdowns or connection difficulties. One reason for this is that many apartment complexes share a single optical cable. As the number of users increases, data transfer speeds slow down. In addition, many ISPs use wire data lines provided by NTT East and NTT West. It has been pointed out that concentrated access to the network termination devices (NTDs) that connect ISPs to these wire data lines causes Internet traffic congestion and slowdowns. Measures to address these issues are being discussed.

These are the basic reasons why network conditions can vary so much from one home to another. To solve this problem, it is necessary to install more optical lines in residential complexes, add more NTDs, and allocate more bandwidth to ISPs. This means, however, that there is no easy solution to this problem from the user perspective. This raises serious concerns for the everyday user.

Professor FUKUDA describes the issues, saying, “Differences in residential network conditions can determine whether or not students can receive online education under stable conditions.”

The use of mobile data networks presents an alternative, but most current mobile data contracts are subject to a monthly data limit beyond which pay-as-you-go rates apply. So, for now, this option is too expensive for most students. In response to government calls for students to stay at home to reduce infection risk, some major mobile carriers are offering extra data up to 50 GB, at no additional charge, to anyone under 25. Looking ahead, there will definitely be a need for mobile data plans and fee structures that make it easier for students to study with a reliable Internet connection. Up until now, we have tried to avoid using costly mobile data as much as possible, but in the future it may be necessary to utilize mobile networks to help carry the excess data load when fixed-line networks are congested.

In addition to bolstering fixed-line data networks, we hope that it becomes easier for students to make effective use of smartphones for online learning, e.g., by tethering.

Ways to make more effective use of network resources

To deliver stable online education, the universities on the delivery side also need to be creative. As Prof. FUKUDA says, it is difficult to reserve band-

width and control priorities on the Internet. For this reason, it is essential to formulate ways to avoid over-concentrating access and increasing traffic. He suggests several ways of doing this.

One method, for example, is to use only still images and audio rather than video. Prof. FUKUDA explains, “It would be ideal to always have access to HD-quality video. This would make it possible to conduct interactive classes in real time with clear visual communication. But assuming that a stream of such video and audio requires 1 Mbps of bandwidth, serving 1 million connections would require a total bandwidth of 1 Tbps.”

If junior colleges are counted, there are about 3 million university students in Japan. Assuming that the approximately 6.4 million elementary, 3.2 million junior high, and 3.2 million high school students also do their schooling online, no practically achievable amount of bandwidth would be enough to meet the total demand. If we take into account household network conditions, this kind of online education would heavily concentrate traffic at certain times, leading to new issues.

Prof. FUKUDA: “However, if we stream only audio, we can cut the bandwidth we need to just 100 kbps or so, which is 10 times less. Also, since traffic is extremely low in the early morning hours, a good way to utilize bandwidth more effectively would be to automatically download teaching materials during this part of the day.

If real-time or interactive learning is not essential, students could stream or download video at different times, thereby reducing traffic congestion and bandwidth use.

To successfully implement online education, it is necessary to find ways make the best possible use of network resources. It is simply not possible to expand network infrastructure immediately without changing the methods and means of both delivery and use.

I hope that as online education expands, discussions will focus on networks, and also that guidelines to utilize network resources effectively will become widely practiced.

(Interview/Report by Katsuyuki Okawara)

Note

[1] Source: https://www.ntt.com/about-us/covid-19/traffic_archive.html#0526

[2] A network optimized for high-speed delivery of high-resolution content over the Internet

The History and Current Status of Online Classes

Opening up new forms of learning

FURUKAWA Masako

Assistant Professor, Information and Society Research Division,
National Institute of Informatics

Online education originated with correspondence courses

To prevent the spread of COVID-19, many universities and other educational institutions have introduced online classes as a form of distance learning. However, online learning is not exactly new. Since Internet use became widespread in the 1990s, it has become possible to make use of many kinds of databases and education resources online. Since then, universities have made extensive use of Internet-based educational tools and resources.

Distance learning has a surprisingly long history. Long before the advent of the Internet and as early as the 1800s, forms of distance learning were offered for studying specific subjects and skills through postal mail and telephone. Universities such as the University of London in the U.K. and the University of Chicago in the U.S. were, respectively, offering degree programs by correspondence and various correspondence courses.

Over time, communications technology improved, and by the early 1900s radio began to be used in the U.S. There were amateur radio stations specializing in educational broadcasts, and radio broad-

casts of university classes were also offered. Later, from around 1950, universities began to offer credits for TV broadcast courses.

At around this time, Professor B.F. Skinner of Harvard University developed a “teaching machine” to implement his “programmed learning” method. In later years, this would have a noteworthy impact on individualized learning methods, such as computer-assisted instruction (CAI), computer-based training (CBT), and web-based training (WBT). In 1960 the University of Illinois in-

troduced the first CBT program. Students used an intranet system for accessing their course materials and recorded lectures.

From one-way distance learning to interactive online learning

Until that period, distance learning systems had only been set up to deliver information to students, but in the 1970s, as online education evolved, these systems started to become more interactive. The Open University, the world's first higher education distance learning institution, opened in the U.K. in



FURUKAWA Masako

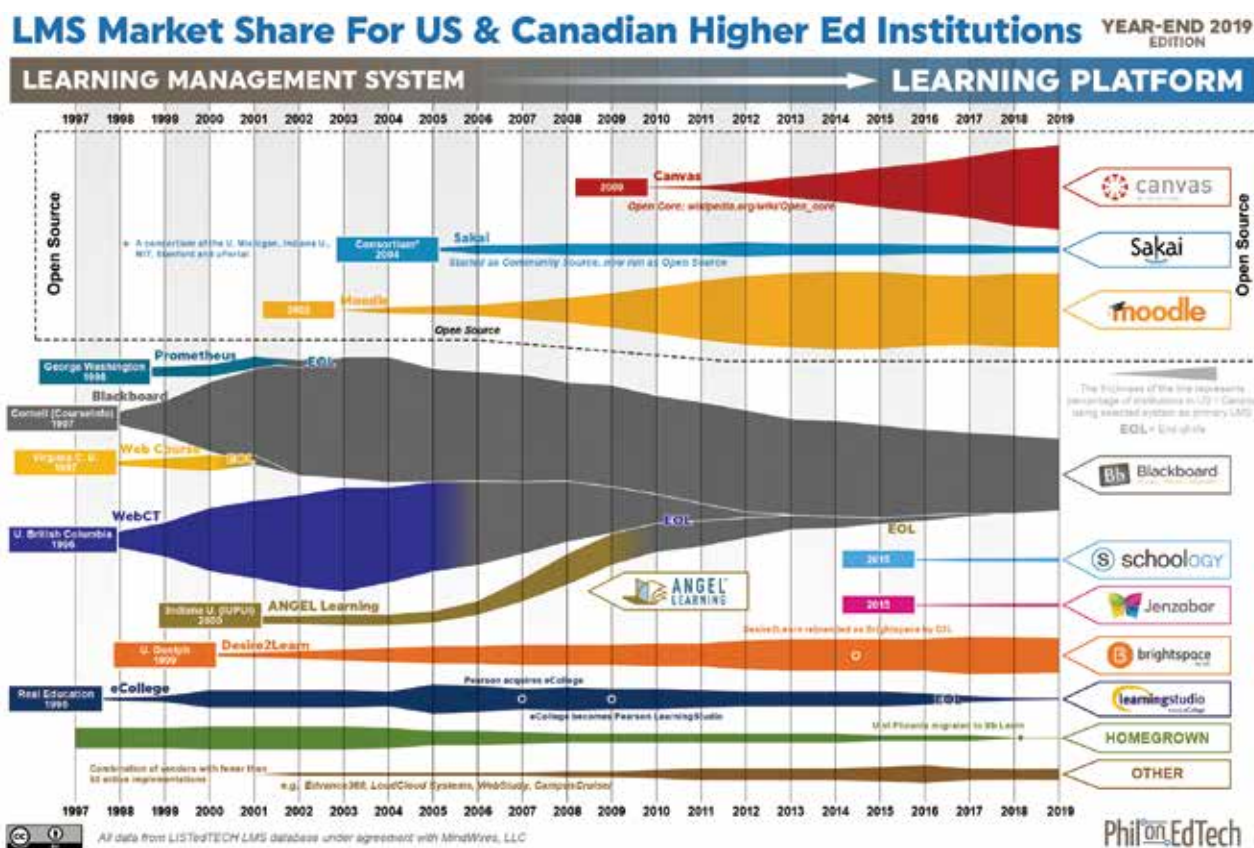


Fig. 1 Higher education LMS market in the U.S. and Canada

1969. Eventually it became the country's largest university in terms of student enrollment. Initially, the university mailed out course materials and study assistants provided learning support by mail. Decades later, when the Internet became widely available, email and other electronic services enabled much faster interaction with students.

In the 1990s, as commercial applications of the Internet began to take root, many companies began to use the Internet to explore the fields of entertainment, education, and information searching. Out of this, many platforms were developed, some of which are still battling for market share. As an example, multiple Learning Management Systems (LMS) were developed in and after the 1990s. (See Fig. 1.) Multiple LMSs are still widely used in Japan.

In the 2000s, most major univer-

sities began adding online courses to their curriculum offerings, and corporations began to use "e-learning" to train their employees.

Since around 2000, the Internet has become a vital part of modern societies. Traditional businesses and information media have increasingly migrated to online settings, and it has become commonplace for people to have their own websites and maintain their own "digital profiles" (e.g., for social media activity, viewing, commenting, tracking of shopping and other transactions).

Steady improvements in video and other media communication technologies and increasingly widespread adoption of computing devices and smartphones have driven continual developments in education. In 2002, MIT provided free educational resources through its OpenCourseWare project, and in 2007 iTunes U was launched. Stanford University and other presti-

gious U.S. universities used these platforms to deliver lectures and other content. Even individuals began to provide educational tools via YouTube, e.g., the American educator and mathematician Salman Khan, founder of Khan Academy. All kinds of initiatives were being launched.

In 2009, the YouTube EDU service was rolled out and in 2012 huge online education sites like Coursera, Udacity, and edX launched Massive Open Online Courses (MOOCs), which made hundreds of university-level MOOCs available to learners all over the world.

Today, in 2020, as part of efforts to contain the spread of COVID-19, many universities are running online classes using web conferencing tools that enable large numbers of students to connect simultaneously. In this way, distance learning, including today's online classes, have always been

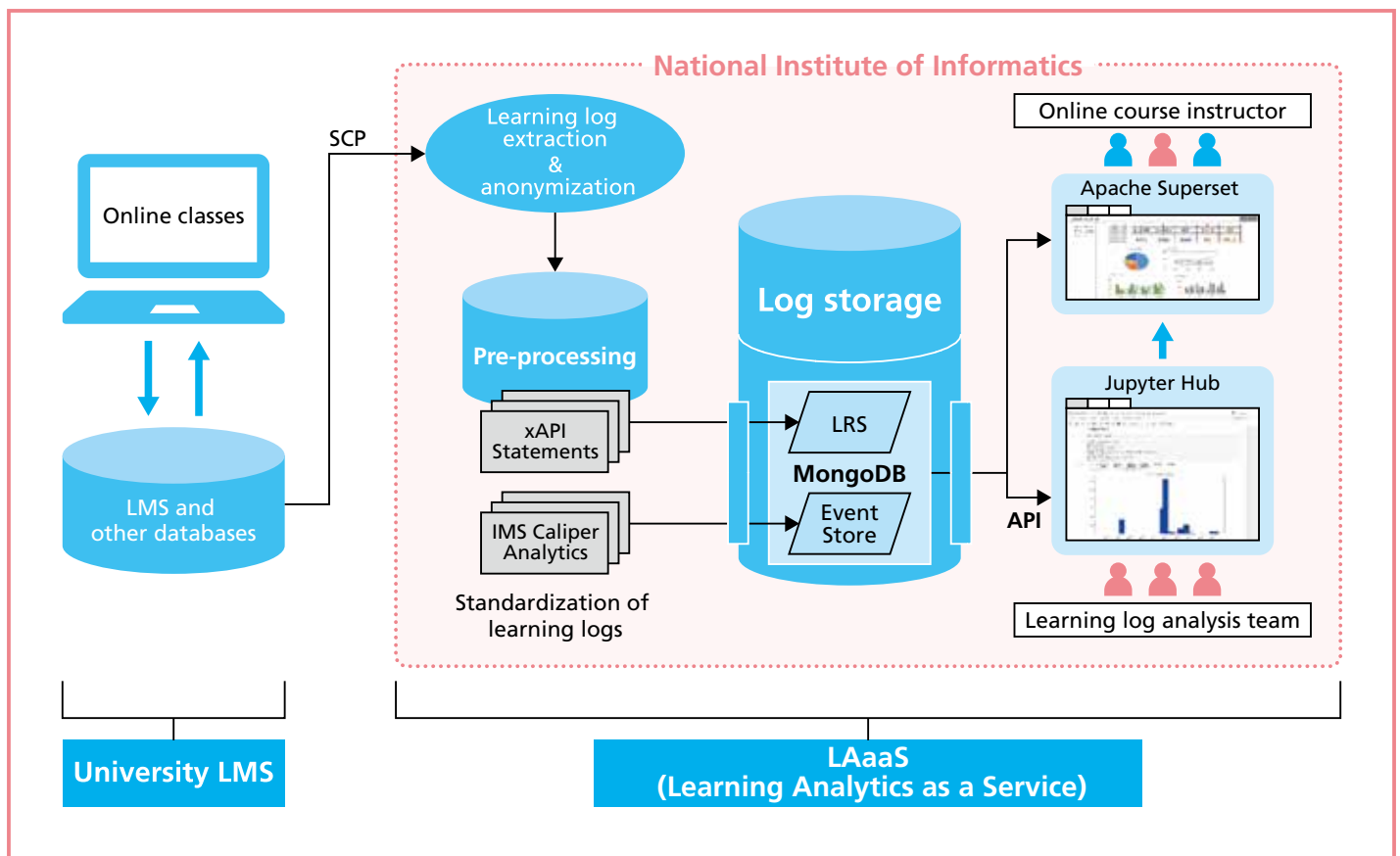


Fig. 2 NII's use of learning logs for educational support

Analysis of learning logs is important for understanding students in distance learning (as opposed to face-to-face) settings. (Source: "Improving the Quality of Online Education by Storing and Analyzing Learning Logs," FURUKAWA Masako, NII Research 100 Series, Open House 2017)

strongly influenced by the development and spread of the communication and media technologies in addition to the social conditions that prevailed at that particular time.

Using learning logs for more effective education

When learners take an online class using an LMS or other online platform, their daily learning process is recorded automatically as a learning history file (learning log). The recorded details might include how many pages of material they viewed, at what time they moved through particular pages, or how much time they spent to answer questions. Furthermore, course credits and grade information, which used to be managed on paper, can now be obtained as digital data. (See Fig. 2.) Methods for utilizing vast volume of data like this, known as "learning analytics"

(LA), are expected to open up and pave the way to new forms of education.

For learners, the benefits of using LA include the ability to optimize learning based on objective data and to save data on learning activities. For educators, LA enables them to provide guidance, to create teaching materials, and to design lessons in a way that suits individual students, and to make assessments and provide explanations on the basis of objective data. The automation of tasks also reduces the workload of teachers outside the classroom. For parents, there is the benefit of knowing the daily learning status of their children. Educational institutions are able to objectively examine ways to improve their methods of education by visualizing the effectiveness of different approaches. This can help them to create better learning environments and to opti-

mize curriculums and educational policies.

On the other hand, for LA to be truly effective, some issues need to be addressed. First, due to the wide variety of LMSs and other tools used for online learning, the learning logs that are stored in proprietary formats need to be standardized. Also, learning logs often contain personal information, so careful consideration must be given to the handling of privacy, e.g., by establishing LA policies and anonymizing data.

Online education will continue to evolve with technological advances and the demands of the times, even after the current pandemic is over. In light of this, I believe that if we utilize LA appropriately and after laying the proper groundwork, we will be better able to deliver highly effective education that meets the real needs of learners.

Expanding Possibilities with “Textbooks of the Future”

Digital archives open up new learning opportunities

TAKANO Akihiko

Professor, Digital Content and Media Sciences Research Division, National Institute of Informatics
Professor, Graduate School of Information Science and Technology, University of Tokyo

This past spring, while art galleries, museums, libraries, and other educational and cultural facilities were closed to prevent COVID-19 infections, online learning rapidly gained in popularity. In connection to this, there has been a growing interest in “digital archives,” which make available books and cultural assets via the web. TAKANO Akihiko, a professor at the University of Tokyo and NII, has been involved in a number of studies related to digital archives. We asked him about the current state of work on developing infrastructure to promote the use of information on cultural assets, and the potential of this to be used as content for education.

Better preservability, easier searching and collaboration

In May 2020, a collaboration between the Metropolitan Museum of Art in the U.S. and a popular video game company created a stir. Virtual “exhibits”

of the museum’s collections were created by incorporating them into spaces within the game. This was all made possible by the fact that the museum had available more than 400,000 high-resolution digital images of its collections, most of which are copyright-free in the public domain.

Basically, collections and archives in art galleries, museums, libraries, and archives consist of physical items made of paper, wood, cloth, or other materials, or are some kind of specimen. These items deteriorate over time and in some cases are lost. For these reasons, cultural assets and materials are being digitalized. Paper materials are converted into digital data by image scanning and OCR, while paintings, 3D objects, and structures are converted into high-definition digital images and video by means of various technologies, including color measurement and 3D measurement. In this manner, a digital archive is constructed.

Professor TAKANO, who has conducted extensive research on digital archives based on the technology of associative retrieval engines, which search information spaces using human-like association, lists the advantages of digital archives as follows: (1) digitalization enhances the permanence of precious materials and information; (2) it enables access to the information from anywhere; and (3) it makes it easier to collaborate on and share related information across disciplines since it enables instantaneous searches from various perspectives. As in the video



TAKANO Akihiko



Fig. 1 The top page of Japan Search, a cross-disciplinary integrated portal site, offers search hints.

game mentioned above, digital archives also enable completely new uses of existing content.

Cross-disciplinary searching promotes utilization of cultural assets

Digital archiving of books and cultural assets owned by cultural institutions has been ongoing in Japan since around 2000. Initially, each facility kept its own archive, but this was less than convenient. For one thing, it made cross-disciplinary use difficult. In light of this, Prof. TAKANO created the “Cultural Heritage Online”[1] (beta version in 2004, official release in 2008), operated by the Agency for Cultural Affairs. This website draws together digital representations of artworks provided by cultural institutions across Japan, including national treasures and important cultural properties, and provides one-stop searching and image viewing.

When it first opened, “Cultural Heritage Online” attracted worldwide attention as a pioneering initiative. It was followed by Europeana (2005) in the EU and the Digital Public Library (DPLA) of America (2013) in the U.S., both of which are portal sites centralizing information from numerous cultural institutions. With their enormous quantities of metadata, these portals continue to be used for practical purposes and they are recognized as successful models of digital archives. However, the presence of “Cultural Heritage Online” has faded.

Prof. TAKANO: “The remarkable thing is that much of the content collected on these two portal sites is copyright-free. There is even plenty of content that, despite not being copyright-free, can still be used under certain conditions. In contrast, Japan’s digital archives are quite rich in terms of the number of items, but they lag behind in terms of openness and international accessibility. For example, the contents of books and high-definition images are

not widely available, and explanations are only available in Japanese.

In an attempt to improve this situation, there is now a serious push to creating a larger-scale digital archive, based on the Cabinet Office’s “Intellectual Property Promotion Plan 2015.” In his role in chairing a working-level review committee that is pursuing this plan, Prof. TAKANO has been working on developing the necessary infrastructure. Particular emphasis was placed on maximizing the use of the materials; that is, making them as open as possible for free secondary use. The fruit of this endeavor is a cross-disciplinary integrated portal site called “Japan Search.”[2] The beta version of this site was released in February 2019. (See Fig. 1.)

Prof. TAKANO: “This is basically a collection of metadata about Japan’s diverse cultural resources that can be searched through in various contexts and across disciplines. Although it is still incomplete, the number of open resources has grown substantially. The tool is designed to stimulate the intellectual curiosity of users by displaying images, books, and other information related to the search results.

During the summer of 2020, we expect to release an official version of the site featuring more participating organizations and content.

Easy access to cultural assets enables learners to explore more deeply

With an ever-growing number of channels for accessing materials, the ways in which we use materials will themselves change. As an example, magazines are essentially a medium for communicating information within only a very specific period of time. When they are digitized and made publicly available, however, so that back issues are searchable on the Internet, people can use them at any time, and search through them according to the



Fig. 2 A search of the Omi Province Picture Map on Cultural Japan revealed that in addition to the official version at the National Archives of Japan, the Stanford University Library has a map of the same size created the previous year. Comparing the two maps side by side and examining their subtle differences yields new insights.

information they want.

Prof. TAKANO: “Digital archives will also bring about changes in the way physical media such as books, photos, images, and maps are used in education. Anyone can freely browse a variety of content from home and use it for their online learning, and teachers are able to create learning resources that combine materials they make themselves with materials from digital archives.”

So, how exactly can digital archives be used for learning?

Let’s say, for example, that you need to examine or inspect bones in the context of biology or archaeology studies. Up to recently, the only way to do this was to go to a museum and ask to see the actual bones, or else to look at secondary materials such as photographs. With digital archives, however, you can access museum materials from anywhere in the world, zoom in to see details, or rotate a 3D image to view it from different angles. Or, if you come across something interesting in an art history book, instead of just checking the small pictures in the book, you can search out the artist’s works, wherever they may be scattered across the world, and zoom in on the parts you want to investigate. Even the act of simply editing your own study materials, e.g., by sorting chronologically, could give rise to new insights.

Prof. TAKANO: “Digital archives enable materials to be used in almost endless ways, limited only by the motivation of educational practitioners and learners. As online education becomes more widespread, these archives are likely to become very useful as teaching resources.

In the near future, a new portal site, “Cultural Japan”[3] will be released by a team of engineers including Prof. TAKANO (see Fig. 2). This service, offering approximately one million items of content for viewing, allows users to search for information

about Japanese culture that are physically scattered worldwide. As well as making it possible to search the collections of overseas museums and other institutions in Japanese, the images conform to the IIF international framework for high-definition image publishing, so that even details that are hard to see with the naked eye can be magnified and closely examined. It is also fascinating to be able to search for images of similar shapes to the search results, as well as similar titles (using text information).

Prof. TAKANO: “By just searching and following your own curiosity, looking at the images that come up, you can discover all kinds of new things, like unexpected connections between Japan and other countries. In Japan, there is still a general reluctance to disclose information. Making information public enables it to be used in a variety of ways, which can lead to new revenue streams. Now that the legal measures to clarify the use of copyrighted works in digital teaching materials are being prepared, I hope to see Japan making more data openly available.”

I have high hopes that digital archives will become used as the “textbooks of the future,” thereby enabling deeper study and exploration.

(Interview/Report by Yuko Sakurai)

Note

- [1] Cultural Heritage Online: <https://bunka.nii.ac.jp/>
- [2] Japan Search: <https://jpsearch.go.jp/en/> (Digital Archive Japan Promotion Committee, Intellectual Property Strategy Headquarters, Cabinet Office)
- [3] Cultural Japan: <https://cultural.jp/en/>

[Other major research findings are as follows.]

- Rokusuke Ei Virtual Memorial Archive: <http://eirokusuke.nkac.or.jp/> (The Consortium for the Promotion of Broadcast Script Archives in Japan)
- Japanese Animated Film Classics: <https://animation.filmarchives.jp/> (National Film Archive of Japan)
- The Meiji Period on Film: <https://meiji.filmarchives.jp/> (National Film Archive of Japan)
- Book Map: <https://shinshomap.info/> (NII + Association Press)

Envisioning a New Society

HASEGAWA Mariko

President, SOKENDAI (Graduate University for Advanced Studies)

Although the crisis seems to have eased, I still spend most of my time thinking about COVID-19. I doubt anyone could have predicted in January of this year what the world would look like now.

I believe that this experience is giving people all over the world an opportunity to think about the foundation on which our civilization rests. There are other things that prompt us to rethink our civilization, like nuclear accidents, global warming, and plastic waste. However, the world has always tended to focus on immediate economic development, so it has not reflected on civilization, but maybe this time it will be different. Individuals living in developed and developing countries alike have been forced to change their usual way of life and behavior; they have been made aware of just how delicate the economic fabric of our civilization is.

This leads me to my response to the COVID-19 crisis as the president of SOKENDAI (Graduate University for Advanced Studies). When I took up this role three years ago, I decided that in line with the University's mission, I would give the highest priority to supporting students, leaving research to the respective re-

search institutes and laboratories of SOKENDAI. Accordingly, in response to the pandemic, the University's top priority has been protecting students from infection, developing video conferencing systems and other IT tools and services to enable students to study from home, and taking measures to aid any students facing financial difficulties as a direct or indirect result of the pandemic.

Firstly, to protect students against the risk of infection after the nationwide state of emergency was declared, we asked all SOKENDAI students to stay at home. The various departments of our university are scattered all over Japan, so the situation varies significantly from region to region. Some departments were displeased about the fact that only SOKENDAI students were asked to stay home. In my opinion, this was unavoidable, however.

When students are stuck at home, they cannot conduct experiments or attend lectures in person. It is therefore essential that they have access to a video conferencing tool for at-home research guidance and lectures. Students who live in a place equipped with good Internet connectivity are fine, but for those who do not, setting up a good IT environ-

ment is necessary. SOKENDAI has provided support for this. Although some of the support was provided the students' respective research institutes, I think we were able to provide considerable help.

There is also the issue of financial difficulty. Due in large part to the declaration of a state of emergency, many economic activities came to a standstill. There were reports from all over the country about students who were unable to continue their studies due to a sharp drop in their part-time job income or family allowance. Aside from government support, the university also raised funds to provide financial support for students suffering economically from COVID-19-related disruptions. These funds were used to provide emergency non-repayable scholarship grants. We are very grateful for the support we received from so many people in such a short period of time.

Although infections seem to have peaked, it is too early to be optimistic. Over two or three months, I think we have started to see the benefits and limitations of telecommuting using online conferencing tools, and of web-based lectures and research guidance. The notion of using more IT to work "smarter" has been proposed for years, but this concept was never implemented seriously until now. At the same time, there is also a tendency to unreasonably idealize an IT-oriented society.

Since all university lectures

have been conducted online in many universities in the U.S., there have been calls there to cut tuition fees by half based on the idea that students gain more than just knowledge through their university education. University life is about

more than acquiring advanced knowledge; it is also a place to build lifelong social skills and interpersonal relationships based on the experience of thinking and discussing together. This is something which is difficult to replicate online.

I sincerely hope that all of us will be able to make use of our various experiences throughout this pandemic as a basis for fruitful discussions about how we can create a better IT-oriented society.

(Written on June 11, 2020)

News

Online keynote speeches and poster session Open House 2020

The National Institute of Informatics (NII) Open House 2020 (research presentations, open to the public) was held online over two days on June 12 and 13. The Open House is held each year to give the public an opportunity to learn about the NII's research activities and projects. This year, to help prevent the spread of COVID-19, the Open House was held online for the very first time.

In addition to keynote speeches, dialogues, and symposiums that were streamed live over the Internet, a poster session was held in a virtual space. The "Computer Science Park," designed to give children the opportunity to learn about the concept of programming, was also conducted online. Through this, children were able to participate in interactive workshops in a virtual space.

Notes on cover illustration

In response to the COVID-19 pandemic, even robots are now attending lectures online. Although we initially had no choice when online study and work were implemented this year, we are now familiar with their benefits, so these innovations are likely to become part of a new way of life.

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Contact | Publicity Team, Planning Division, General Affairs Department

TEL | +81-3-4212-2028 FAX | +81-3-4212-2150 E-mail | kouhou@nii.ac.jp

<https://www.nii.ac.jp/en/about/publications/today/>

