

THE ROLE OF JAPANESE INTER-ORGANIZATIONAL NETWORK FOR STATISTICS EDUCATION (JINSE)

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Japanese Inter-university Network for Statistical Education (original JINSE) was founded in 2012, based on a support by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) of the Japanese government. It was a network of eight universities, in collaboration with six academic societies and eight organizations related to statistics, such as Keidanren and the Bank of Japan. When the support by the MEXT ended in April 2017, JINSE member universities started the extended JINSE in order to share our experience with more educational institutions in Japan. We describe the backgrounds of JINSE and our future plan to enhance statistics education in Japan.

INTRODUCTION

JINSE was founded in 2012, and it was reorganized in 2017. In April 2012, the Ministry of Education, Culture, Sports, Science & Technology (MEXT) announced a new funding program for joint projects among universities for reforming Japanese university education, with five-year support until March 2017. The announced maximum budget for a project was 66 million yen (about 750,000 US dollars in 2012) each year. One category for proposal was joint projects for specific fields, such as statistics. This was a good news for us, current JINSE members.

A group of statisticians immediately started to form a network and applied to this project for the following reasons: (1) the funding program seemed very attractive to statisticians, (2) when we planned a project, there was no statistics department in Japanese universities, so that this kind of joint university project was very much needed for improving statistics education in Japan, (3) for quality assurance, we were convinced that Japan Statistical Society certificates (JSSC Exam), which was just started in 2011, provides an ideal tool, and (4) we also have strong supports from industrial organizations.

Project proposals had to reflect needs from the society. It was also necessary to implement some quality assurance program in a proposal. By the time we submitted a proposal to the MEXT, we have had quite appropriate backgrounds and strong driving factors for initiating JINSE.

First of all, there had been a sturdy movement of statistical community to improve statistical education:

- (1) In the 1990s, “Special Committee of Statistical Education” of the Japan Statistical Society (JSS) undertook researches on improving statistical education.
- (2) In 2005, six academic societies specialized in statistics jointly organized the Japanese Federation of Statistical Science Associations (JFSSA) to facilitate better communication and collaboration among statisticians.
- (3) The JSS and JFSSA members occasionally made public proposals for improving statistical education in Japan, which was widely recognized, and such activities laid ground to higher public awareness of importance of statistical thinking.
- (4) In 2011, the JSS initiated examinations called JSS Certificate (JSSC) Exam to provide recognized qualifications in statistics, detail of which is described in Yoshizoe (2011) and in Takemura (2012). JSSC Exam was first designed as a tool to assure the quality of statistical education at college level. Following the revision of “Curriculum Guidelines” by the MEXT that became effective in 2012, the JSS decided to support enhancing statistical skills of high school students. Yet another request came from official statisticians and research companies. A Certification system is useful for interviewers working mainly in official statistics to improve the performance in carrying out their jobs. In the 2000s, the Japanese government had started to rely partly on private survey companies to conduct official statistical surveys. But inexpensive proposals usually imply less reliable surveys. Thus, we needed an external system that can provide appropriate judgment of the ability of statistical research companies. Research companies also wished to prove their quality to the government and other customers if their employees have highly qualified certification through JSSC.

Moreover, some statisticians in our group, who contributed to organize JINSE, had been cooperating with various organizations in statistical practice and statistics teaching.

- (1) The establishment of JFSSA in 2005 was quite timely, because it provided a common ground for collaboration among statisticians working in different fields. In Japan, no university has a department of statistics, because statistics has been treated broadly in various departments, such as mathematics and economics. Development of standard reference for statistical education helped gather momentum for promoting statistical education and external assessment, as it involved a number of government and academic institutions as well as members of JFSSA and JSS.
- (2) The MEXT has been promoting problem solving skills in education from around 2008. As it has become an urgent challenge to enhance career education and vocational education, the MEXT asked the Central Council for Education, a committee of the MEXT, in December 2008 to deliberate how career education and vocational education should be implemented at schools in the future. Five skills emphasized in a report of the MEXT are as follows: communication skill (in Japanese and in English), numerical skill (ability to work with numbers and symbols), Information skill (ability to utilize ICT), logical thinking skill, and problem solving skill (find the right problem and solve it). JINSE believes these skills are essentially related to statistics. Then, the MEXT proposed to initiate “Quality Assurance Framework for Higher Education,” and asked Science Council of Japan (SCJ) to consider subject benchmark statements framework and set up “reference standards” for various academic fields taught in universities. The SCJ requested academic societies to develop subject benchmark statements for major fields of sciences. The MEXT expected SCJ to compile guidelines similar to those proposed by the “Quality Assurance Agency for Higher Education” (QAA) in UK, which is the independent body that checks on standards and quality in UK higher education. The SCJ is the representative organization of Japanese scientist community ranging over all fields of sciences, and it consists of 30 committees corresponding to 30 academic fields. Unfortunately, however, statistics is not an independent subject in research committees of SCJ. Indeed, Mathematical statistics is only a part of mathematical sciences. Thus, statisticians in the SCJ are scattered in several disciplines such as mathematics, sociology, and economics. Since there was little hope that statistics will be treated appropriately in the reference standards of the SCJ, these statisticians gathered immediately and prepared our own “Standard Reference for Statistical Education,” JFSSA (2010), which was publicized by JFSSA much earlier than other benchmark statements by SCJ.
- (3) In parallel with higher education, the MEXT was revising the official guidelines for high school curricula to take effect since 2012. In this revision, teaching of statistical thinking and data analysis at high school level was emphasized for entry-level mathematics. The revision was motivated by a concern about the gradual decline in international ranking of Japanese students in performance in numerical thinking. An example was the result of PISA (Programme for International Student Assessment) conducted by the OECD. MEXT expressed that Japanese high school students should be equipped with quantitative skills, and in the revised version of “Official Curriculum Guidelines,” the importance of statistical thinking and data analysis was emphasized.
- (4) With increase of demands for data analytic research contracts, research companies have been in need of objective means for assessing the quality of their employees handling statistical data. Since the Japanese government had begun out-sourcing some portion of statistical survey operations to private companies, private companies who are interested in getting contracts needed a means to prove their quality level. In the absence of a commonly accepted system for assessing statistical skills by an independent body, a new system of examinations and qualifications in statistics became necessary. The JSSC Exam became available then.

To summarize, there were increasing demands for statistical skills in Japanese society around 2010 just before we started JINSE.

FORMATION OF JINSE

The result of selection by the MEXT was announced in September 2012, and our proposal was accepted. As we expressed our intention to establish “Japanese Inter-university Network for

Statistical Education” (JINSE) in the proposal, we immediately formed JINSE. The structure of JINSE when it started was as follows:

$$\begin{aligned} \text{JINSE} &= 8 \text{ Universities} + 6 \text{ Academic Societies} + 8 \text{ Related Organizations} \\ &= \text{Steering Committee} + \text{Advisory Board} + 4 \text{ Committees} \ \& \ 2 \text{ WGs} \end{aligned}$$

Cooperating Universities

In 2016, Shiga University joined JINSE, partly suggested by the MEXT, when it was preparing to start a new department for statistics and data science. In the final year of the MEXT support, the universities forming JINSE were as follows:

University of Tokyo, Shiga University, Osaka University,
The Graduate University for Advanced Studies,
Aoyama Gakuin University (head of the partnership), Tama University,
Rikkyo University, Waseda University, and Doshisha University.

Associating academic societies

Six academic societies that form JFSSA have been supporting JINSE. They are:

- Japanese Society of Applied Statistics,
- Japanese Society of Computational Statistics,
- The Biometric Society of Japan,
- The Behaviormetric Society of Japan,
- The Japan Statistical Society, and
- Japanese Classification Society.

Since most statisticians are members of at least one of these academic societies, their support to JINSE was quite strong.

Associating organizations

Some of JINSE members have been working with various organizations that use statistics extensively, and the following 8 organizations have explicitly supported JINSE, and called “associating organizations” by the MEXT:

- National Center for University Entrance Examinations,
- The Institute of Actuaries of Japan,
- Union of Japanese Scientists and Engineers,
- The Bank of Japan,
- Keidanren (Japan Business Federation, which is a comprehensive economic organization with a membership comprised of a number of large representative companies of Japan as well as nationwide industrial associations)
- Japan Pharmaceutical Manufacturers Association,
- Japan Statistical Association, and
- Japan Marketing Research Association.

All of these organizations have strong influence on the Japanese society, and supported JINSE activities in various ways. For example, the Bank of Japan sent JINSE two experienced researchers who have worked with statistical data analysis for a long time. They were appointed as professors at Aoyama Gakuin University and helped us develop teaching material.

STRUCTURE OF JINSE

Just after JINSE started, statistics suddenly became a hot topic in the Japanese news media. A popular business book titled *Statistics is the Strongest Science* sold nearly half a million copies, popular business magazines featured statistics as a special topic several times, and NHK (Nippon Hoso Kyokai, or Japan Broadcasting Corporation) televised a special program on statistics and big data, inviting a few members of JINSE. Although some people claim that the computers and algorithms can handle big data so that they do not need statisticians, we tried to emphasize that the contributions from qualified statisticians are vital to keep the quality of data analysis reasonably high. We recognized that the shortage of statisticians in Japan is really serious.

We carried out JINSE project following the PDCA cycle shown in Figure 1.

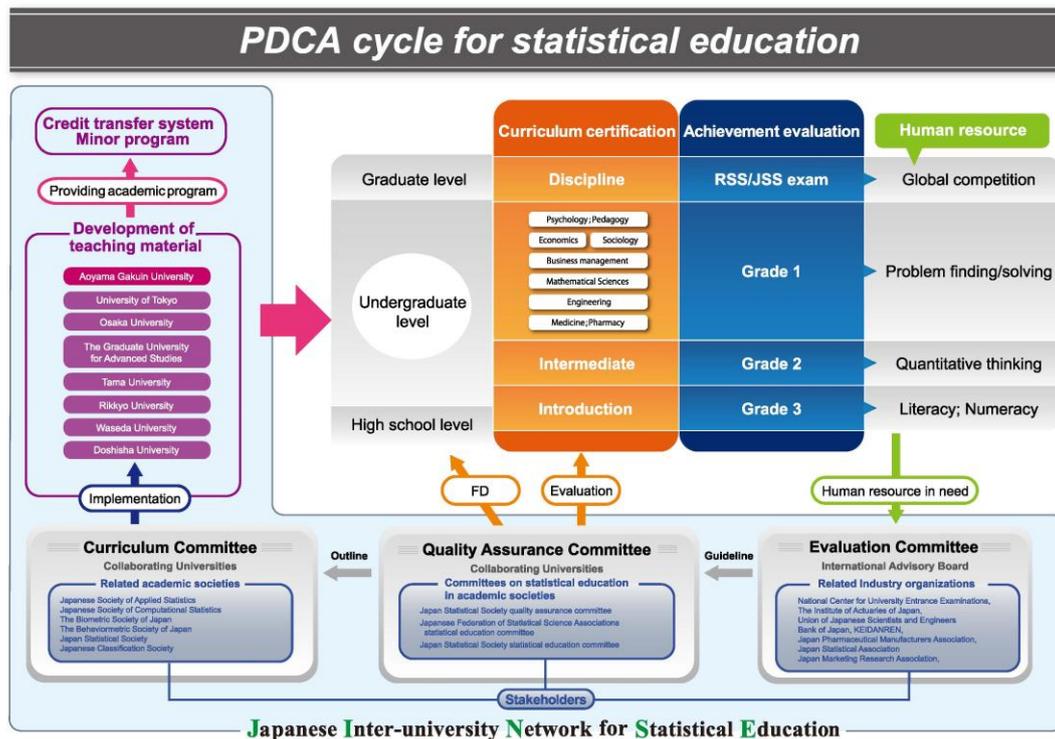


Figure 1. PDCA cycle of JINSE project in the proposal to the MEXT (2012)

The broad cooperation among universities, academic societies and associating organizations is perhaps the most unique feature of JINSE. The associating organizations gave us advice concerning what kind of statistical skills are necessary in industry and government, and the academic societies helped us control the quality of the curriculum.

First step of the PDCA cycle in Figure 1 was carried out by the Evaluation Committee consisting of members from the associating organizations. They had heated discussion and published a report describing their advice concerning what kind of statistical skills are actually required by various industries and by the government. They also played a role of evaluating the outcome and made appropriate suggestions throughout JINSE activity during the five years.

The second step was to compile appropriate subject benchmark statements for statistics, following the advice given by Evaluation Committee. The Quality Assurance Committee revised the subject benchmark statements, JFSSA (2010) cited above, to reflect the advice.

The third step was to set up appropriate syllabuses for statistical theory and for various fields of applications. Half of the members of the Curriculum Committee were recommended by each of JINSE universities. Another half of the members were recommended by each of JFSSA societies. They played an important role of preparing vast amount of teaching materials.

The fourth step consists of statistics teaching at JINSE universities, where we applied models of syllabuses and used teaching materials developed by JINSE members. In this step, JINSE universities were explicitly assisted by the JSS that cooperated with us to modify JSCC Exam to suit the purpose of JINSE. It was made possible to assess the achieved improvement in statistical education carried out by JINSE universities objectively and appropriately.

At the final step of the PDCA, the performance of JINSE was checked by the Evaluation Committee, as well as by the International Advisory Board. The latter consists of leaders in promoting statistical education such as Jim Albert, Neville Davies, Iddo Gal, Joan B. Garfield, Rob Gould, Tae-Rim Lee, Hans-Joachim Mittag, Roxy Peck, Jessica Utts, Ronald L. Wasserstein, Chris Wild. All of them gave JINSE valuable advice. Through the advisory board and other means, JINSE intended to cooperate with similar organizations in other countries.

ACHIEVEMENT OF JINSE

JINSE project was administrated by the Steering Committee consisting of representative members from JINSE universities and chairpersons from three committees, where Yoshizoe was the leader. We closely followed the PDCA cycle always supported by associating academic societies and organizations. The activities of JINSE in its early stages are described in Takemura & Yoshizoe (2013) and in Yoshizoe, Takemura & Kawasaki (2013). Our major activities are summarized below.

Standard Curriculum and Learning Contents

During the five-year support period by the MEXT, JINSE developed standard curriculum and learning contents. They are available through our Japanese website. Currently, our English website, http://www.jinse.jp/old/index_en.html, contains some English materials.

- Core curriculum
- Humanities (Psychology & Education)
- Political science
- Sociology
- Economics
- Business
- Mathematical sciences
- Quality control
- Biology
- Medical pharmacy
- Demographic statistics
- Data source for teaching statistics

Excerpts from teaching materials are available, examples are:

- Introduction to Statistics (Waseda University, School of Political Science and Economics)
- Statistics (Waseda University, School of Political Science and Economics)
- Statistics (Tama University, School of Management and Information Sciences)
- JINSE FD Lecture open to the public (University of Tokyo), Speaker: Neville Davies

Use of JSSC Exam

JINSE used JSSC Exam as a tool to evaluate improvement in leaning and teaching of statistics. After JINSE started, JSS and JINSE cooperated to contribute to improving statistical education, enhancing students' statistical thinking, and improving capabilities of society at large to produce and use statistics appropriately. Every year, JINSE university students took JSSC Exams to provide us with their exam results for statistical analysis, through which we found where students have difficulty in understanding topics of statistics, and modified teaching materials accordingly. Thus, JSSC Exam have been used to measure our achievement in statistics education. In this way, JINSE and JSS closely collaborated to enhance statistics education through JSSC Exam. The number of applicants for JINSE version of JSSC Exams are as follows:

| | | | |
|---------------|-------|---|---------------------|
| 2012 November | 821 | | |
| 2013 November | 1,111 | | |
| 2014 June | 665 | / | 2014 November 855 |
| 2015 June | 1,023 | / | 2015 November 1,266 |
| 2016 June | 941 | / | 2016 November 856 |

Symposia, Workshops and Meetings

JINSE hosted a number of symposia, workshops and various kind of meetings every year, where researchers, educators, entrepreneurs and official statisticians gathered to exchange ideas. These symposia are described in our website, although most of them were conducted in Japanese. JINSE also offered various workshops to enhance communication with statisticians from all over Japan and overseas. Some presented materials can be seen in our website. Following are the titles of JINSE symposia “Statistics is better than debate,” which we gave every year after a memorial symposium held in 2012.

- 2013: How to contribute to the society as statisticians
- 2014: Fostering human resources with data scientific skills
- 2015: Data science solves challenging social issues
- 2016: Activities toward improving statistics education

Publication by JINSE

JINSE has published a number of brochures, which can be seen through JINSE archives website. Major reports are as follows:

- Report on the JINSE Activity, every year from 2012 to 2016
- Report of the Evaluation Committee
- Report of the Quality Assurance Committee,
- Subject Benchmark Statements for Statistics, revised edition
- Report of the Advisory Board
- Quality Assurance of Statistics Education and Analysis of JSSC Exam
- Questions and Comments for Quality Assurance of Statistics Education, Part 1 to Part 3

INTERIM ASSESMENT OF THE JINSE PROJECT BY THE MEXT

In April 2014, the MEXT conducted “interim assessment” of all projects that were accepted in 2012, and JINSE received the highest “S” (superior) grade, with the following “general overview”: The project has been carried out beyond the expectation from the proposal, and by keeping the current efforts, the purpose of this project will be successfully accomplished.

The assessment committee also gave us the following comments, which precisely agreed with our purpose.

- (1) Use of JSSC Exams to objectively assess the achievement in statistics teaching is highly rated.
- (2) Cooperation with statistical societies and related organizations is effectively functioning, which is also highly evaluated by committee members.

CONCLUSION

In April 2017, we expanded JINSE and located its executive office at Japanese Association for Promoting Quality Assurance in Statistics (QAJSS). QAJSS is an incorporated foundation established by the JSS when we started JSSC Exam. New JINSE stands for Japanese Inter-organizational Network for Statistics Education, implying that JINSE will accept all educational institutions and organizations that are interested in statistics education. Currently, extended JINSE has organizational members such as universities, departments and high-schools, as well as a few individual members.

JINSE continues to cooperate with academic societies and associating organizations, and provides detailed results of JSSC Exam for its members, so that members can analyze the exam results to improve their teaching skills. JINSE also has a plan to start some accreditation system for university statistics courses in the future.

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