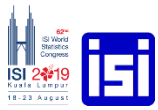

< Status of Statistics Korea's School Statistics Education Support Program>

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Abstract:

There is a growing interest in science, math, and technology education around the world. Statistics Korea is also making great efforts to promote statistical literacy in schools. Developing students' statistical literacy can support rational decision-making in complex and uncertain situations. Furthermore, statistical education of students, the future generation, is important to expand the base of national statistics. In addition to providing specialized training for national statisticians through the Statistical Training Institute(STI), Statistics Korea is also actively promoting statistics education for elementary, middle and high school students. In particular, with regard to the education of students, it operates various educational programs to cultivate statistical thinking in everyday life and enhance problem-solving skills. In the following, we introduce the statistical education programs of Statistics Korea, focusing on educational content development, student and teacher education, and the National Statistics Competition. In doing so, we will share the experiences of Statistics Korea over the past 30 years of statistical education in schools and explore the future direction of the program.

Keywords: statistics education, statistics poster, statistics literacy, data literacy, KOSIS, SGIS

1. Introduction

In order to capture rapid technological development and changes in the economic and social environment, more and more national statistics are produced by statistical organizations in each country, and the role of national statistics offices is gradually expanding. In line with this trend, the target audience for statistical education has also been expanding. In addition to national statistics, Statistics Korea puts a lot of effort into statistical education for students. The most important part of statistical education is to improve the quality of national statistics by raising the professional competence of the people who produce national statistics.

In addition, the importance of students' statistical data literacy is increasingly emphasized as we rapidly move towards a data-driven society. Today, statistical thinking is becoming an essential skill not only for statisticians, but also for students, teachers, and the general public. In collaboration with frontline schools, Statistics Korea has been operating various curricula to foster students' data-driven problem-solving skills. In this paper, we introduce various educational programs of Statistics Korea, including its experience in running statistical poster competitions, and explore the changes and future directions of practical statistics education.

2. Overview

Statistics education in elementary and secondary schools in Korea is being reorganized from the traditional focus on theory, calculation, and entrance exams to allow students to experience statistical thinking and problem solving in real life. According to the 'Mathematics Education Plan (2020~2024)' prepared by the Ministry of Education, new technologies such as artificial intelligence (AI) and data science are emphasized along with participatory, real-life applied education where students experience data-based statistical problem-solving processes. The newly elected government of South Korea has also made systematic fostering of digital talents in education a key national goal to respond to the era of digital transformation.

In line with this trend, Statistics Korea, together with the Ministry of Education, has been working to revitalize statistics education in schools to foster digital-age talent and improve statistical thinking and data literacy.

Statistics Korea's school statistical education program is being promoted in various ways. First, it operates a systematic education program through the establishment of a collaborative system between relevant departments such as the Ministry of Education, the Ministry of Education, Statistics Korea, and frontline schools. Second, the National Statistical Office develops and disseminates statistical education contents such as school textbooks and statistical packages for students. Lastly, it provides direct training for teachers and students and runs educational programs such as the National Statistics Competition. In the following, we will discuss the details.

3. Statistics Korea's School Statistics Education

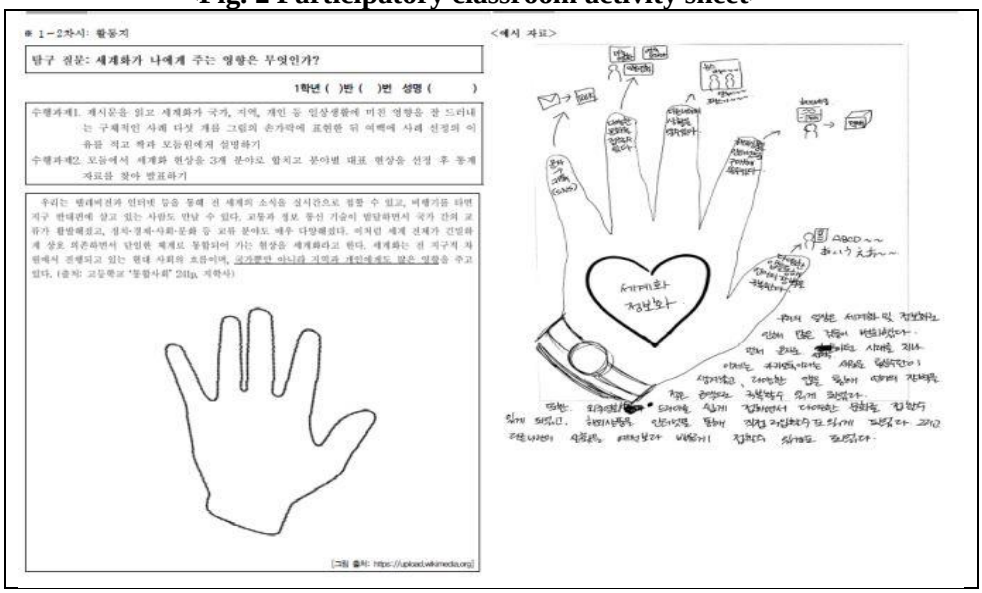
3.1. Development of Statistical Contents

3.1.1. Textbooks and teaching and learning materials

Statistics Korea distributes textbooks and teaching and learning materials for students to improve their understanding of statistics and learn how to solve statistical problems. It aims to develop the ability to acquire and utilize statistical literacy in daily life through the distribution of activity-oriented practical statistical education materials that can be used directly in school classes. Under the premise that improving teachers' capabilities is essential for fostering students' statistical thinking, we organized a writing team with relevant competencies, including current teachers, to develop teacher-friendly teaching and learning materials. The high school textbook, "Practical Statistics," is composed of units such as "Statistical Problems and Data Collection," "Analysis and Interpretation of Data," and "Understanding and Processing of Big Data" to help students develop data collection, analysis, visualization, interpretation, and prediction skills. In addition, we provide support through textbooks and teacher training.

<Fig. 1 Introduction to teaching material >

<Fig. 2 Participatory classroom activity sheet>



3.1.2. **Statistics Packages for Students**

There has been a problem that the current elementary, middle, and high school statistics education is centered on theory and calculation, and students lack an understanding of how to apply statistical phenomena in their daily lives. In 2015, the Ministry of Education revised the mathematics curriculum and emphasized the use of engineering tools (statistical packages) optimized for student statistical education to reduce the learning burden of students and reorganize statistical content centered on real life.

Statistics Korea developed and disseminated an engineering tool ("Tonggrami") in 2016.(http://tong.kostat.go.kr) “Tonggrami” encourages students to participate directly by supporting questionnaire creation, data collection management analysis, result interpretation, and report writing. It helps students improve their information literacy skills to express and communicate their thoughts in various forms. In particular, with the recent increase in interest in statistics such as big data, and the reorganization of elementary and secondary school statistics education into a participatory practical statistics education where students experience statistical thinking and problem-solving processes, the demand for engineering tools has increased dramatically. Project-type lessons using circles and statistical posters and various analysis cases using statistics are included in middle and high school math textbooks to help students experience the statistical problem-solving process in regular classes.

<Fig.2 Introductin to Tonggrami site >

3.1.3. Teacher training for the spread of statistics education

In order to cultivate statistical literacy and statistical literacy, statistical education for students, the future generation, is essential. To do this effectively, it is necessary to improve the statistical thinking of teachers who directly teach students in schools. Statistics Korea's teacher training program aims to improve the statistical literacy and teaching skills of frontline teachers, and to establish a statistical mindset so that they can creatively teach students useful statistics in their daily lives.

The Institute of Statistics has been conducting teacher training since 2011, and since 2016, it has developed and operated a project-based statistics class program in cooperation with the Ministry of Education. Teacher training is divided into two main programs. There are two types of teacher training programs: elementary and high school teacher statistics training and practical statistics teacher training. The elementary school teacher statistics training focuses on discussing the process of forming a statistical mindset and delivering educational contents that need to be delivered in the field, such as motivation and solution techniques. It explains how to solve statistical problems such as questionnaires, data management, and statistical analysis using statistics and circles that can be effectively applied in the school field. This course also teaches students how to create statistical education posters. Participants will have the opportunity to practice the entire process of creating a poster, including selecting a topic for a statistical poster, setting a hypothesis, and discussing how to create a questionnaire.

The Practical Statistics Teacher Training Program, which started in 2020, provides training on how to utilize practical statistics textbooks developed by Statistics Korea. The course covers data and samples, data collection, data analysis, data representation, and statistical estimation and testing, along with an introduction to the statistical problem-solving process. It also introduces big data processing, text mining, and data visualization, which have been emphasized recently.

3.1.4. Student Education

Statistics classes to improve students' understanding of statistics have been held annually since 1998. It is aimed at elementary, middle, and high school students and is conducted as a discussion-oriented participatory class.

<Table. 1 Examples of project-based statistics class topics>

daily life area; -Which restroom stall do students prefer and why? -How do students take care of their umbrellas? -How much do students spend on pocket money? -Independence, when is it good? experimental area; - How long does a minute really feel like to people?

3.2. National Statistics Poster Contest in Korea

3.2.1. **Overview**

A statistical poster is a one-page poster that summarizes the results of a topic and its exploration (analysis). It should include the topic, problem statement, problem solving method or research method, statistical analysis results, discussion, and conclusion. The National Statistical Office, through the Statistical Education Institute, holds the National Statistical Utilization Contest every year. This is to expand the base of national statistics and raise awareness of the importance of national statistics by exposing elementary, middle, and high school students to the use of statistics.

It aims to develop problem-solving skills and statistical literacy among elementary, middle and high school students and young people of the same age by participating in data collection and analysis and creating statistical posters. The statistical poster competition is open to students in grades 4-5-6, middle and high schools, and youths of the same age nationwide. Teachers and up to three participants will work in teams to submit statistical posters that they have planned, researched, and produced on an open-ended topic. It is characterized by free narrative according to the topic and approach.

< Table. 2 Statistical Poster Frame>

① Selection of topics (questions) ▪ A topic that can be clearly defined, making it easy to gather relevant data ▪ Fun and creative topics that people will be interested in ▪ Topics that are easily understandable and have clear conclusions ② Data collection for problem solving ▪ The data should be representative of the general situation. ③ Data analysis and graph ▪ Data is analyzed directly or using computer programs. ▪ Data should be summarized and explained using figures, graphs, and tables. ▪ Synthesized/analyzed data should be included, not raw data. ④ Interpretation of statistical results ▪ Include a description of the meaning of the material ▪ In the case of data directly investigated or tested, all conditions must be specified. ▪ Problems in the data can be specified, and improvements and solutions can be suggested. ⑤ Conclusion, Suggestion ▪ Participants should have a conclusion based on the research content, research method, and main results and results.

3.2.2. **Competition Judging Criteria**

Judging will be conducted in two stages. The judges are statisticians and in-service teachers, and the first stage is written and the second stage is presentation. The judging criteria will be finalized annually through an advisory meeting. The judging criteria are creativity, exploration, rationality of problem solving, statistical analysis and results, and appropriateness of expression.

< Table. 3 Criteria of Statistical Poster Contest >

creativity, inquisitiveness ① Is the research topic and idea original? ② Did you think from various angles and try to express it? ③ Did you effectively solve the topic you want to know? logical validity ① Is the topic you want to convey clear? ② Is there any problem in logic development? ③ Are the conclusions reasonably drawn from the collected and analyzed data, and are the contents valid? Statistical analysis validity ① Have you made a plan and collected data according to the research topic? ② Did you select a reasonable data collection method? ③ Was statistical analysis appropriate for the collected data performed? ④ Is the statistical analysis method or expression correct?

⑤ Do you properly understand the analysis method or results?
⑥ Did you properly use the statistical techniques of the regular curriculum?

Expressiveness (Effort)
① Are statistical posters designed to attract viewers' attention?
② Has the content been considered to be delivered well?
③ Has the content to be delivered been sufficiently explained?
④ What efforts did you make to solve the selected topic and problem?

3.2.3. **Result of the Contest**

Student interest in the Statistical Applications Competition is very high. In 2019, 2167 teams participated, but in 2020, which was held entirely online due to COVID-19, 1253 teams participated. For the 24th edition in 2022, a total of 1,469 teams, including 351 elementary, 472 secondary, and 646 high school teams, participated with their teachers from all over the country. After the judging, 116 teams were selected as winners. The winning teams will be eligible to represent Korea at the International Statistical Poster Competition organized by the International Statistical Institute (ISI) every two years.

As for the topics of the winning entries for the 24th edition of the competition in 2022, the elementary school team examined the satisfaction with school playgrounds and suggested improvements to our school playgrounds. The secondary category explored the seriousness of climate change and how to change young people's perceptions through carbon neutrality education. The high school category addressed the increasing amount of recyclable waste, including plastics, bottles, and cans, and how to effectively separate recyclables.

As the contest has progressed over the years, it has moved beyond the simple use of math and statistics to cover a variety of topics in everyday life and analyze information. In particular, a number of works that drew differentiated topics and conclusions stood out, and many works were submitted with excellent content delivery based on experiments and investigations that fit the characteristics of the data and the purpose of the analysis.

3.3. Provision of statistical services for students

We would like to briefly introduce the statistical services for students provided by Statistics Korea. Statistics Korea has developed 「KOSIS Statistical Playground」 and 「SGIS Edu」, which allow students to experience statistics in an easy and fun way and can also be utilized in school classes, and provides them as a service to the public, including students and teachers.

<Figure 4 : 「KOSIS Statistics Playground」 and 「SGIS Edu」>

3.3.1. KOSIS Statistics Playground

KOSIS (KOrean Statistical Information Service, https://kosis.kr) is a representative statistical portal site in Korea that collects state-approved statistics produced in Korea and major international and North Korean statistics in one place so that users can find the statistical information they want at once. In addition, KOSIS provides a shared service (Open API) so that the statistical information provided by KOSIS can be used in various ways, and develops and provides various visualization contents every year so that the public can easily understand and feel familiar with statistical information.

Recently, in response to the growing demand for content to support the fostering of future talents with data literacy and problem-solving skills, which are core competencies in the 4th industrial era, KOSIS Statistics Playground, a statistical service for children, was developed and has been in service since

February 2022. "KOSIS Statistics Playground" was built from the perspective of the consumer by listening to various opinions of the public, including education experts, elementary school teachers, and children, and was operated with channels for children to directly participate and present ideas, collaborate with consumers, experts, and related organizations, and participate. We organized the pages in a child-friendly format and made it easy to use on mobile devices that children use a lot. The core services are visual statistics, speaking with data, and project-based statistical learning. The "KOSIS Statistics Playground" updates the statistics printed in textbooks with the latest data in connection with the National Statistics Portal (KOSIS), which contains all nationally approved statistics. Through this service, it is expected that children can naturally acquire data utilization and interpretation skills by using reliable statistics.

3.3.2. SGIS EDU

SGIS (Statistical Geographic Information Service) is a statistical platform that can be utilized by linking and fusing spatial statistical data produced by utilizing general surveys of Statistics Korea and public and private data. The Statistical Geographic Information Service (SGIS) is a service that can conveniently utilize statistical geographic information on a map by linking and fusing census spatial DB and public and private data built as a result of statistical surveys, and develops and provides contents every year.

SGIS EDU is an educational content provided by Statistics Korea to make it easy and convenient to utilize statistical geographic information during school hours. In particular, it is characterized by the ability to easily understand and utilize statistics visually while experiencing statistical geographic information in the educational field in connection with elementary, middle, and high school curricula. In addition, the content is organized so that students can learn how to create statistical maps by themselves, and teaching and learning materials in the form of workbooks have been developed and provided to help frontline schools actively utilize statistical geographic information using 'SGIS edu'.

4. Discussion and Conclusion

Statistics Korea has endeavored to improve the content and methods of statistical education in schools. In this process, it has made achievements in connecting national statistics with school sites. Based on the know-how gained over the past 30 years, it is necessary to develop programs that are more user-friendly for teachers and students. In addition, it is necessary to actively utilize rapidly changing digital technologies and platforms. This is in line with the digital talent development strategy that the Korean government has been actively promoting recently. For example, the Korean Statistical Institute could maintain the tradition of the 24-year-old statistical poster competition while applying the latest technologies such as Metaverse to increase student interest. As the importance of digital literacy is increasingly emphasized, it is necessary to strengthen cooperation with related departments such as the Ministry of Education and the Ministry of Science and Technology to spread statistical education.

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