STATISTICS LEARNING ENVIRONMENT FOR STUDENTS THROUGH JAPANESE CENSUSATSCHOOL PROJECT

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ABSTRACT

Since the Curriculum revision in 2008 and 2009, statistics education in Japan is improving gradually. Number of teachers who have concerned with statistics education, develop and try new lessons has been increased. But the usage of software in statistics lessons is very limited. Many teachers teach statistics only with papers and pencils in traditional style. In this paper, what kinds of obstacles for teachers in Japan to teach statistics especially focused on software use are reported firstly. Secondly, we note needed supports for them, 1) Statistical software (or function) accessible without install process, 2) GUI which enable for teachers and students to analyze data intuitively, 3) Interesting dataset which can enrich students' data analysis activities and lessons. Finally, we report construction and new system of Japanese CensusAtSchool website to match those demands.

1. INTRODUCTION

In the last school curriculum revision, Japanese mathematics curriculum includes more statistical contents than before, through elementary and secondary level. Those curricula have already implemented from 2009 for elementary and lower secondary level, and 2012 for upper secondary level (Ministry of Education, Culture, Sports, Science and Technology-Japan, 2008a, 2008b, 2009). In the new curriculum, concepts of practical use of statistics are emphasized which is reflecting the international movement in statistics education.

Very few teachers had known how to teach statistics in such way when the curriculum was published. To overcome such problems, Ministry of Education, community of teachers, some academic societies related to mathematical, statistical, and educational gave many kinds of supports for them. Those were seminars for teacher training, symposium which titled statistics education, teaching resource or examples through internet, and so on. Teachers' conscious and understanding of what is statistics education are improving gradually in recent years. Japanese CensusAtSchool is one of supporting projects which are implementing by Japan's Statistical Society to provide rich learning environment of statistics for teachers and students.

In this paper, what kinds of obstacles for teachers in Japan to teach statistics along with

new concepts of statistics education, especially focused on software use in school, and support measures for that through Japanese CensusAtSchool Project are reported.

2. OBSTCLES OF SOFTWARE USE IN JAPANESE STATISTICS EDUCATION

2.1 SOFTWARE USE IN JAPANESE STATISTICS LESSONS

Although software as data analysis tool is essential to teach statistics, teachers who use software when they teach statistics are very rare in Japan. Matsumoto (2010, 2012) have surveyed about status of utilization of software and teachers' consciousness with software. He sent questionnaires to more than 200 schools in five prefectures. Teachers have asked how many hours they used software when they taught statistics. Table one and table two shows the length of software usage of grade seventh and ninth teachers respectively. Because there is no content of statistics in grade eight (only probability), Matsumoto did not surveyed in grade eighth teachers.

Table 1: Time of software usage from seventh grade teachers (n=135)

Time of software use	Proportion (%)
Zero	73.9
One hour	7.5
From two to four hours	6.0
From four to Six hours	2.2
Six hours and more	3.7
No answer	6.7

Table 2: Time of software usage from ninth grade teachers (n=161)

Time of software use	In PC room (%)	In normal room (%)
Zero	93.2	91.3
One hour	4.3	5.0
From two to four hours	0.0	0.6
From four to six hours	0.6	0.6
From Six to eight hours	0.6	0.6
From eight to ten hours	0.0	0.0
From ten to twelve hours	0.0	0.0
No answer	1.2	1.2

As shown in the tables above, most teachers didn't use software when they taught statistics. It is important to note that all schools have one or more computer rooms which they can use for lessons if they want. The small proportion of software usage is the result of each teacher's choice, not of the facilities of their schools.

One of the reasons why they don't use software in the classroom is their confidence in using statistical function with software. Following table shows the result from another questionnaire item from Matsumoto's survey. Number of column of "Confident" is the sum of participants who answered "Confident very much" and "confident", also "Not confident" is the sum of participants who answered "not so confident" and "not confident at all".

Table 3: Teachers' confidence in operation of software

Kind of operations	Seventh grade teachers (n=135) (%)		Ninth grade teachers (n=161) (%)	
	Confident	Not confident	Confident	Not confident
Calculate mean	86.6	11.2	85.7	13.0
Frequency table make	54.5	44.0	52.8	45.9
Pie graph and line graph draw	55.2	43.3	52.2	46.5
Histogram draw	50.8	47.0	46.6	52.1
Statistical software	23.9	73.9	22.9	75.8

It is natural for teachers to avoid the situation which they are not confident. They need to know how to operate software itself as one user and also to know how to coordinate students' activities with software as one teacher. If a teacher is not confident as user, he cannot choose such software at his class. Teacher training program are urgent problem in statistics education in Japan.

There are other obstacles to use software in classroom. Access permissions with computers in schools are extremely limited for teachers and students. All users, even for teachers, can use computers only with "guest account". So, teachers cannot install any software to school computers because of their account permission. Students' work with software (ex. excel data) will be deleted when they shut down. In many schools, to connect USB media is not allowed because of security reason. In such condition, to distribute the data which will be used in the classroom becomes much more difficult. This is one of the reasons to keep teachers away from software use.

2.2 NEEDED SUPORTS FOR TEACHERS

There is a variety of obstacles for teachers to teach statistics and use software. Teacher training programs for statistics education and how to use software are required, of course. Those will be held in many communities, and some of those are provided by Ministry of Education. It will take long time. Teachers also need rapid support for tomorrow's lessons.

From the research result of their conscious and capabilities to use software, following three points are essential to improve current condition.

- Statistical software (or function) accessible without install process
- GUI (Graphical User Interface) which enable for teachers and students to analyze

data intuitively

- Interesting dataset which can enrich students' data analysis activities and lessons

One reason why the proportion of the confidence of teachers in drawing histogram with software is so small (see table 3) is that the procedure to draw a histogram with Microsoft Excel is too complex for ordinal teachers. To support those teachers, Excel VBA macros for histogram, simple software specialized to draw histograms which is not needed to install, but just needed to download and decompression, and also some programs which work on the browser are provided from societies or researchers.

Japanese CensusAtSchool has a potential to give rich educational environment with data sources and situations. One weak point is needed process for lessons: that is 1) access the website, 2) download a random sample, 3) analyze the sample with other software. It will become a big barrier for them at the current situation. Special Committee of Statistics Education in Japan Statistical Society has decided to mount a graph drawing system on the website connected with CensusAtSchool database to overcome this obstacle. UK CensusAtSchool has such system already, and they have accepted to give the system to Japanese CensusAtSchool. But unfortunately, because it have been too difficult to transport the system to our server, we developed own program. It has been activated from March 2013.

3. FEATURES OF JAPANESE CENSUSATSCHOOL PROJECT WEB SITE

Japanese CensusAtSchool site has similar structure with other countries' site. Some of original items from online questionnaire, teaching materials which can be downloaded from the site, graph drawing system are taken up here.

Figure 1: Top page of Japanese CensusAtSchool site

3.1 ONLINE QUESTIONNAIRE

Japanese CensusAtSchool site has activated in 2009. As mentioned earlier, there are some obstacles in diffusion of our project. The number of entry by school or teacher was increasing slowly. We have kept online questionnaire same in three years.

In 2012, system revision have been started to improve database system, and to develop graph drawing system. Taking advantage of this opportunity, online questionnaire have revised. Most parts are kept to compare yearly change. Here are some examples of new items.

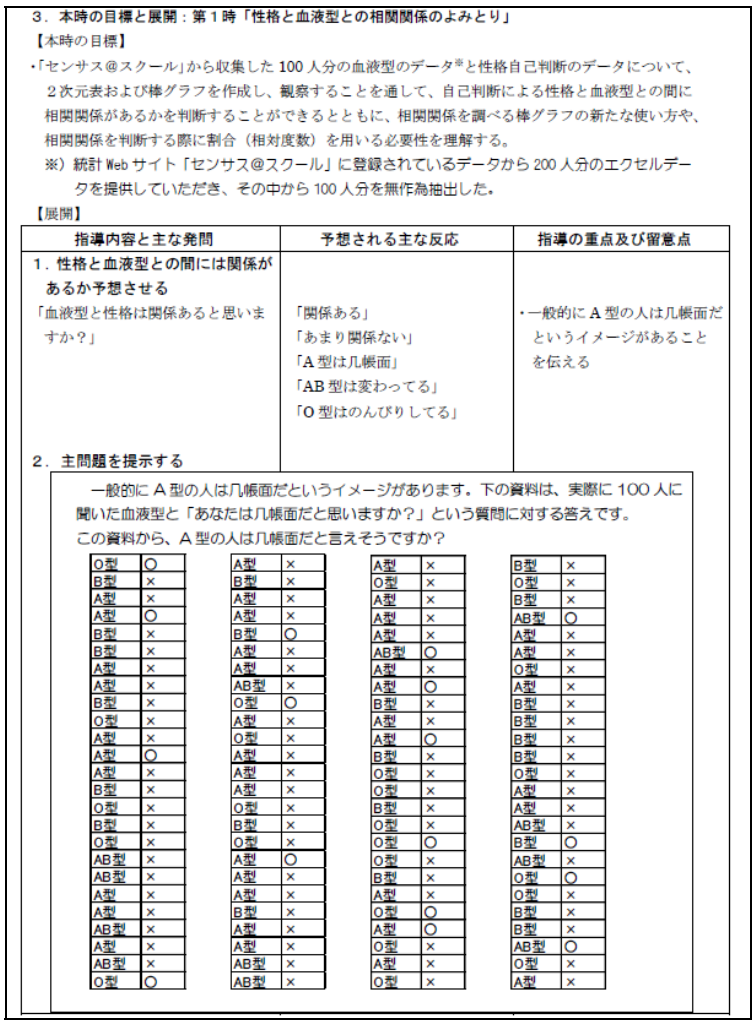
- Please click the “Start” button first, and then click “Stop” button when you feel ten seconds passed.
- How many books do you usually read in one month? (Excepted comic or picture book)
- Please input your favorite number within five digits.
- How long do you watch the TV program every day? Please move the slider for weekday and weekend respectively.

Figure 2: Online questionnaire page

3.2 TEACHING MATERIALS

Teaching materials related with CensusAtSchool data can be downloaded freely from the site. Although many of them are translated from UK, New Zealand, and Australia CensusAtSchool project, Japanese original materials have been developed.

Figure 3 is an example of Japanese original teaching materials. There are items questioning student’s blood type and their personality in 2009 questionnaire. This material is focusing on the relationship between student’s individual blood type and personality. This kind of topic is unfamiliar in many countries, but it is very common in Japan and some Asian countries.



3．本時の目標と展開：第１時「性格と血液型との相関関係のよみとり」

【本時の目標】

・「センサス@スクール」から収集した 100 人分の血液型のデータ※と性格自己判断のデータについて、２次元表および棒グラフを作成し、観察することを通して、自己判断による性格と血液型との間に相関関係があるかを判断することができるとともに、相関関係を調べる棒グラフの新たな使い方や、相関関係を判断する際に割合（相対度数）を用いる必要性を理解する。

※）統計 Web サイト「センサス@スクール」に登録されているデータから 200 人分のエクセルデータを提供していただき、その中から 100 人分を無作為抽出した。

【展開】

指導内容と主な発問	予想される主な反応	指導の重点及び留意点
１．性格と血液型との間には関係があるか予想させる 「血液型と性格は関係あると思いますか？」	「関係ある」 「あまり関係ない」 「A 型は几帳面」 「AB 型は変わってる」 「O 型はのんびりしてる」	・一般的に A 型の人は几帳面だというイメージがあることを伝える
２．主問題を提示する		

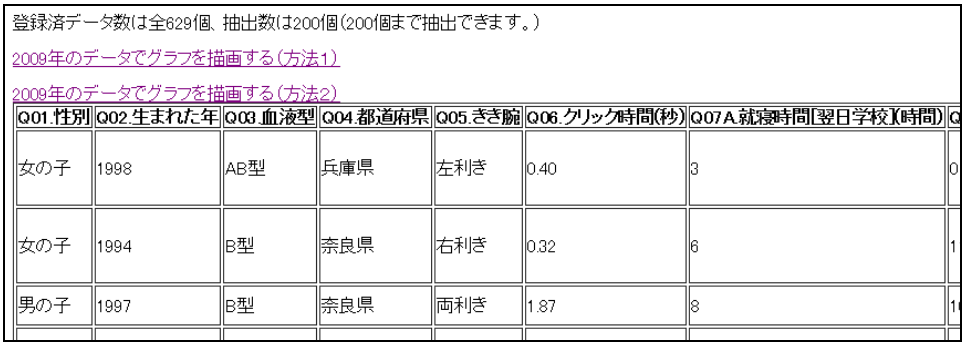
一般的に A 型の人は几帳面だというイメージがあります。下の資料は、実際に 100 人に聞いた血液型と「あなたは几帳面だと思いますか？」という質問に対する答えです。
この資料から、A 型の人は几帳面だと言えそうですか？

O型	○	A型	×	A型	×	B型	×
B型	×	B型	×	O型	×	O型	×
A型	×	A型	×	A型	×	B型	×
A型	○	A型	×	A型	×	AB型	○
B型	×	B型	○	A型	×	A型	×
B型	×	A型	×	AB型	○	A型	×
A型	×	A型	×	A型	×	O型	×
A型	×	AB型	×	A型	○	A型	×
B型	×	O型	○	B型	×	B型	×
O型	×	A型	×	A型	×	B型	×
A型	×	O型	×	A型	○	B型	×
A型	○	A型	×	B型	×	B型	×
A型	×	A型	×	O型	×	O型	×
B型	×	O型	×	O型	×	A型	×
O型	×	B型	×	B型	×	A型	×
B型	×	O型	×	O型	×	AB型	×
O型	×	A型	○	O型	○	B型	○
AB型	×	A型	×	O型	×	AB型	×
AB型	×	A型	×	B型	×	O型	○
A型	×	A型	×	A型	×	O型	×
A型	×	B型	×	O型	○	B型	×
AB型	×	A型	×	A型	○	B型	×
A型	×	A型	×	O型	×	AB型	○
AB型	×	AB型	×	A型	×	O型	×
O型	○	AB型	×	O型	×	A型	×

Figure 3: Example of Japanese teaching material

3.3 GRAPH DRAWING SYSTEM

Users can download random data within 200 from CensusAtSchool database. They can download the data in CSV format. The link to graph drawing system is shown on the screen when the random data downloaded.



登録済データ数は全629個、抽出数は200個(200個まで抽出できます。)

2009年のデータでグラフを描画する(方法1)

2009年のデータでグラフを描画する(方法2)

Q01.性別	Q02.生まれた年	Q03.血液型	Q04.都道府県	Q05.きき腕	Q06.クリック時間(秒)	Q07A.就寝時間[翌日学校](時間)	Q
女の子	1998	AB型	兵庫県	左利き	0.40	3	0
女の子	1994	B型	奈良県	右利き	0.32	6	1
男の子	1997	B型	奈良県	両利き	1.87	8	1

Figure 4: Display of random data downloaded

The first step is to choose the data item which will be analyzed. Each small box represents each item. Yellow box means that item is qualitative variable, while Brue one means quantitative variable. Just to drag & drop boxes to the bottom rectangle is needed when they chose items. Then, the next step is to choose the graph. Bar, Pie, Dot, Band, Line graph, Scatter plot, Histogram, and Box-and-Whisker plot are provided.

Figure 5: Display of data choice

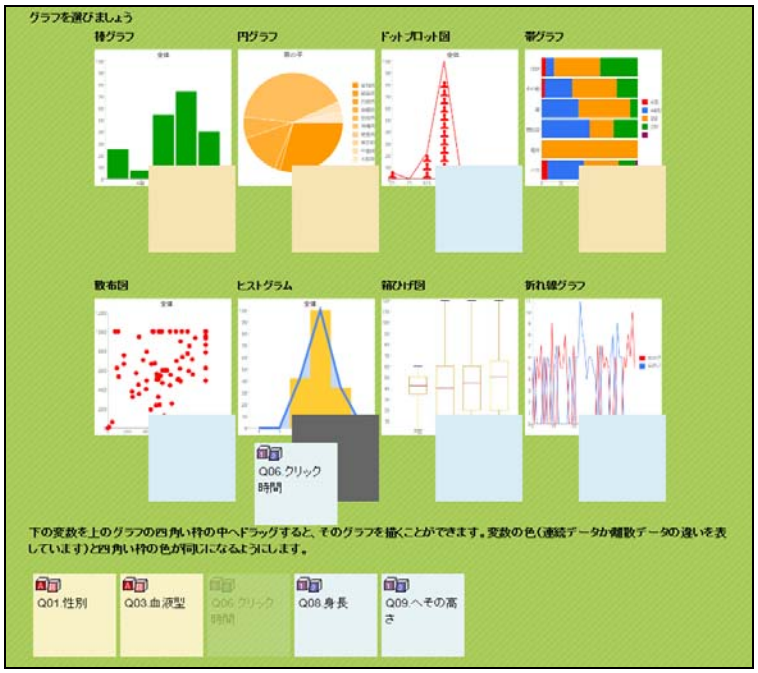


Figure 6: Display of graph choice

Students drag & drop the box to the graph which they want to display. There are functions to except outliers when the data is quantitative with check the white blank by click, to stratify by qualitative variable with check the circle beside the box, and to change the number of ranks when the graph is Histogram.

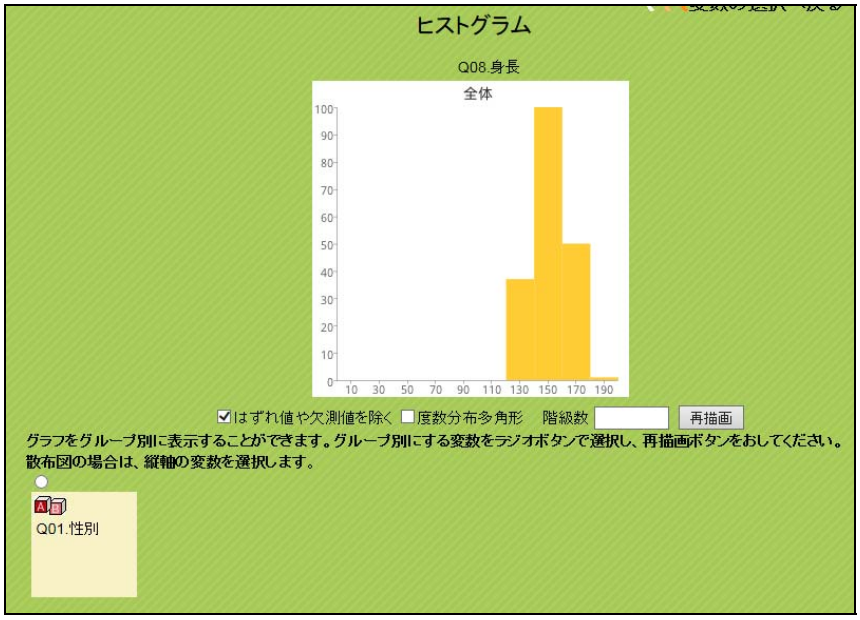


Figure 7: Display of graph

This set of actions is very easy to understand and apply for teachers and students. Required facility of school is only internet access. It allows students to face to data analysis itself directly without barrier of software usage. This learning environment can encourage teachers to use tools in their lessons and to change their style of statistics lessons.

4. CONCLUSION

It is needed to improve the function of the system of Japanese CensusAtSchool site for teachers and students. Demands from teachers' interview on our site and graph drawing system are to add a function to save the individual result of analysis, copy and paste the graph to Microsoft Word to make their analysis report, and so on. Collaboration with the teacher training program is much more effective to diffuse the new statistics education.

Since the school curriculum revision of mathematics in 2008 and 2009, it took already five years. Teachers' conscious of statistics education has changed gradually. Number of teachers, researchers, educators, and officers of ministry concerned to diffuse statistics education in new style are getting increasing. Good example of lesson plans and teaching materials are developing day by day. Obstacle of software usage is becoming one of the biggest problems for statistics education in Japan.

In the areas of Geometry and Function education in mathematics, there are many tools for educational use. Proportion of teachers who use those tools in their daily lessons is also small in Japan. Some educators and officers of ministry expect that statistics education can change the situation of software usage in other areas.

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