Tomoko NINOMIYA, Oosaka University of commerce, Tetsushi KA-WASAKI, Gifu University, Sonoko MORI, Takushoku University, Yoshi-hiro HASHIMOTO, Kansai Gaidai University, JP

A Comparative Research of Three Countries on Various Backgrounds of Students and Mathematics Education Through Surveys in Germany, Brazil and Japan

1. Introduction

There are two motivations for us to think deeply about mathematics education.

One of those motivations is that statistical education in Japan is very late compared with those of overseas developed countries. Another motivation is that the mathematical basic ability of university students has declined. For example, in my no science class of the private university, as a result of investigating graphs of elementary functions (Linear function, Quadratic function, Fractional function, Exponential function) can be written correctly, the correct answer rate was very low (Ninomiya, 2012). I am doing the same survey for about 20 years, but over the years the student's correct answer rate has declined. The correct answer rate of the graph of a quadratic function in my research was the almost same of the correct answer rate of the problem describing the nature of quadratic functions in the "University Student Mathematics Basic Survey" (Number of responses is about 6000) conducted by the Japan Mathematical Society in 2011 (The Mathematical Society of Japan, 2013). Such a decline in mathematical skills of university students is one of the causes of hindering higher education in the university. It is an important issue for university math education.

To solve these problems in our country, our research group is planning to conduct surveys for university students who are supposed to be future teachers, to get a chance to think about how mathematics education is there. Here we study various elements of life, society and education in the background of the student and clarify how they affect student's happiness degree and lead to future hope. For that purpose, we will conduct a question survey on students and analyze them statistically. In this paper, we propose a statistical model for that purpose.

2. Results of the previous research in the cross-cultural project

Students who major subject is mathematics education in Germany, Brazil and Japan in 2015 gained data on students' awareness about environmental problems in environmental consciousness surveys. As the results of comparing students' view of their country with other countries among the three countries, it became clear that the survey was very useful for intercultural learning in education, including various differences (Hartmann, 2016).

Here we describe one of the results of further analysis using the same data. That is about educational issues to be tackled in class students think important. "Most importance for mathematics teaching" and "Most importance for teaching in general" differ from country to country (Fig. 1). But, "Importance for mathematics teaching" and "actually dealt with in mathematics teaching" are almost in agreement. In Germany and Japan, "media education" and "consumer education and leisure", and "environment education and leisure" are important issues and are actually dealt. However, in Germany, although the proportion of students who answered that "environmental education" and "education of conflict management and violence protect" are also important themes in mathematics education is relatively high, the actual proportion of those education is low (The most students have chosen "education of conflict management and violence protect" for themes that are important in all subjects). In Brazil, "environment education" is most important theme and actually dealt, but "media education" is not so important for students, and actually not so dealt. In Brazil, "education of conflict management and violence protect" is actually dealt the second most.
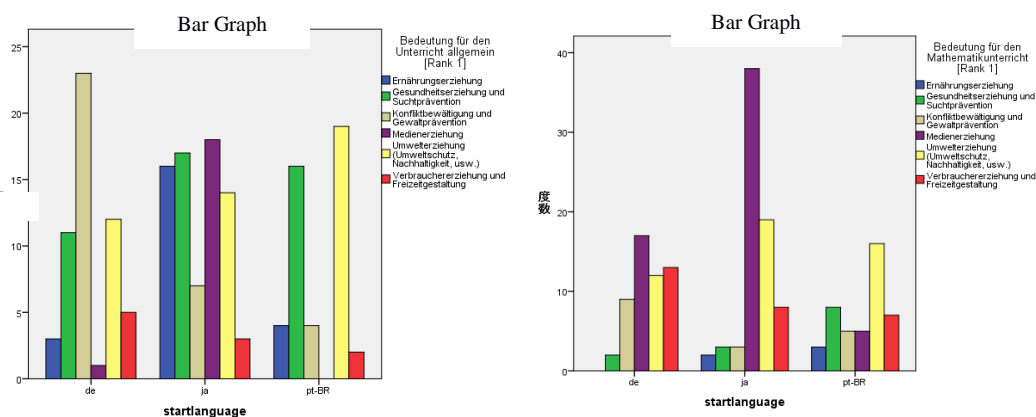

Fig.1 Most importance for mathematics teaching and most importance for teaching in general (exclude no answer)

3. A New Research Model and Variables

Based on the results described in Section 2, we will propose a new model to further clarify the differences between students and education in different cultures.

Happiness is being debated in various places and in various fields in the world. There are also large and small objects such as world level, national level, regional level, individual level etc. to measure happiness degree. And, there are various indicators to measure happiness, and various statistic models are assumed. For an example, in the reference "Happiness a Revolution

in Economics" (Frey, 2008). The degree of happiness as an effect in economics was treated at the national level. In one of the models indicators were used to explain income, unemployment, inflation, income inequality and so on.

In this paper, of course, we will treat the happiness level of students aiming to be teachers. We will propose one of statistic models (Fig. 4). At first, we considered a model in where there are three composition concepts, "Campus Life Satisfaction", "Satisfaction on Education" and "Social Environment", related each other. But, the concept of "Social Environment" is more difficult to treat equally as the other two concepts due to the difference in scale. Then we will omit the concept of "Social Environment". Finally, we will use those two concepts affecting happiness and various kinds of reasonable indicators to explain those concepts. We will treat those concepts as latent variables in the statistic model. We will list up examples of indicators that explain each latent variable.

Indicators explaining "Campus Life Satisfaction", "Family Support", "Friends", "Club Activity", "Economy", "hobby", etc.
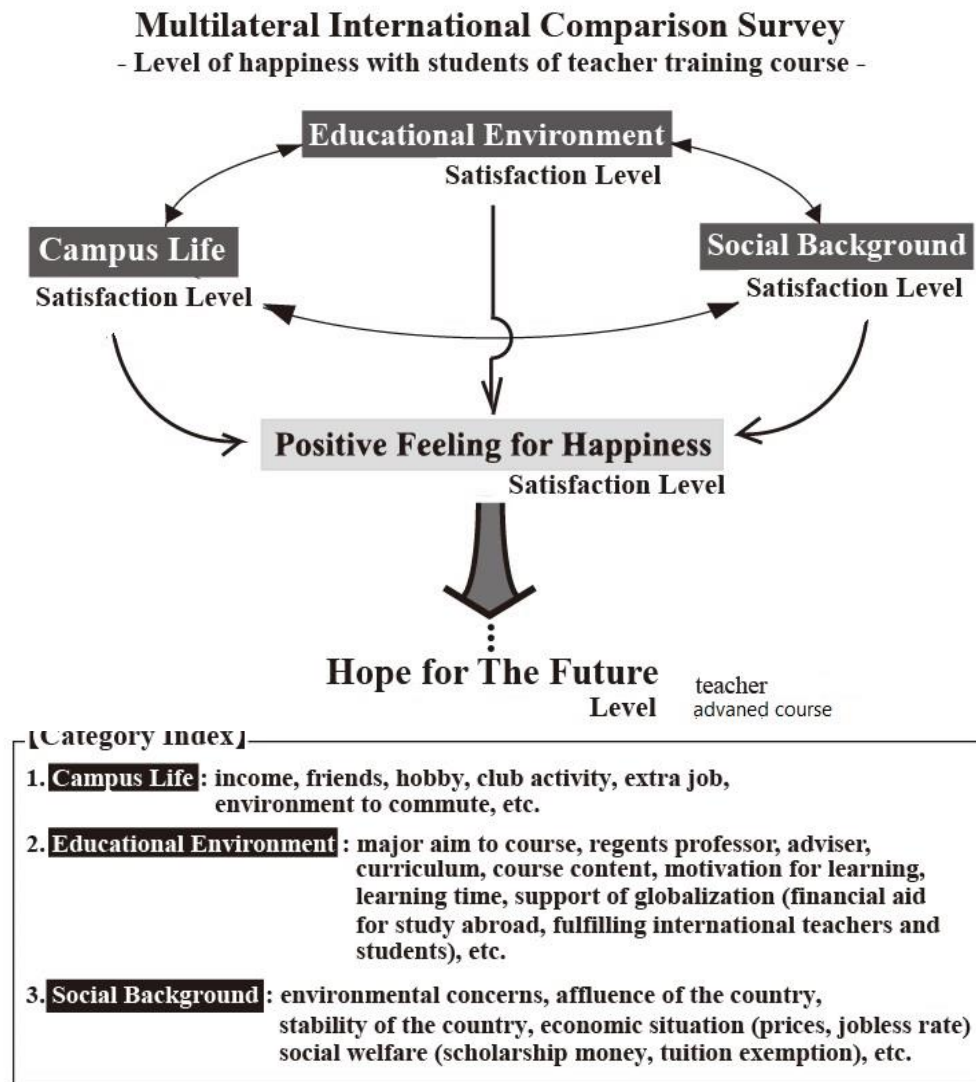
Indicators explaining "Satisfaction on Education": "Major Course", "Curriculum", "Professor", "Advisor", "Achievement", etc.

Furthermore, the following indicators will be used as factors of an latent variable "Hope for the Future" that is explained by "Happiness": "Profession", "Intention to become a teacher", "Intention to contribute to society", "Intention to become a leader", etc. This hypothesis is the most important hypothesis in our model. The ultimate goal of our research is to explore the factors that students want to become good teachers in the future.

4. For the future

In the future, further discussion will be made in our project and a more definite statistical model will be decided. Then conduct surveys of students and clarify the statistical analysis results. Ultimately, we will clarify the problems of mathematics education based on the findings of the survey and to make proposals that can be applied to future education. And furthermore, it is fortunate that it is a positive utility if students from three countries can understand each other's country and exchange them through survey.

Fig. 4 The research Model

Multilateral International Comparison Survey
- Level of happiness with students of teacher training course -

Educational Environment
Satisfaction Level

Campus Life
Satisfaction Level

Social Background
Satisfaction Level

Positive Feeling for Happiness
Satisfaction Level

Hope for The Future
Level

teacher
advaned course

[Category Index]

1. Campus Life : income, friends, hobby, club activity, extra job, environment to commute, etc.

2. Educational Environment : major aim to course, regents professor, adviser, curriculum, course content, motivation for learning, learning time, support of globalization (financial aid for study abroad, fulfilling international teachers and students), etc.

3. Social Background : environmental concerns, affluence of the country, stability of the country, economic situation (prices, jobless rate) social welfare (scholarship money, tuition exemption), etc.

References

Ninomiya, T. (2012): High school mathematics education problems for students going to undergraduate studies. In *Japan Mathematic Education Society in Japan*, p. 52-54

The Mathematical Society of Japan (2013): *University Student Mathematics Basic Survey*, The Mathematical Society of Japan in Japan,
  URL:http://mathsoc.jp/publication/tushin/1801/chousa-houkoku.pdf (Stand: 21.03.2017)

Hartmann, M. et al. (2016): *Teaching and Applying Research Methods in a Cross-Cultural Project for Students of Mathematics Education.* ICME13

Frey, B. (2008): *Happiness - a revolution in Economics.* Massachusetts Institute of Technology URL:https://mitpress.mit.edu/sites/default/files/9780262514958_sch_0001_0.pdf (Stand: 21.03.2017)