A Look into the ‘No Problem’ Feeling Towards Studying Major Areas of Mathematics Among Japanese Junior High School Students

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Abstract

This work is concerned with the assessment of the awareness of ‘good at’ and ‘not good at’ that Japanese junior high school students, who thought that “mathematics learning is no problem”, have towards the three major areas of mathematics learning. To accomplish this purpose, 616 junior high school students of a typical public junior high school were surveyed regarding their feelings towards learning mathematics and a two-step analysis was carried out. The first part consisted of the tabulation of Likert scale-type survey with 5 levels of evaluation aimed to evaluate their feelings towards learning mathematics. Next, we looked only into 182 students who responded ‘no problem’. We assessed their feelings towards the three major areas of mathematics learning using conjoint analysis. The results are discussed in terms of this conjoint analysis, which made it clear that despite the fact that the students do not feel resistance towards learning mathematics, they have feelings of ‘not good at’ towards particular area learning, independent of the gender.

Keywords: Mathematics Education, Japanese Junior High School Students, Conjoint Analysis

1 INTRODUCTION

In Japan, mathematics is part of compulsory education which comprises 6 years of elementary school and 3 years of lower secondary school (junior high school) (MEXT, 2008; MEXT, 2010). In addition, it is also compulsory during the first year for those who are going to upper secondary school (high school) (MEXT, 2009). In this context, students experience a variety of feelings towards learning mathematics, either as whole or related to some particular modules of learning.

As far as junior high school students are concerned, a recent report shows that nevertheless more than 70% of the students consider that their mathematics learning will be useful at some point in the future, about half of them do not like studying mathematics (NIER, 2018). Nishikawa and Izuta (2018) have suggested that this like-not-like feelings translate in fact into the students’ anxiety towards learning some specific topics of learning due to their individual abilities; and the burden that classes with tight class-hours and schedule without much room for taking into account the students’ skills may influence their attitudes towards learning mathematics as a whole.

As a matter of fact, Mohamed and Waheed (2011) categorized the factors affecting student’s attitudes towards mathematics into three distinctive groups: (1) related to students themselves, such as mathematical achievement, anxiety, self-efficacy, and self-concept; (2)
related to teacher and teaching method; and (3) related to home environment and society.

Findings related to these groups are as follows. Mata et al. (2012) found that, in general, students have positive attitudes towards mathematics; Arslan et al. (2012) examined mathematics achievement and attitudes towards mathematics among middle school students and found that female students tended to have more positive attitude and higher grades than males. However, according to Goetz et al. (2013), female students do not, in fact, experience more anxiety than males during mathematics instruction and testing on mathematics despite their reporting higher levels of habitual mathematics anxiety. Akin and Kurbanoglu (2011) examined the relationships between mathematics anxiety, mathematics attitudes, and self-efficacy on the basis of correlation analysis, and showed that anxiety was inversely related to attitudes and self-efficacy, in the sense that as positive attitudes and self-efficacy increase, anxiety decreases. Mutohir et al. (2018), using exploratory factor analysis and confirmatory factor analysis, identified three distinctive factors related to the students attitudes; namely teacher presentation, mathematics interest, and mathematics values. As the teacher and teaching method, studies have shown that teachers’ attitudes toward teaching mathematics play an important role in forming students’ attitude towards learning of the subject (see for example, Marchis, 2011; Mensah et al., 2013; Mutodi & Ngirande, 2014). Yet, Davadas & Lay’s (2017) research model using structural equation modeling (SEM) predicted that students’ attitudes towards mathematics are correlated to factors as teachers’ affective support and instruction in class. Lazarides & Watt’s (2015) research model on the basis of Multilevel SEM revealed links between teacher’s beliefs, learning environments, students’ motivations, and mathematical career intentions, and showed that female students, although they had higher beliefs in the prestige of mathematics teachers, perceived lower expectations in mathematics teaching career than males.

Now, focusing specifically on mathematics education in Japanese junior high schools, self-feeling of difficulty in learning mathematics among students has been an area of intense investigations. For example, there are reports presenting the feelings of junior high school students towards three main areas of mathematics learning, as well as dependency analysis of these feelings on gender and academic year (Izuta & Nishikawa, 2017; Nishikawa & Izuta, 2017a; Nishikawa & Izuta, 2017b; Nishikawa & Izuta, 2018). Taking these into account, in this study, we performed a survey research among Japanese junior high school students analyze those respondents who said to have ‘no problem’ feeling towards mathematics learning. The purpose is to examine in detail their feelings related to the three major areas of mathematics curriculum using conjoint analysis. Note that results concerning other groups of respondents have been reported elsewhere (Nishikawa & Izuta, 2017b).

2 METHODS

Participants were junior high school students from grades 1 to 3 of a public school located in a country city of Niigata Prefecture in Japan. A total number of 616 students, ages ranging from 12 to 15 years, participated in this study: 182 first-year, 212 second-year, and 222 third-year pupils. The questionnaire survey which had two parts was carried out at the end of the academic year 2016 in March.

Participants were firstly asked questions related to their feelings towards learning
mathematics in general. The rating was based on a 5-point Likert-type scale (‘not good at’, ‘somewhat not good at’, ‘neutral’, ‘somewhat good at’, and ‘good at’). From these, only 182 ‘neutral’ answers were selected for this study, and these account for 44 first-year, 75 second-year, and 63 third-year students. Next, the selected respondents were asked to evaluate the conjoint cards (Fig. 1) from number 1 (fulfills or closest to what they think or feel) through number 4 (less applicable case). As for the conjoint analysis, the ranks of the cards were converted into numbers: first into 4, second into 3, and so on.

The data was processed and analyzed manually with traditional conjoint analysis using Microsoft Excel 2013 (Orme, 2014) on a Microsoft Windows 8.1 computer. R version 3.5.1 (R Core Team, 2018) and several packages were used for visualizing the result of Conjoint Analysis (Wickham, 2016; Wickham, 2017; Kassambara, 2018; Wickham, 2018).

<table>
<thead>
<tr>
<th>Card</th>
<th>Algebra calculations</th>
<th>Geometrical figures</th>
<th>Functions</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Card 1</td>
<td>Good At</td>
<td>Good At</td>
<td>Good At</td>
<td></td>
</tr>
<tr>
<td>Card 2</td>
<td>Good At</td>
<td>Not Good At</td>
<td>Not Good At</td>
<td></td>
</tr>
<tr>
<td>Card 3</td>
<td>Not Good At</td>
<td>Good At</td>
<td>Not Good At</td>
<td></td>
</tr>
<tr>
<td>Card 4</td>
<td>Not Good At</td>
<td>Not Good At</td>
<td>Good At</td>
<td></td>
</tr>
</tbody>
</table>

Figure 1. Conjoint cards used in the survey

3 RESULTS

3.1 Feelings of First Year Students

The results of conjoint analysis for boys and girls of first year students are shown in Figure 2. Surprisingly, the graph of relative importance for boys and girls had similar graphical patterns as clearly seen in Fig. 2(A). The values of importance and relative partial utilities which is the positive value for males were 71.4% for ‘Functions’ with ‘Not Good At (Functions)’, 23.8% for ‘Algebra calculations’ with ‘Not Good At (Algebra calculations)’, and 4.8% for ‘Geometrical figures’ with ‘Good At (Geometrical figures)’, whereas females ranked 51.0% for ‘Functions’ with ‘Not Good At (Functions)’, 39.2% for ‘Algebra calculations’ with ‘Not Good At (Algebra calculations)’, and 9.8% for ‘Geometrical figures’ with ‘Not Good At (Geometrical figures)’.

These results suggest that first year students in general considered ‘Functions’ as the most important area and ‘Algebra calculations’ as the second most important area; and felt ‘Functions’ and ‘Algebra calculations’ to be ‘Not Good At’. Thus, first year students felt ‘Not Good At’ towards ‘Functions’ and ‘Algebra calculations’.

However, the precision of measurement ($R^2$) in the conjoint analysis were 0.17 and 0.30 for boys and girls, respectively. Note that the results of both conjoint analysis do not have sufficient accuracy.
3.2 Feelings of Second Year Students

Figure 3 indicates the conjoint analysis for males and females of second year students. From the relative importance graph (Fig. 3(A)), it is clear that males focused mainly on ‘Functions’ with 90.2%, in which the attribute level is ‘Not Good At (Functions)’. Moreover, males had both importance 4.9% for ‘Algebra calculations’ with ‘Good At (Algebra calculations)’ and ‘Geometrical figures’ with ‘Good At (Geometrical figures)’.

With respect to female students, they ranked 76.9% for ‘Functions’, 17.3% for ‘Geometrical figures’, and 5.8% for ‘Algebra calculations’ while their representative attribute levels were ‘Not Good At (Functions)’, ‘Not Good At (Geometrical figures)’, and ‘Good At (Algebra calculation)’, respectively.

Thus, the results indicate that the males and females of second year students considered ‘Functions’ as the most important area; and felt ‘Functions’ to be ‘Not Good At’. Thus, second year students felt ‘Not Good At’ towards and ‘Functions’.

However, the precision of measurement ($R^2$) in the conjoint analysis were 0.20 and 0.23 for males and females, respectively. Note that the results of both conjoint analysis do not have sufficient accuracy.
3.3 Feelings of Third Year Students

The importance and partial utility value graphs for males and females of third year students are shown in Figure 4. As shown in Fig. 4(A), boys measured 70.7% of importance for ‘Algebra calculations’ and 29.3% for ‘Functions’ and their respective attribute levels were ‘Good At (Algebra calculations)’ and ‘Not Good At (Functions)’.

For girls, on the other hand, the importance values of all attributes were alike (Fig. 4(A)). In fact, ‘Geometrical figures’ with 39.3%, ‘Algebra calculations’ with 32.1%, and ‘Functions’ with 28.6% of importance which their attribute levels being ‘Not Good At (Geometrical figures)’, ‘Good At (Algebra calculation)’, and ‘Not Good At (Functions)’.

From the results, we have that the third year male students felt ‘Algebra calculations’ to be ‘Good At’ whereas ‘Functions’ to be ‘Not Good At’. Thus, third year students felt ‘Good At’ towards ‘Algebra calculations’ and then ‘Functions’ towards ‘Not Good At’.

However, the precision of measurement ($R^2$) in the conjoint analysis were 0.23 and 0.05 for boys and girls, respectively. Note that the results of both conjoint analysis do not have sufficient accuracy.
Figure 4. Comparison of conjoint analysis for boys and girls of third year students. (A) Relative importance of attributes. (B) Partial utility values for each level of weight.

4 DISCUSSION
Taking into consideration the results of conjoint analysis, they suggest that students who thought that "mathematics learning is no problem" tended to evaluate their feelings towards ‘Functions’ as ‘Not Good At’; and this tendency can be seen across all grades. It is worth noting that it may happen that some students might have felt anxiety towards learning ‘Functions’ area during their first academic year, and as they advanced to upper grades this feeling might have persisted on, and effected their performance as well as their attitudes towards learning ‘Functions’ in a snowball effect fashion. Either way, the results suggest that one way to help students overcome their anxiety towards mathematics learning is first to have classroom composed of students allocated to on the basis of an feeling assessment for placement; and then focus on ways to help and assist students with “mathematics learning is no problem” feeling with their learning of ‘Functions’ from the very time they start their academic life in junior high school.

5 FINAL COMMENTS
This work focused on Japanese junior high school students with neutral feeling towards mathematics learning and aimed to investigate in detail whether they felt the same towards particular curriculum modules of study. The results showed that in general these students were actually struggling with ‘Functions’ learning. Thus, based on it, we claimed that class placement followed by teaching methods emphasizing ‘Functions’ would be one way to improve the situation. Moreover, the use of conjoint analysis-based assessment may help teachers to understand the level of anxiety that students are going through these issues.
Finally, since these findings are derived from a single case study, further studies are needed to draw a general conclusion.

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References


