Mathematics choice in upper secondary school: a divider in Finnish educational pathways

Satu Kaleva, Jouni Pursiainen, Mirkka Hakola, Jarmo Rusanen, Hanni Muukkonen

more information: AVAIN – community: http://www.oulu.fi/avain/node/46274

Introduction

Finnish education, policy makers and workforce are struggling with the fact, that too few of the Finnish students choose the subjects that are needed for entering the digital professions of the future. Science, Technology, Engineering and Mathematics (STEM-subjects) are not attracting enough students during their final years of high school. Students make these subject choices at the age of 16, or even earlier, which decisively affect their future, and the selection to higher education are made based on these choices. Particularly females continue to be underrepresented in math-intensive fields.

Based on large national data sources, this Finnish study shows, that the selection between basic or advanced mathematics is one of the most critical bottlenecks of the Finnish higher education.

To investigate the reasons behind the choices, the second part of this study examines students’ perceptions during the first year of their upper secondary school studies in 2017.

Materials and Methods

The data used in this study consist of all (N=93 955) Finnish students (age 18-19) who passed the national matriculation examination during 2013-15, and students (N=46 282) who were recruited to the Finnish Research Universities within the same three year span. The data was collected from the Universities and combined with the data from Matriculation examination Board by CSC (IT Center for Science). Based on this data, we examined:

• How students’ mathematics choices affect their admission to university degree programs?
• What is the gender distribution among bachelor’s degree graduates in different degree programs?

To investigate the reasons behind the choices, students’ (age 16) perceptions (N=3802) during the first year of their upper secondary school in 2017 were studied. This material was collected from 12 different upper secondary schools in Oulu by using an on-line survey during spring semester 2017 (response rate 51%).

Based on a cohort sample of one city’s first year upper secondary school students’ (N=3802) responses, we investigated:

• What kinds of reasons students gave for choosing advanced mathematics?
• Were there any gender differences in students’ mathematics choice?

The N3 data was collected by using the Webropol online survey tool. The survey was held during the school’s class hours with teachers’ supervision. The optional open ended questions were:

“Please continue the following sentences that concern your own choice of mathematics:
• chose advanced mathematics, because...
• didn’t choose advanced mathematics, because...
• I didn’t choose basic mathematics, because...
• I chose basic mathematics, because…”

The data analysis began by reading carefully through each students’ responses (n=1572) they gave to these open-ended questions. After this, each of those responses were individually placed to the “reason” categories: “Usefulness, Advice, Enjoyment and Interest, Logistics, Self – Efficacy, Ability and Competence, Teaching and Other”, that followed the Palmer et al. (2017) Best-Worst Scaling (BWS) system. One response often included multiple reasons behind mathematics choice, therefore one response had to be divided into multiple units of analysis.

To examine the inter-coder reliability two independent raters categorized 10 % of the qualitative data. The Kappa coefficient 0.753 (Cohen’s Kappa) was statistically significantly different from 0, suggesting that the two independent ratings are largely similar.

Results

According to these findings, those students who opt for advanced mathematics, have considerably better chances at recruitment to the Finnish Research Universities. Only 33 % of the upper secondary school graduates chose to take the advanced mathematics test, but 55 % of the new university students have taken it. Advanced mathematics is male-dominated (55 %) and basic mathematics female-dominated (57 %) in upper secondary school. This is one of the reasons behind the gender distributions in the university degree programs.

As many as 65% of the first year students of Oulu upper secondary schools chose advanced mathematics in 2017. According to student (age 16) responses (N=359), the main reason for choosing advanced mathematics is the “Usefulness” (n=359) of the subject. Students find the subject useful as it opens more options for their future professions or studying place, whether at this point they had or did not have a clear view of their future careers. Some point out the usefulness of the advanced mathematics and logical thinking to be a useful skill for everyday life.

The second most reported reason for choosing advanced mathematics was “Enjoyment and interest” (n=119) towards mathematics, and the third was self efficacy, ability and competence (n=54), as those students who choose advanced mathematics find that they have good mathematics skills and mathematics competence.

Conclusions

Regarding the dividers of the Finnish educational pathways, mathematics is clearly one of the most critical. According to our data, as much as 83 % of the secondary school graduates who conducted the advanced mathematics exam, are eventually chosen to the universities. Students make these choices at the age of 16 or earlier, and informing the students about the consequences of this choice is important.

Concerning the reasons for choosing the advanced mathematics, the students do see the value of the subject. Although the majority (in 2017 65%) of the students in Oulu have chosen advanced mathematics during the first year of their studies, many of them tend to change to basic mathematics. If only 33 % of the upper secondary school graduates in national level will end up taking advanced mathematics test in their third year matriculation examination, but 55 % of the new university intakes have taken it, the information of the value of this choice should be delivered to these students promptly, in cooperation with educators, parents, and media.

References


Further information: AVAIN – community: http://www.oulu.fi/avain/node/46274