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MetaMath and MathGeAr Projects: Students' Perceptions of Mathematics in Engineering Education

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Introduction

Mathematics is considered as the foundation discipline for the entire spectrum of Sciences, Technology, Engineering and Mathematics (STEM) curricula. Its weight in the curriculum is therefore high (Alpers, et al., 2013).

Several special studies in Europe suggest that competencies gap in mathematics is a most typical reason for STEM students to drop out of study. The overall objective of the Tempus projects, MetaMath and MathGeAr, is to improve the quality of STEM education in the South Caucasian region and Russia, by modernizing and improving the curricula and teaching methods in the field of Mathematics.

After Gaston Bachelard, in Cardoso (1985), an epistemological features evident in the sciences include the aspiration to be objective. From the intuitive perception of a phenomenon, a pre-scientific spirit needs to overcome a set of epistemological obstacles to reach a scientific stage.

Methodology

To explore students' perceptions of mathematics we produced an online survey to be distributed in all participant countries. The questionnaire has three main dimensions:

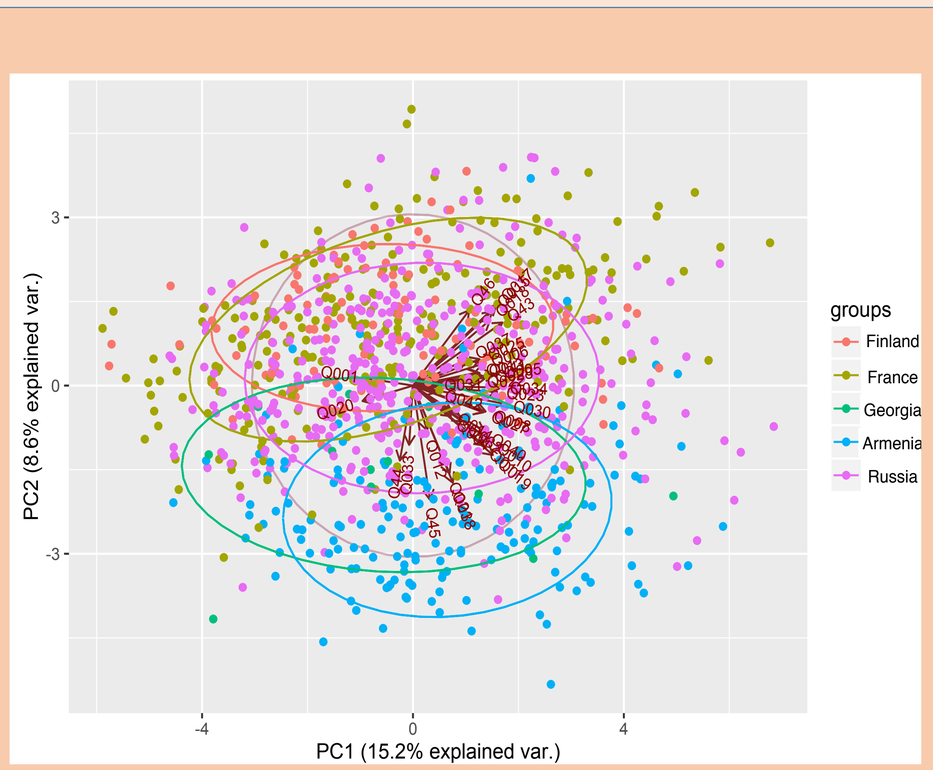
Questionnaire dimensions	N. of Questions
Usefulness of mathematics	8
Teaching mathematics in engineering schools, contents and methods	15
Perception of mathematics	12
Total	35

A total of 35 questions were answered by 1548 students from all participant countries. After collecting the data from the online survey we used the statistical package R to analyze the data and draw conclusions. We performed a *Principal Component Analysis* (PCA) to investigate patterns in the students' responses. In general terms, PCA uses a vector space transform to reduce the dimensionality of large data sets. Using mathematical projection, the original data set, which may have involved many variables, can often be interpreted in just a few variables (the principal components).

Country	N
Armenia	24
Finland	189
France	430
Georgia	285
Russia	612

Results

Using R statistical package we plot the two first Principal Components. The analysis shows that all students feel that math teaching is too theoretical, not practical enough and has not enough connections with other sciences and engineer's job reality.



Therefore, modernized curricula for engineers should address these issues. On the other hand, Caucasian students tend to perceive that mathematics consists of knowledge rather than competencies, mainly of theoretical interest, with a discrepancy between early practical mathematics and theoretical engineer mathematics. The European students feel that advanced mathematics is useful, that the role of a teacher is more to help students to apply mathematics than to only transmit knowledge. The Russian students fall in between the two groups and are more diverse in their opinions.

Conclusion

Our findings suggest that: teaching should put forward the applications of advanced mathematics and focus on competencies rather than transmission of knowledge; the European countries on the one hand and Caucasian countries on the other are quite aligned but Russian students' perceptions are more spread out and in between those of the European and Caucasian students.

References

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