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Critical spots in undergraduate cartographic education: analysis of final tests and oral examinations

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Abstract:

Critical spots of cartography teaching in the university environment are very often an unsuspected, yet still insufficiently addressed professional topic of cartographic research. The topic stands on the borderline between cartography and general didactics, therefore, experts from the Department of Geography participating in cartography education at the UJEP in Ústí nad Labem (Czechia) as well as from the Centre for Promotion of Science Education at the Faculty of Science (UJEP) were involved in its solution.

The main goal of the long-term plan is to create a discussion platform on cartographic education not only at Czech universities. A potential outcome of such a platform in the future may be the innovation of curricula of courses in which students study the basics of cartography, taking into consideration the specifics of the graduate profile of the respective study programmes and, of course, the needs of the labour market.

Critical spots are identified within the framework of this research project on the basis of analysis and initial interpretation of longitudinally, i.e. since 2010, obtained results of anonymised didactic tests (over 1,300 tests as of September 2023) and anonymised results of oral examinations, which conclude the courses *Geographical Cartography* and *Fundamentals of Cartography*.

The *Geographical Cartography* course is intended for single-subject Geography and double-subject Geography Bachelor Programmes (in combination with another subject, usually preparing future Geography teachers), while the *Fundamentals of Cartography* course is intended for students in the Applied Geoinformatics Bachelor Programme (from 2021). Successful completion of the test is a condition for the award of the exam (previously only course credit) for double-subject students, while subsequent successful oral examination is a condition for the award of the exam for other students.

Long-term monitoring allows trends in success rates to be tracked and critical spots to be identified, while monitoring across different study programmes allows for comparison. Over the 14-year period, changes have been made to the practical part of the courses (exercises and map tasks) and to the didactic tests. This also makes it possible to monitor the development of the reliability and difficulty of the tests and, in particular, whether the changes in teaching and the modification of the tests have led to a more efficient learning process and the assessment of students on the output of the courses.

In order to analyse the students' results, the tasks in the tests and questions in the oral examination were also categorised in terms of cartography, but also in terms of their didactic aspects, e.g. revised Bloom's cognitive taxonomy. In addition to the database of written didactic tests and its structure, the authors will present some of the results of the quantitative analysis. This analysis shows, among other things, that students achieve better results in tasks that test their procedural knowledge (e.g. scale creation, legend creation) compared to tasks in which they have to demonstrate conceptual knowledge dimension (e.g. knowledge and use of map projections, knowledge of methods of cartographic generalisation). Students achieve the worst results in tasks that test their factual knowledge (e.g. knowledge of cartographic terms such as distortion isograms, transcription or reference surface), while poorer results are also associated with tasks that require mathematical calculations. However, students have higher success rates in tasks that require application over tasks that test less cognitively demanding knowledge and understanding.

If the students' results are monitored within the individual categories of the cartographic curriculum (e.g. thematic cartography and maps, mathematical foundations of maps, map composition, etc.), then the quantitative analysis of the tests can lead to the following conclusions (see Fig. 1): the highest success rates were achieved by students in

composition and creating compositional elements, while the lowest success rates were achieved in tasks testing their competences in statistical data analysis, mathematical cartography, or other parts of cartography; greater variability in results was observed in tasks related to map lettering, topographic cartography, or statistical data analysis; relatively low variability and average results can be observed in cartographic semiology and thematic cartography. The authors attribute the lower level of variability to the greater emphasis on these topics during the seminars.

The above and other results have become the basis for the stimulus material for the planned discussion platform of Czech didacticians of cartography in September 2024. The aim of the research is also to provide generalizable conclusions to the cartographic community as a contribution to the subsequent discussion.

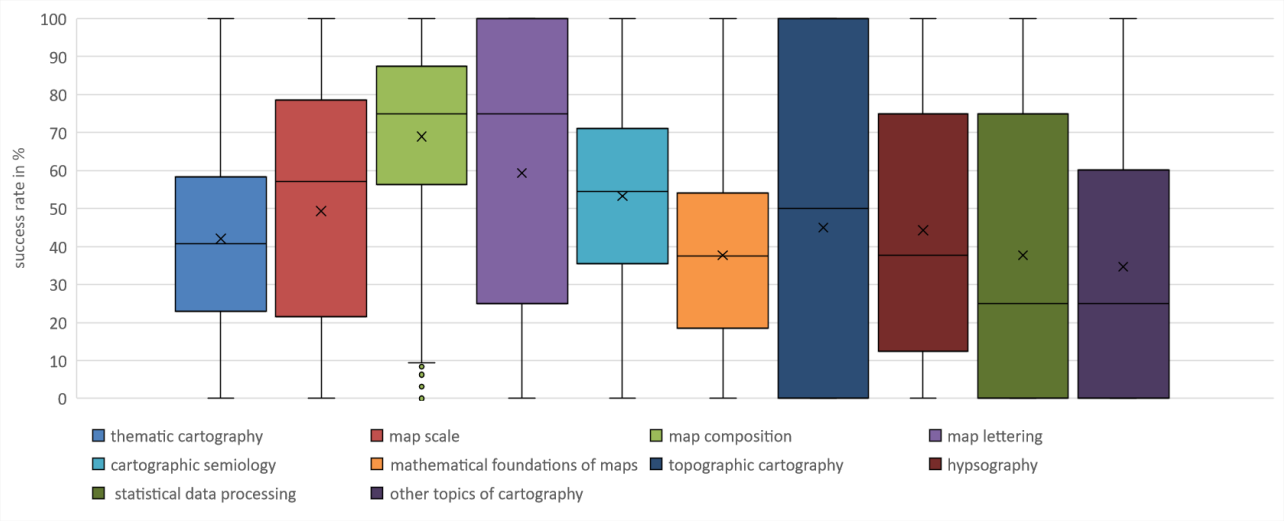

Figure 1. Students' success in individual parts of the cartographic curriculum

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