International Cartographic Association
Association Cartographique Internationale

Co-designing a new Bachelor study programme at the interface of geo(infor)matics and data science together with students – first insights

Gertrud Schaab [a,*], Christine Preisach [b], Michael Tewes [a] & Felipe Vásquez Tavera [a]

[a] *Karlsruhe University of Applied Sciences, Faculty of Information Management, Karlsruhe, Germany, gertrud.schaab@h-ka.de*
[b] *Karlsruhe University of Applied Sciences, Faculty of Computer Science and Business Information Systems, Karlsruhe, Germany*

* Corresponding author

Keywords: higher education, instructional design, student engagement, survey, teaching/learning formats, multidisciplinary

Abstract:

The field of cartography, always dynamic, is especially again so in the current era of big data. Meng (2022) predicted that cartography will have a more important role in spatial reasoning built on intellectual skills, adding, "Cartography […] is thriving in the soil of data science" (p. 7). Clarke et al. (2019) pointed to the necessity for cartographers to handle a different set of skills including data science for similar reasons, foreseeing that calls for data will be increasingly replaced by the use of maps for insights and knowledge creation. Robinson et al. (2017) highlighted the critical demand for interdisciplinary knowledge transfer between various data sciences due to the complexity of geospatial big data. Meanwhile MacEachren (2019) used the example of Bertin's semiology of graphics and its visual variables to demonstrate how a fundamental concept has impacted the disciplines having data visualization as its core and is likely to do so also in the future. This is in short, the background in which academic teaching on geospatial data creation and use is to be reconfigured, with Clarke et al. (2019) pointing to the likelihood of new forms of teaching and learning. To add, new study and examination regulations developed by lecturers are today no longer enough to reach the next generations. Here, involving students at an early stage makes it possible to gather their ideas and needs. The question is: how can the ideas of the lecturers (solid training, coverage of content) and those of (potential) students (digitalization: teaching formats, new technologies, project orientation) be brought together?

Since April 2024, at Karlsruhe University of Applied Sciences the project "Open Geo-Data-Science Space" (https://www.h-ka.de/ogdss) exists, funded by the foundation "Innovation in der Hochschullehre" (Innovation in Higher Education). The aim is to collaborate on a new innovative, attractive and sustainable Bachelor study programme. The co-design efforts involve students and lecturers from geomatics-related Bachelor study programmes as well as a more recently established data science Bachelor programme. This cooperation across faculty borders helps to evaluate the opportunities of a study profile at the interface of geo(infor)matics and data science. Rather than lecturers mainly deciding on what to cover in a curriculum, we are conducting an array of activities taking place over two years to gather ideas on up-to-date higher-education teaching as well as on advertising the envisaged study programme by learning from our students.

Central to our approach is a workshop series adapting the open space technology. Each of the seven workshops targets a different topic sequentially, to build on knowledge and ideas created from previous events. The workshop series started by learning about what data science stands for and by collecting ideas in a World Café format of participants' thoughts about four major goals targeted by our project: potential applications of geodata and data science, engaging learning and attractive studies, doing justice to the diversity among students, and the integration of sustainability into the studies. Next, moderation from an expert on higher education confronted us with the "w"-questions of who, what, why, and which success, to develop first ideas for a study plan. In the second workshop, we provided examples on how geoprocessing methods, including GeoAI, will change by contrasting established methods versus novel approaches. This was required, as while the geomatics-related students were largely blind on how the field is changing, the data science students considered geospatial applications like forecasting something never before done. The workshop's main focus, however, were so-called 'future skills' leading to ideas of how to integrate them into the new study programme, as well as design thinking, which we learned to apply by coming up with a webpage for the new study programme as an example. In the third and so far latest workshop we aimed to produce a questionnaire for a Germany-wide survey to test our ideas. On the first afternoon every group worked on possible questions linked to one of five topics (prior knowledge and interests, ways of teaching and learning, the organization of the study programme, the new Bachelor's programme in more concrete terms, and how to advertise the study programme). The suggestions were presented to all participants and then clustered. This allowed on the next day for newly formed groups dedicated to one topic each to condense the suggestions to about five apt questions.

Abstracts of the International Cartographic Association, 10, 250, 2025
32nd International Cartographic Conference (ICC 2025), 17–22 August 2025, Vancouver, Canada.
https://doi.org/10.5194/ica-abs-10-250-2025

Supporting us was a representative of the market research institute commissioned to run the survey, who provided practical hints on how to come up with a successful questionnaire. By the end, an early version of the questionnaire was ready.

Another project activity was the demand analysis for a Bachelor study programme at the interface of geo(infor)matics and data science. Before an online meeting with representatives of companies, public institutions and research organizations, inviting both experts from the field of geodata processing as well as of data science, we distributed a series of questions. The overall idea was welcomed, with the private sector seeing more pressing demand for training in new methods when compared to public institutions. Additionally, universities within a 150 km-radius around Karlsruhe, in the state Baden-Württemberg as well as Germany-wide were assessed, producing two maps for revealing potential competition in similar study offers. Revealed is an interesting pattern of teaching hotspots with several related options for study programmes in the same towns (many of them long-established) but interleaved nowadays with many recently established programmes. As lecturers, we are also interested in supporting as well as challenging students by means of new teaching/learning formats. The testing of new forms of teaching and learning started in the study programmes of both disciplines with three selected modules or courses within winter semester 2024/25. In this, student assistants (i.e. students of a higher semester with a contract) provide constant feedback. The funding also enabled the setup of a teaching/learning environment for creative collaboration, i.e. a room for new ways of conveying and building knowledge approached within a different atmosphere.

So, what have we learned so far? In the workshop series, learning and testing new skills while generating ideas for an attractive study programme is working out. Even a change in participants due to our students leaving the university for their practical semester is not a problem as long as some students participating in the previous semester remain in the next workshop. The demand analysis provided two main messages: As the professionals pointed out, the new programme should provide a strong profile for convincing employers, and have an attractive name to attract students. So far, there is only one offer for studying geospatial data science in Germany (and the German-speaking countries), this at Munich University of Applied Sciences, which opted for a strong focus on building computer science skills. Considering other teaching/learning methods contributes to more diversified teaching, it being more attractive to the students and providing a different atmosphere when student assistants have a say, but also far more time-consuming when preparing courses.

While we wait for the survey data and the analysis, both aiming at a broad opinion base, we also started making plans for how best to advertise such a new study program to those keen on advancing to university. School visits by students or visits to the university by schools are to be accommodated. We also see the need to make use of new media channels for providing convincing first-entry access to information. Two of the remaining workshops will thus be dedicated to work with students on how to promote the new study programme and developing a social media campaign. We are optimistic that the co-design approach will influence the visibility and appreciation of the study programme.

Project funds and a lively participation in project activities are crucial but not the only stimulants for success. The final implementation of the study programme developed in co-design with students also depends on the university's overall strategy and the decision boards. We are optimistic in achieving our goal, although it might take time. For about two decades, programmes named "Cartography" have vanished, apart from one International Cartography Master offer in Europe which started 2011 and covers more than cartographic courses in the strict sense (https://cartographymaster.eu/about/structure-2/). We believe that with the advent of Big (Geo)Data, thematic cartography in particular will again flourish with its particular strengths of visualizing and communicating multivariate as well as time-dependent data, from which spatial data science is likely to benefit. As such, the envisaged new programme at Karlsruhe University of Applied Sciences, which has been known for thematic cartography since 1978 (Schaab, 2014) will keep up said reputation in the future. In addition, the new project may well spark the rethinking of processes for coming up with new or revised study programmes at our university by directly involving students with their fresh ideas and valid concerns, thus helping to implement study programmes which attract and convince beginners.

References

Clarke, K.C., J.M. Johnson & T. Trainor, 2019. Contemporary American cartographic research: a review and prospective, *Cartography and Geographic Information Science*, 46:3, 196-209, DOI: 10.1080/15230406.2019.1571441.

MacEachren, A.M., 2019. (re)Considering Bertin in the age of big data and visual analytics. *Cartography and Geographic Information Science*, 46:2, 101-118, DOI: 10.1080/15230406.2018.1507758.

Meng, L. (2022) Proliferation of cartographic education in the age of big data. *Journal of Geodesy and Geoinformation Science*, 5:3, 7-18, DOI: 10.11947/j.JGGS.2022.03.02.

Robinson, A.C., U. Demšar, A.B. Moore, A. Buckley, B. Jiang, K. Field, M.-J. Kraak, S.P. Camboim & C.R. Sluter, 2017. Geospatial big data and cartography: research challenges and opportunities for making maps that matter. *International Journal of Cartography*, 3:sup1, 32-60, DOI: 10.1080/23729333.2016.1278151.

Schaab, G. (2014) 35 Jahre Kartographie-Ausbildung an der Hochschule Karlsruhe – den Wandel visualisieren. Kartographische Nachrichten. Journal of Cartography and Geographic Information, 4(2014), 187-198, DOI: 10.1007/ BF03544164.