International Conference on Geomatics Education - Challenges and Prospects (ICGE) - Rundown

Location: N003, G/F, Block N, The Hong Kong Polytechnic University (PolyU)

More conference information: https://www.polyu.edu.hk/lsgi/icge22/

Keynote Speech 1

Sailing Through Radical Changes in the Geomatics Education

Prof. Liqiu MENG

Technical University of Munich

Professor of Cartography at the Technical University of Munich (TUM), and Member of the German National Academy of Sciences. She was Senior Vice President of TUM (2008-2014), one of the TUM's Principal Investigators in the first round of the German Universities Excellence Initiative, member of the Senate of the German Helmholtz Federation, deputy chairperson of the German Space Agency, member of the International Advisory Board of the Humboldt Foundation, and is currently Vice President of the International Cartographic Association, and Board Member of the Hans-Rudolf Foundation. She initiated the international master's program "Cartography" in 2011, which is jointly run by TUM, Technical University of Vienna and Technical University of Dresden and University Twente. Her recent research interests include geodata integration, multimodal navigation algorithms, map-based open portal for climate events, and ethical issues in cartography.

Abstract

The speaker takes a cognitive walk through the major educational reforms in Europa over the last 25 years in an attempt to explain the radical changes in the geomatics education. For instance, the Bologna reform has greatly facilitated the mobility of students and teaching staff, which in turn has contributed to the internationalization of curriculum design and given rise to new Master's study courses. The competencies required of new geomatics graduates have also been expanded. In addition to professional skills (know-how) and critical thinking (know-why), social skills, communication skills and adaptability have become indispensable.

The developments of data science, social media and artificial intelligence (AI) in recent years are having an unprecedented global impact on the education community. During the several recurring peaks of the pandemic, universities have adapted to online or hybrid teaching with incredible efficiency. With the advent of the post-pandemic era, we generally believe that we have now developed the habit of being highly vigilant and resilient to daily eventualities and multiple uncertainties. Nonetheless, the release of chapGPT as a disruptive milestone in AI has once again left us feeling underprepared.

Facing this new situation, the speaker addresses the changing relationship between lecturer and student from knowledge provider and recipient to co-learner and co-creator of new knowledge. She also points out that regular academic degree programs as primary delivery units that are built upon each other are increasingly being flanked by flexible lifelong learning modules based on anytime, anywhere micro-learning and micro-credentials. Furthermore, she emphasizes the need to engage students in the loop of educational quality management. Approaches such as trusted learning analytics and gamification may help create an intrinsically motivated and happy learning process and are therefore as important as conventional means such as exams and post-exam assessments of teaching quality. Finally, using case studies, the speaker calls for the inclusion of AI and ethics in the curriculum of geomatics education to enhance the human capacity of deep learning, thus prepare future talent with not only analytical problem-solving skills, but also a systemic understanding of complex and wicked geospatial problems.

Keynote Speech 2

Integrating New and Emerging Concepts into a Geomatics Engineering Curriculum

Prof. Derek LICHTI

The University of Calgary

Prof. Lichti joined the Department of Geomatics Engineering in 2008. Following his promotion to Professor in 2013, he served a five-year term as Department Head. Prior to his time in Calgary, Dr Lichti worked as an academic in Perth, Australia starting in 1999 and has held visiting academic positions in Australia, Brazil, Malaysia and Switzerland. He was also a co-founder of Scanalyse Pty Ltd, a successful Perth, Australia based start-up company specialising in wear measurement solutions for the mining industry based on laser scanning technology. Since 2013, Dr Lichti has served as the Editor-in-Chief of the ISPRS Journal of Photogrammetry and Remote Sensing. Prior to that, he served two terms as Chair of the International Society for Photogrammetry and Remote Sensing (ISPRS) Working Group V/3 Terrestrial Laser Scanning.

Abstract

Geomatics education faces pressure to integrate new and emerging methods into undergraduate curricula. Examples include deep learning, simultaneous localization and mapping, structure from motion, building information models, digital twins, autonomous vehicles, and others. The pressure can be attributed to multiple sources: widespread use in closely-related disciplines; the increasing ubiquity of technology like smart phones; and the democratization of methods such as photogrammetry. Moreover, there exists industry demand for graduates equipped with knowledge of the aforementioned methods as well as software development skills.

It is clear that in order to stay relevant, geomatics education must adapt to meet this challenge. Doing so will create new and exciting opportunities for graduating students. It is important, however, to prevent curriculum overload. The capacity to add new content to an already-packed undergraduate degree program may be very limited. Adding more content runs the risks of treating subjects in insufficient detail and overloading students. In practical terms, curriculum modification is required in order to add new material. That said, content revision cannot be at the expense of important fundamental material that comprises a student's knowledge base and may be required to meet accreditation requirements. Finding the right balance is a challenge.

This presentation will report on curriculum challenges faced by the Department of Geomatics Engineering at the University of Calgary. Some recent initiatives taken to integrate new and emerging methods into our undergraduate program will be described. The presentation will conclude with a case study of how students are engaged in both fundamental material and emerging concepts in a final-year photogrammetry course.

Keynote Speech 3

Experiences from several Erasmus + Education Projects

Prof. Georg GARTNER

Vienna University of Technology

Georg Gartner is a Professor for Cartography and Geo-Mediatechniques at the Research Group of Cartography at the Vienna University of Technology. He holds graduate qualifications in geography and cartography from the University of Vienna and the Vienna University of Technology, including a habilitation.

His main research interests lie in the role of modern cartography and applying LBS and interactivity to this role.

Abstract

Since the winter term 2011/2012 the International Master´s Program Cartography is offered (cartographymaster.eu). It lasts two years and is a cooperation between the Technical University Munich (TUM, Germany), the Technical University Vienna (TUM, Austria), the Technical University Dresden (TUD, Germany), and the University of Twente (UT, The Netherlands) (Cron et al 2014).
The aim of this Master´s Program is to educate specialists who are able to face the challenges of modern cartography and to help in forming the future of cartography. The full time study contains 120 ECTS. The students get 30 ECTS per term/at each university as well as 30 ECTS for the master thesis. The program is strongly structured.

The students remain as group during the whole studies and switch together to the next university after each term. The corporate feeling and collegiality are especially supported within this program. A

survey among the students showed that the students prefer this model. The studies last 4 terms and begin in each winter term at TUM. The students pass the second term at TUW and the third at TUD. They can choose at which of the four cooperating universities they want to complete their master thesis in the fourth term.

The development of a curriculum of an international master program needs to consider several constraints:

- Local Arrangements: many of the potential offered classes might need to be also part of the respective local curriculums
- Local Strengths and Directions: as a master curriculum should be researchoriented the respective research directions of the scientists and lecturers involved influence the content and focus of classes
- Global Scientific Directions and Developments: the curriculum should allow for alumnis which are trained in the recent and ongoing available technologies and methods as well as being able to contribute to their further development, thus fundamentals as well as new trends need to be included and offered
- Didactic and pedagogical concepts: the curriculum should reflect the ideas and concepts of the didactical aims involved, defining the mixture of practical, 2 theoretical classes as well as the pedagogical concepts and educational means involved

As part of the International MSc Cartography program the Research Division Cartography of the Technical University Vienna has developed specific answers to those constraints. The core part of these answers is the development of a so-called triangle of competences. This triangle defines the major cornerstones of competences a modern cartographer should achieve and is derived from the analysis of the domain research activities, the evolution of technologies, methods and applications, the job market and general considerations (Gartner 2014). If a Body of Knowledge (BoK) of a domain exist, this could be an excellent source for underpinning the definition of such a triangle of competences, however, in cartography such a BoK is not available yet (Huang et al 2018). Such a triangle allows then for placing potential classes and their objectives and aims in relation to each other and allow for a holistic view of the context being offered.

As a further specific answer to the constraints listed above the curriculum includes a rather “problem-based” learning style (PrBL). In a project-based learning environment tasks, assignments and action

steps are usually defined by the teacher. In contrast, PrBL is rather student-centered and provides self-paced learning modules for the students. Learners are gradually given more and more responsibility in order to become independent life-long learners. Unlike traditional pedagogy methods, which are teacher-centered and where teachers transfer knowledge directly to students, in PrBL, teachers are there to facilitate learning and educational materials to students.
Furthermore, it is based on real world problems, sometimes research-oriented, that stimulate learning, integrating and organizing learned information to ensure recall and future application (Retscher et al., 2022).

As part of the three-year Erasmus+ Capacity Building in Higher Education (CBHE) project called "LBS2ITS" (Curricula Enrichment for Sri Lankan Universities Delivered Through the Application of Location-based Services to Intelligent Transport Systems) so-called "Trainthe-Teacher Courses" are conducted. Generally speaking, Train-the-Teacher (TTT) workshops are designed to equip university teaching staff with the necessary skills and knowledge to deliver effective training sessions to other individuals or groups (Gabela et al 2022). Principles that should be incorporated into Train-the-Teacher workshops include understanding learning processes, practice effective communication, appropriate interaction strategies, develop clear learning objectives and goals, discuss feedback and evaluation options, and allow for practical experiences if appropriate.

A dedicated one-week TTT-workshop on Location-based Services and Multimedia Cartography was conducted from February 20-24, 2023 at General Sir John Kotelawala Defence University in Ratmalana, Sri Lanka, following several other TTT-workshops on topics related to the overall project context of LBS2ITS. The workshop was visited by 25 lecturers and academia staff of four Sri Lankan partner universities of several domains, including geodesy, urban planning, computer science and management. Two trainers from TU Wien - Vienna University of Technology have been the resource persons. The TTT-course was designed as a mix of theoretical, interactive and practical inputs, as the respective level of education in LBS in Sri Lanka is still in its infancy and cannot rapidly deliver the knowledge inputs required to change transport management decision-making in Intelligent Transport Systems (ITS).

The overall structure of the TTT-workshop introduced the idea of a "why-what-how" structure, thus WHY is educating students on the subject of Location-based Services and Multimedia cartography, relevant and in which context, followed by WHAT content can be taught and is aims for gaining particular skills and competences related to LBS2ITS, and finally HOW education in LBS and multimedia cartography can be pursued (Huang et al 2018), including the idea of how to introduce problem-based learning (PBL) approaches, active learning strategies, quality assessment options and curriculum development (Gartner 2022a).

While the workshop reached its objectives by offering a total of 15 sessions on the "WHY", "WHAT" and "HOW" topics, key interventions have also been on the interaction and discussion about experiences and best practices amongst the participants. The outcome of the workshop allows participants to reflect on key concepts needed to be considered when building or editing curriculas in the context of integrating innovative topics such as LBS2ITS (Gartner 2022b). Possible Syllabi's, course contents and learning environments as well as possible quality control measures have been analyzed and discussed. As a project in the context of "Erasmus+ Capacity Building in Higher Education (CBHE) program" aims for exposing project partners on understanding learning processes, practice effective communication and appropriate interaction strategies, develop clear learning objectives and goals, discuss feedback and evaluation options, and allow for practical experiences if appropriate, all these aspects have been offered and lead to follow-up activities and results, including:

- Sharing best practices of quality management of higher education;
- developing a follow-up research project on higher education in the context of digital transformation of teaching and education;
- developing a joined research project in the context of the SriLanka Transport Board's needs on LBS2ITS;
- establishing teacher and student exchange plans.

Train-the-teacher courses are designed to provide teachers with the knowledge, skills, and tools necessary to effectively teach and engage their students in a particular subject area. The results of these courses can be measured in several ways, including changes in teaching practices, improvements in student learning outcomes, and increased teacher confidence and motivation.

As one scientific approach to measuring the impact of Train-the-teacher courses is through the use of pre- and post-training assessments. These assessments can measure changes in teacher knowledge and skills, as well as changes in their attitudes and beliefs about teaching. For example, a pre-training assessment might include questions about the teacher's understanding of the subject matter, while a post-training assessment might measure their ability to apply that knowledge in the classroom. Such post-training assessment is applied and results will be reported.

Another way to measure the impact of Train-the-teacher courses is through observations of classroom practices. Researchers might use a standardized observation tool to assess changes in the quality of teacher-student interactions, the level of student engagement, and the use of effective teaching strategies. These observations can provide a more nuanced understanding of how the training has impacted teacher practices and student learning.

Finally, researchers might also measure the impact of Train-the-teacher courses on student learning outcomes. This could involve analyzing student performance on standardized tests or other assessments, as well as gathering feedback from students about their learning experiences. By measuring changes in student outcomes, researchers can assess the overall effectiveness of the training in improving teaching practices and enhancing student learning.