Sustainable Development Goals in Applied Geo-information Science education, an example how to incorporate societal challenges in a curriculum.

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SUMMARY

Many societal challenges like climate change, energy transition, food security are related with and depend on reliable geo-information data. But to collect data of a high and relevant quality and useful for society we need also good, educated people. The four-year bachelor course Applied Geo-information Science (formerly known as Geo Media & Design) of the HAS University of Applied Sciences in the Netherlands started to incorporate the Sustainable Development Goals (SDGs) into the program. Also, we developed a new (geo)data science circle to combine the building bricks of (geo) data, the SDGs, and organizational issues. We (students and staff) think that the connection with the societal challenges and SDGs with the technical and organizational aspects of Geo-information Science will help the society.

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1. INTRODUCTION

Many societal challenges like climate change, energy transition, food security are related with and depend on reliable geo-information data. But to collect data of a high and relevant quality and useful for society we need also good, educated people. The four-year bachelor course Applied Geo-information Science (formerly known as Geo Media & Design) of the HAS University of Applied Sciences in the Netherlands started 8 years ago. After such a time, living in a dynamic world and to be attractive for new students we needed to update our curriculum. Another reason for the change is to keep the strong link with the labour market. In such a way we can guarantee for an influx of 100 students a job placement.
In this paper we show why and how we incorporate the Sustainable Development Goals (SDG's) (United Nations, Department of Economic and Social Affairs, ND) in our curriculum. We will discuss how to balance in our curriculum: the technology (use of GIS hard- and software); (big) data science (collection, analysis, Artificial Intelligence, visualization); user interface development (due to new users like policymakers, managers, citizens); soft skills (like communication and project management) and most important the relevance and usage of geo-information for the societal challenges.

2. SOCIETAL CHALLENGES AND SUSTAINABLE DEVELOPMENT GOALS

As seen in our times we have many challenges to have a good life, not only for use but also for future generations. Climate change, population change and migration, diseases, use of resources in different areas with different impact makes it important to measure, maintain, analyze, and visualize these societal challenges. The UN but also many children as grown-ups are involved in these challenges. The SDGs gives a direction and hope, to see that we can reach these goals in 2030.
Citizen science, data and professionals are needed. An example of this connection is discussed by Steffen, F. et al (2019).

3. EDUCATION

Education is changing. Students become more and more in control of their own learning. Covid made this development even more urgent, because direct contact between students and lectures became less and more distant. Most students are digital versed, and they expect the same from their educational environment. In such a way, almost a permanent innovation in education is needed. But students and their environment differ. Education cannot be any more

for everybody the same. So, education should be more flexible and adaptive to different and dynamic situations. Lecturers and students should have the luggage to make well defined choices to be ready for the real world. Certainly, both need to be well versed and educated in basic knowledge and skills, but especially the attitude to deal with change will be coming more important.

4. IMPLEMENTATING APPLIED GEO-INFORMATION SCIENCE AT HAS UNIVERSITY

HAS University of Applied Sciences (2021) developed an educational vision and holistic model in which education, research and professional practice are connected. Students, staff members, organizations and businesses work together on current issues and societal challenges in our sector Agriculture, Food and Living Environment. For the Bachelor program Applied Geo-information Sciences (AGIS, formerly known as Geo Media Design) this means that we combine the developments, trends, and innovations in society and the job market with our educational approach.

4.1 Design of the AGIS program

As illustrated in figure 1 we organize the 4-year program according to the well-known Geo-Information circle. Important is that we start with the spatial issues, the questions, and challenges. This motivates our students and is the reason why we would use geo-information. In most cases the SDG's and their data needs are related with the spatial issues. In figure 1 also two pillars are mentioned. You can find them back in figure 2. Pilar 1 (mostly in year 1) is the process from data towards information. Pilar 2 (more in year 2) is using this information

to develop and realize applications (technical solutions). The legs (three for good balance) are spatial thinking, spatial data and spatial solutions. All topics are illustrated by case studies. Overall communication skills are essential and are learned within the general Bachelor skills. In such a way we can deliver the Young AGIS Professional with a mindset to map, to monitor and to solve relevant and actual SDG questions. They have and will have impact.

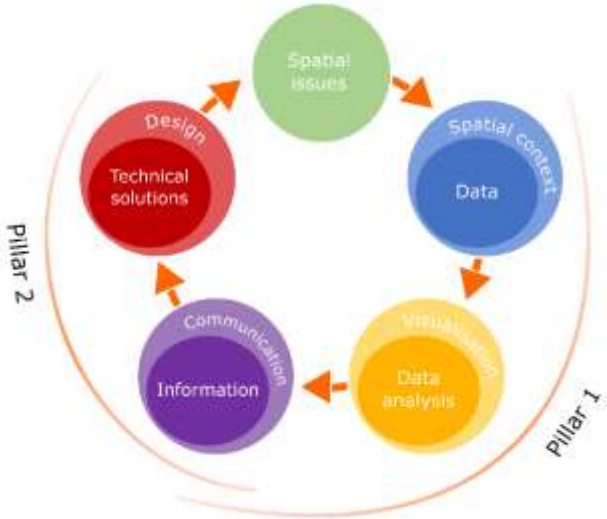

Figure 1. The curriculum structure of AGIS

Figure 2. AGIS stool with the two main processes/pilars: From data to information and From information to application

Behind this approach is that we developed an updated version of the data science circle (figure 3).
In the center the most important building bricks of (geo)data are shown. Location (as indicated in different coordinate systems, space), Time (as the dynamic aspect and history), Theme (as the context and domains); Data management (the amount of available data increase makes this more important) and Process (different analysis methods).
The outer circle gives all the SDGs as Applications. A selection of the 17 SDGs are used in our programme, all in relation with the needed and available data. We put emphasis on the following SDGs: Quality Education (4); Affordable and clean energy (7); Industry innovation and infrastructure as Hightech & Data (9); Sustainable cities and communities (11); Climate action (13); Life on land (15). In the program we use proprietary and opensource software.
The in between circle illustrated the meaningful organizational and societal topics like governance, ethics, (public) value, legislation, and regulation. These gives our students insight that we need more than a technology approach. Organizational issues, especially in our global society are needed to discuss.

Figure 3. The AGIS data science circle, connected with the SDG's

We do realize that we cannot work on all SDG's simultaneously, so we opted to select several issues, such as water, climate change, energy, biodiversity and urbanization. These are also near HAS university missions. Within these themes, we work on assignments for real organizations. Working Cross-border between different educational programs and integral spatial thinking will be the future.
In this way we can use data and tools and implement these in real life situations.

4.2 Example of a SDG project

An example of a project of second year students:
Three students worked on a project for the start-up Water I can Do. This organization aims to launch a platform on which people can calculate their 'water-footprint' when it comes to the

consumption of clothing and food. “Water I can Do is founded by to people from the Philippines. There, the availability of clean drinking water is not always a certainty. They were shocked when being confronted with the general Dutch attitude towards water waste. It became the driving force behind the organization. For Water I can Do, we developed an online calculator to provide insight in the usage of water. Next to that, we gathered advice to assist people in changing their behavior.”
During the project the students learned how little people feel responsible for their actions if it does not directly affect themselves or their close environment. “Water waste mostly affects the countries where clothing or food is being produced. By taking the SDGs, especially Nr 3 *Good health and well-being* and Nr 6 *Clean water and Sanitation* as a starting point for the project, we really gained awareness on the scope of the water problem in the world. And, additionally, on how we, as students, can contribute to solutions.
During these types of projects tensions can arise between the expectations of students, the needed expertise, the lack of reliable data and the available time for the project. As educator we learned from this to make some tasks smaller or schedule more time.

4.3 Core values

During the restructuring of our program, we defined some core values for our students and staff. This makes it also easier in attracting new students. The core values are to be curious, analytical, involved, connected, critical, adventurous, and creative. It is difficult to expect all of these in one person, but for a team effort these values should be dealt with.

5. CONCLUSION

Although educational development is never finished and an ongoing process, we (students and staff) think that the connection with the societal challenges and SDGs with the technical and organizational aspects of Geo-information Science will help the society. Working in a team with different competences and interests, using approaches like the data science circle is a nice and fulfilling experience. This will give the basis for lifelong learning and using applications of (geo)data.

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BIOGRAPHICAL NOTES

Marinus (Marien) de Bakker, a senior lecturer of AGIS with the main task: "*students out, question from the professional world in*". He has almost 35 years of experience with Geo-information education at several levels. Main interest is the needed competences in a very dynamic world, as encountered in professional work.

Michiel Jellema is director of Infofolio, an innovative datascience company adding value with many different (geo) data sets and AI-knowledge for informed datadriven insurance companies. He is part time connected with HAS University as external advisor of AGIS.

Susan van Dijk is organizational coordinator of AGIS and inspirator for the educational development of the programme.

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