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Designing an interactive environment to share education materials and resources. Application to the Geomatics Hub at Institut Polytechnique UniLaSalle Beauvais

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Abstract

Teaching is a process requiring a logical and progressive frame, which is formalized in the pedagogic curriculum. Selecting, arranging and framing the content is necessary to enhance the learning experience (Deng, 2011). The making of a curriculum implies the creation of materials that can be numerous. These pedagogic resources can be of different kinds: course materials, exercise instructions or help tools. Using technology to provide an easier access to these resources to the students through an online platform is a great way to perpetuate these materials and ease the work of teachers (Nachmias et al., 2008). Furthermore, the development of such online media permits a valorization of the pedagogic resources and its innovations (Mahajan, 2010). It is a step towards an open science approach of teaching geomatics which goes further than actual textbooks (Bell et al., 2018). This paper focuses on the online platform designed by the Institut Polytechnique UniLaSalle Beauvais for the Geographic Information System (GIS) courses: The Geomatics hub, which is mostly free to access for the general public. 54 answers were collected from a survey to collect the experience of students on this online tool. 87% declared that this platform allows a better access to the pedagogic resources while 89% indicated that its organization is clear and logical. The Geomatics hub is also a way to display the results of projects lead by either teachers or students. The use of an innovative solution with a digital open-access has a reach that is not limited to the students. The display of the education tools produced by UniLaSalle Beauvais for GIS can be noticed by companies, potential partners or former students.

Keywords: Innovation diffusion; open science; e-Learning; Educational innovation

1. Introduction: teaching geomatics at UniLaSalle – Campus of Beauvais

Geomatics is an umbrella term for all disciplines related to collecting, analyzing and storing geographic data. It gathers Geographic Information Systems (GIS), Remote Sensing, and Photogrammetry. The sensors and platforms are extremely varied, from ground-based GNSS to imaging satellites, or airborne LiDAR systems. The full Data Life Cycle is included, from the acquisition to the processing and communication of the results (Levitin and Redman, 1993). At UniLaSalle, the topics studied are mostly centered around Earth Observation, and more precisely Agriculture and Geology.

UniLaSalle Beauvais is an engineering school, teaching to about 3000 students in 5 years. Geomatics is an important part of the curriculum, with on average XX % of the time spent learning GIS, Remote Sensing and Photogrammetry, with an emphasis on the former (REN, 2022). Since the students have different career ambitions in Earth and Life sciences, being able to offer a wide range of real-life examples, especially for lab sessions, is estimated crucial as a way to keep them interested and therefore more engaged. One goal is to bring the students to work autonomously on Labs that they choose from a library. Taking ownership of their learning experience by choosing exercises could increase the efficiency of the course (Kolb and Kolb, 2005).

Additionally, as teachers we are aware that some knowledge learned during in college years, if not used, will be forgotten. We wanted to provide Alumni with a tool that will allow them to access hands-on knowledge and tutorials even years after graduating, if the need arises for them to use the geomatics tools in their careers.

Teaching requires to produce a non-negligible quantity of materials. While some teachers choose to make those available through their professional or personal webpage, some of these materials are lost. Making all materials available for the teachers of an organization could provide more time for others to improve their own curriculum, without having to reproduce materials that already exist. It is also in line with the Open Access movement claims, which is that everyone would gain from making materials public, by avoiding duplicate work (Hylén, 2021).

Creating interactive online course materials was selected as the way to evolve teaching Geomatics at UniLaSalle. The Geomatics Hub was invented as a platform to gather all those materials and bring them beyond the classroom, in the light of the new paradigm of Education 4.0 which emphasizes experimentation as a way to learn, especially by taking advantage of emerging technologies (Almeida and Simoes, 2019).

2. Development of the Geomatics Hub

2.1. The Geomatics Hub: a repository for course material

The Geomatics hub was developed in 2019. It is freely accessible online at <https://hub-geomatique-unilasalle-fr.hub.arcgis.com/>. About four teachers are involved and make their materials available in the platform. The main strategy is to provide students, as future Technician and Engineers, real-world examples and problem-based exercises to work on. The design is meant to be very interactive, with the implementation of naturally interactive tools, such a Genially, a platform to create dedicated interactive content.

The original idea was to give more autonomy to students by making them work on a workflow-based approach, where they were provided data, some context, a general workflow and access to a user manual created by the teacher. This allowed the teacher to focus on students with more difficulties. Those labs were then hosted and gathered under one Hub. Student can work in complete autonomy, by choosing in a library of labs with varying levels of difficulty, and also check their skills autonomously using lists of technical skills. GIS was originally the main discipline taught in Geomatics but creating an online Hub was to opportunity to gather together all the disciplines in Geomatics.

The three main disciplines are easily available: GIS, Remote Sensing, and Photogrammetry. For GIS, the main parts are: the lecture slides, about different topics related to GIS, the exercises as Lab Sessions, and an online help on three software: ArcGIS Pro, ArcGIS Online and qGIS. Online skills trees also guide students to different parts of the user manual depending on the skill they want to practice. For the Photogrammetry part, lecture slides are available as well as an online help on the software Agisoft Metashape (proprietary). There is a similar structure for Remote Sensing: lecture slides, labs and online help on ENVI (proprietary). In terms of web hosting, the user manuals are written and hosted on Scenarii, the lecture slides are in Genially, the Labs are on ESRI's servers in the form of Story Maps.

2.2. The Hub as a pedagogic tool

The use of StoryMaps allows to set levels for the Lab sessions. For the GIS part, all labs sessions are taught as Problem-based-Learning, where a situation is described to the student, who then has to follow steps of the processing tasks to complete the scenario. While in the first labs, the workflow is often given to the student, it is progressively less and less detailed, in order to let the student, improve and decide on their own of which tools to use, with the end goal of writing and developing their own workflows. Added to the list of labs, the students have access to an auto-evaluation of their skills, with a division in small skills that they can improve by completing the corresponding lab.

In Photogrammetry, the students are provided with a generic workflow and a detailed user manual, developed by the teaching team. The student then has to apply the processing to given sets of data, that can be changed year after year depending on the current need, for example when we want to student to work on new data.

The display tools chosen as a support (StoryMaps, ESRI hub, Scenari) are easy to edit if the leading teacher is not in charge of the Hub anymore, as it has been the case in this study.

As for now the platform is in French only. Finally, it is worth mentioning that geomatics also includes data acquisition. That encompasses a wide range of platforms: ground-based, drone, satellite, and of sensors. The data acquisition part is not covered by the materials in the Geomatics Hub yet.

2.3. The Geomatics hub as a showcase platform to enhance relations between companies and education

The Geomatics Hub is in close relation with the GéoLab, an innovation center at UniLaSalle Beauvais that provide an access to students to work on innovative numeric tools for 3D modelling and 3D printing. This includes high-quality PCs, software licenses, technical support and more. The Hub is a way to present the current and past student projects. Beyond being a platform for students, it is also the opportunity to build bridges between the academic world and industry. By showcasing the researchers and students work, companies are more willing to offer internships or job offers, or rent the services of the GéoLab for one-time projects, such as fossils and minerals 3D modelling, bio-mimicry research work. It is also a showcase of the education offered at UniLaSalle and bring in new customers for one-time workshops and companies' workshops. By

interacting both with students and professionals, the benefits are coming back to students because the teachers are on the front line and can estimate the needs of the companies, by being in direct communication with them (see Figure 1).

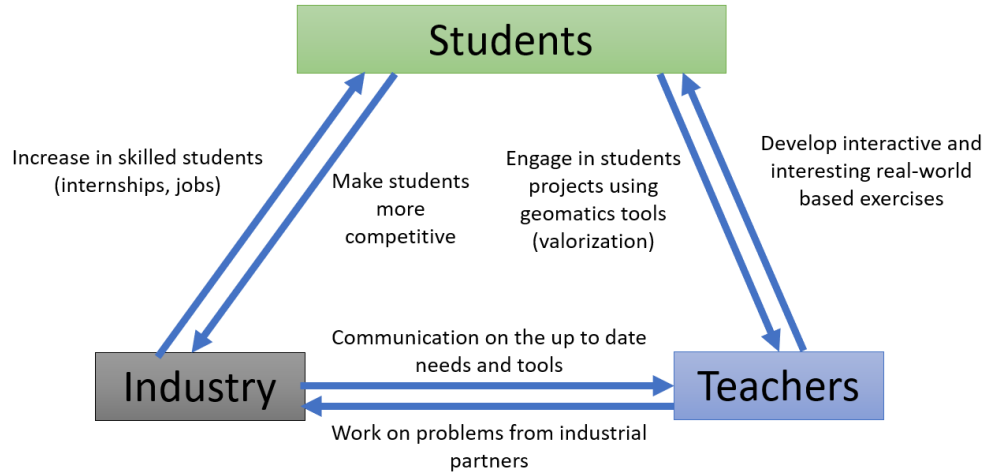


Figure 1 - Multi-parts benefits of an Open Educational Resources with an emphasis on the communication between all three actors of learning: students, teachers and the industry

3. Three years in: evaluating the use of the platform

The main objectives of the Geomatics Hub are (1) to be an efficient tool for current students at UniLaSalle Beauvais, (2) to be useful for former students (3) to be used as a showcasing website for external users, whether they are individuals or companies. Two metrics are here studied to quantify the success of the platform. Firstly, we will evaluate the impact on student through surveys. Secondly, a study of the hub engagement metrics will be used to quantify the impact of the website.

3.1. Students survey

A study was conducted in September 2022, and 66 students answered of the 406 students surveyed. The students targeted were those who already studied GIS in their course, so the third, fourth and fifth year in the curriculum, and the students who had recently graduated. 48.5% of the students who replied are in their third year at UniLaSalle. The questions were divided into three sections: The Geomatics Hub in general, the chronology of the Lab Sessions, and the skills tree. The objective of the survey was to target those specific pedagogic tools in order to assess them individually.

To the first question ("To which occasions are you using the Geomatics Hub?"), and besides a use during the class, 67% say they use the Hub when studying for the exam, 17% say they use it to know more about geomatics in general, 56% say they use it for projects outside of the class, and 15% say they are using it when working for a company (either during an apprenticeship, internships, or in their new position for the recently graduated students). When asked which resources the students were looking at the most, the first place comes for the course materials (73%), then the chronology of Exercises in

ArcGIS (59%), the user manuals (55%), the library of exercises/examples (41%). About the use of the Hub outside of the classroom, a third of the student said they were using it regularly (33%), a third replied they were using it outside of the classroom but not regularly (35%) and another third replied that they were not using it outside of the classroom (31%). Three following questions are about the display and ease of use of the platform. In a large majority, students find that the Hub is easy to use (90%), and would recommend it to someone who is a total beginner in GIS (94%). However, those results are to put in perspective with some written comments by students who say that the interface is sometimes too busy and that there are too many steps to get to the course content.

The second part of the survey deals with the chronology of the exercises. Almost all the students say that the chronology is easy to understand and use (98%), and that it allows them to understand better the course in terms of skills to learn, by putting all the exercises in perspective (94%). The third part of the survey is about the skills list. While only half of the students had seen the skills list before (53%), a large majority of them think that it can be useful for them to learn GIS (85%), and that they would use it autonomously, without being expressively told to during a lecture (75%).

This first experience in surveying the students provided insights on the use of the platform but will also be used to improve the next surveys, especially in terms of focusing questions and getting the students more engaged.

3.2. Website engagement overview

ArcGIS Hubs show a part of statistics on the website views. In the past year (Nov.2021 to Nov. 2022), over 15,000 visits were recorded, and on average in the past three months the visits are about 1,400 visits / month. There is no information on summer views, which could have been a good indication of views from students vs. Views from external users. Those metrics are limited but give a good quantitative indicator on the website's relevance and use.

4. Conclusion

After three years of use of the platform, we now feel confident in putting in perspective the use of the Geomatics Hub. Overall, the feedback from students and teachers alike is in the majority positive. The students can work autonomously, during labs the teacher is in a support position. Students can follow their own pace and see the big picture of the skills expected from them at any time of their education. During the lifetime of the platform, teachers in Geomatics have partially changed. The existence of the platform made those changes easier, and lessened the disruption on students. The school's industrial partners also gave positive feedback. ESRI France, the French branch of the leader in GIS and Remote Sensing software, broadcasted the Geomatics Hub in their magazine "SIGMag" in December 2020.

The feedback is for the moment limited and there is no way for website visitors to leave comments that could let the developer team that something is wrong with the content (broken links, outdated data or new processing technologies, general remarks and

suggestions). Additionally, including Single Sign-On (SSO) to the website would give more information on the profile of the users.

With the improvement in topics such as small objects photogrammetry, there is a need to update the tutorials. New topics related to Spatial Data Science should be included, like Machine Learning techniques, now broadly used in Spatial Data Science, including Geomatics. A part on data mining and data downloading should also be added, as well as reflecting on how to include the data acquisition part. A translation in English would also be a plus. Following the survey with students, it seems important to modify the architecture of the website to streamline the access to the different parts of the materials. A focus should also be made on accessibility (option for contrast, image alternative text for example). One main risk taken with the architecture of the hub is that it relies heavily on external storage. The StoryMaps and main interface are hosted on ESRI's servers, the data is hosted internally on the school's own platform, Claroline. The Software manuals are hosted on Scenarii, and the slides are hosted on Genially and also archived on the teacher's own computers. A way to bypass this would be to develop a server internal to the school, like an ESRI ArcGIS Enterprise solution. In terms of pedagogy, more didactic tools should be tested, such as glossaries, quizzes, serious games.

After three years of experimentation, the students and teachers alike are using the Geomatics Hub for its intended purpose with success. The students appreciate the diversity of materials, but it can also be a drawback by making the platform busy and hard to navigate in. The teachers can rely on previously prepared materials, and also have a freedom to edit anything they want. In the future, the objective is to add or complete the contents, update the information on the software and document the process. Adding levels of help for the GIS labs is proven to be efficient so it should be generalized to all three disciplines. The open science approach is a philosophy the team still fully adhere to, and therefore once the Geomatics Hub fully updated it will be more widely advertised at the level of UniLaSalle Group at first (Beauvais – Amiens – Rouen – Rennes) and in the Geomatics community in general.

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