

# Enhancing the Digital Learning Experience: The Case of the Digital Lab of the Berner Fachhochschule

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**Abstract:** We present experiences from the establishment of the Digital Lab in our school as a means to help our students build the digital skills and capacities to conceptualize, design, implement and lead digital transformation projects. We conceived the Digital Lab as an internal soft-infrastructures building project at the Business Department of the Berner Fachhochschule. In this respect we envisioned it as a place where interesting things would take place and where people would bring their own ideas and have the opportunity to communicate or share them with others. The application area relates to the acquisition of basic skills by the students to understand the rules and the limits in sharing and trading data, acquire some sufficient level of familiarization regarding how data privacy issues affect the partnership between companies, and how existing or newly appearing business constellations can create value for data-based solutions.

## 1 INTRODUCTION AND CONTEXT SETTING

Colicchio et. al. in a relatively recent research they publish results of a study conducted on cloud readiness (Colicchio, 2015). There, the idea is about organisations and in particular small and medium-sized enterprises (SMEs) to hire precisely those services they need, and it is to this aim that cloud computing enables them to overcome restrictions from low budgets and limited resources. In the present paper we shall elaborate on the appropriateness of a Digital Lab as a means to challenge and, hopefully, change the teaching and education culture in the Business Faculty of the Berner Fachhochschule.

Warren Buffett once said that ‘being successful at almost anything means having a passion for it. If you see somebody with even reasonable intelligence and a terrific passion for what they do and who can get people around them to march even when those people can’t see over the top of the next hill. Things are going to happen’ (Buffett, 2017). Our guiding principle for

the establishment of the Digital Lab in our school was to help our students build the means for becoming successful in the digitalization projects they would be asked to conceptualize, design, implement and lead once they will graduate from our school.

We are of course aware of the interest that is attracted and constantly increasing in the last years regarding the issue of digital skills and their acquisition and possession by pupils, students, young persons and at last everyone who is part of the active workforce. To this, one may see the need to teach students and young people in general as well as potentially everyone ‘out there’ who is part of the active workforce to get a starter’s or in some cases more advanced level of capacities regarding Website development, but is this *really* useful? Of course, one may see the need for conveying some basic digital skills regarding e.g. JavaScript Programming, or interactive data visualizations. And again, the question: is this *really* useful? Same can go for digital skills related to databases and Web crawling, or data analytics with use of Python, Jupyter, or Pandas.

Umberto Eco in one of his last works before his death recognized that ‘losers, like autodidacts, always

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know much more than winners. If you want to win, you need to know just one thing and not to waste your time on anything else: the pleasures of erudition are reserved for losers. The more a person knows, the more things have gone wrong' (Eco, 2015). Quite paradoxically, this perspective, though seemingly unexpected, is not in disagreement with an aphorism of Johann Wolfgang von Goethe, who in his novel 'Wilhelm Meisters Lehrjahre' admits that 'humans are born to a limited situation, they can comprehend aspirations that are simple, readily accessible and precise, and they accustom themselves to using means that are close at hand; but as soon as they branch out from their restricted sphere, they know neither what they would like to do nor what they should do' (Goethe, 1995).

The challenges and the open space of opportunities and potentialities is a reality that all of us but especially young(er) people are exposed to nowadays, as result of the proliferation of digital technologies. It is in this context that we see the need for offering to our students the opportunity to acquire those digital skills and organize their digital intelligence in ways that will help them become potential winners of the digital transformation processes that have already started and will stay with us in almost all aspects of the society and the economy.

In the next section we present the background of the EU Digital Competencies Framework (Vuorikari, 2016) and make a first attempt to explore its impact and change potential for individuals as well as for education and research institutions.

## 2 THE EUROPEAN DIGITAL COMPETENCE FRAMEWORK

The European Digital Competence Framework, also known as DigComp, offers a tool to improve citizen's digital competence (Vuorikari, 2016). The original reference conceptual model (appearing as DigComp 2.0) has been complemented by DigComp 2.1 that constituted a further development that presented eight proficiency levels and examples of how these can be applied to the learning and employment field (Carretero, 2017).

The core idea as also presented in the two aforementioned sources is to identify a path of future-relevant *competence areas* (dimension 1) and for them also come up with an identification of the *competences* that are relevant and important for each of them (dimension 2), while for each of the identified

competences be able to identify *proficiency levels* (dimension 3) and also *skills examples* that connect back to each competence (dimension 4), as shown in Figure 1 below.

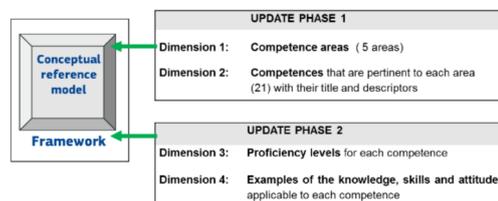


Figure 1: The two-phase process to update the DigComp Framework to version 2.0. Source: (Vuorikari, 2016)

Regarding the value from the use of the DigComp Framework in a setting such as the Digital Lab, below we list some indicative application concepts; there is no doubt that practice may help us come up with more, some of which may be totally unexpected or unplanned and may have the potential for intensive adoption and scale-up.

For the individual lecturers but also in a top-down fashion at the institutional level DigComp can be used to plan and help design teaching and training offers, where the Digital Lab may help for building the corresponding proofs of concept and prototypes; for the educational policymakers it can help as a reference for addressing digital skills and to support curricula development.

The students themselves can also experiment with the various modalities available so that they gain a better understanding to a concept that had been presented only in a theoretical fashion. Though not tested at all, we might risk a hypothetical scenario where students taking a macroeconomics course would have the opportunity to simulate behaviours of a market or an economy for various levels of inflation.

## 3 THE DIGITAL LAB AT THE BERNER FACHHOCHSCHULE

### 3.1 The Concept

We conceived the Digital Lab as an internal soft-infrastructure building project at the Business Department of the Berner Fachhochschule. In this respect we envisioned it as a 'place where interesting things would take place and where people would bring their own ideas and have the opportunity to communicate or share them with others. As a place, the Digital Lab should also offer the means for the

conduct of workshops, allow people to co-work, as well as carry out rapid and hands-on prototyping.

In this respect, our Digital Lab is not a novelty but follows a trend that has like the SwissCom Digital Lab, or the Digital Lab of a scheme of three collaborating universities and three companies to address, again in Switzerland, several areas including amongst others different levels of prototyping and ‘applied digitalization’.

However, we have been aware of the many childhood diseases that such projects may face: enthusiasm is decreasing faster than one may have expected once funding is halted, attention is not any more attained, people who were involved are drifting away and no new people seem to exhibit any interest to get involved.

This is nothing new here, so from the early design and conceptualization phase of our Digital Lab we wanted it to be *sustainable*. Our idea was that if the Digital Lab would be useful for our academic and research staff and also for our students, there would be no problem to even allow for a continuous re-orientation process to run there. Or even better: we could welcome this process as an essential means to meet its ends.

In the beginning we had to cope with some myths, which we briefly present and comment below.

**Digital Does Not Mean Virtual:** It is a common mistake that people make, by identifying anything digital as only relevant when addressing or engaging a virtual space. This is quite wrong, and though we all have experiences of digital banking that affects real and no virtual financial assets e.g. when paying for a good or a service, the latter being also not necessarily virtual but real, we tend to associate digital with virtual. The implication for our Digital Lab is that people could be involved in any type of activities they wanted and for which there was a part that addressed the need for enabling digitalization of a process or of an aspect.

The success of the above approach was foreseen from our side but we never thought how big this would be. Same as in the economy, that *economic slack* is a term used to notify the resources in an economy that are not used, our aim was to *not leave anyone out of what was happening or was about to happen in the Digital Lab*. So same as for an economy economic slackness is measured by the amount of equipment staying idle in factories or people who are unemployed, our aim was to engage all academics and students in the Digital Lab.

### 3.2 Improving the Teaching Experience

For a University of Applied Science, where the major focus has been traditionally been on teaching, the Digital Lab offers a unique element for improving the teaching experience and making a conscious and deliberate effort to reach teaching excellence in the form of situating the teaching subjects in a practice-oriented and hands-on approach. As shown in the Figure below, we designed it as a multi-purpose space where a wide gamut of digital or non-digital activities could take place.



Figure 2: How the Digital Lab looks like (sketch).

Amongst other things we planned to offer from the Digital Lab was a special skills acquisition program called “digital snacks”, which again is not a novelty as there are similar offerings like special acquaintance programs for helping people keep abreast of new technology developments but our aim was to be the first to introduce a novelty but on how to make this an *integral part of a digital skills acquisition process*.

There is a wide bibliography on digital skills see for example in (Van Deursen, 2014) and (Broadband Commission, 2017). There, amongst the trends related to the promotion of the ‘digital literacy for all’, the ‘teaching of computer programming and coding skills to children and young people’, and the ‘facilitation of the development of digital skills needed to enter ICT professions’ is included the need to foster ‘soft’ and ‘complementary’ digital skills’ or what the report calls ‘twenty-first century skills’. The discussion on which ‘soft’, ‘complementary’ or ‘twenty-first century skills’ digital skills are essential for future generations of knowledge workers or employees or more fine-grained categories of professionals may not be easy to structure. For the needs of the present paper we shall limit ourselves to only the first competence area of DigComp as presented in the Figure below, related to *information and data literacy*.

Competence areas	Competences
Dimension 1	Dimension 2
1. Information and data literacy	<p>1.1 Browsing, searching and filtering data, information and digital content To articulate information needs, to search for data, information and content in digital environments, to access them and to navigate between them. To create and update personal search strategies.</p> <p>1.2 Evaluating data, information and digital content To analyse, compare and critically evaluate the credibility and reliability of sources of data, information and digital content. To analyse, interpret and critically evaluate the data, information and digital content.</p> <p>1.3 Managing data, information and digital content To organise, store and retrieve data, information and content in digital environments. To organise and process them in a structured environment.</p>

Figure 3: An excerpt from the first two dimensions of DigComp regarding the information and data literacy. Source: (Vuorikari, 2016).

As shown in the second column of the Figure above, there are three basic competences related to this area namely:

1. Browsing, searching and filtering data, information and digital content
2. Evaluating data, information and digital content
3. Managing data, information and digital content

In (Vuorikari, 2016) where examples of use of the digital competence framework are provided, it is not by chance that all these three aforementioned competences appear at the foundational level, their complexity regarded as simple and on the cognitive domain demanding only *remembering*, while other tasks that are of intermediate, advanced or highly specialized level, demand *understanding* (intermediate), *applying or evaluating* (advanced), and last but not least *creating* (highly specialized).

We regard this as a shortcoming as information and data literacy forms a competence area that needs to be covered at all four DigComp levels. And to this we identified an opportunity for bringing this close to our work at the Digital Lab, for helping people acquire the relevant digital skills for this.

To use another term that has recently appeared in the field, one may say that our aim is to help our students build and further improve their *Digital Intelligence* (DQ). This is an attempt to synthesize many of the skills and abilities outlined above, alongside notions of ‘digital emotional intelligence’ to produce a description of the cognitive, social and emotional elements of contemporary digital technology use (Yuhyun, 2019).

### 3.3 Making It Exciting: The Digital Lab as a Hacking Zone (Bring Your Own Idea)

In the city of Bern there is a very dense public transportation network covering most urban areas and

with connections also to two other neighboring cities (Biel and Solothurn).

Rami, a business informatics student has been using the city transportation for almost two years and hasn’t experienced any ticket controls. So for Rami there was enough ground to believe that either the transportation authority didn’t care at all if people were paying a ticket, or there were some other means to estimate the number of the fare evaders. He has spent some time on how one may come up with an estimate of the amount of the free riders and how one may also achieve some level of confidence.

His girlfriend Namira works shifts in a fastfood chain and once that Rami mentioned his thoughts on the ‘Bern free riders’ problem’, she was surprised: for her that she usually took the trains around noon time, there were very frequent ticket controls. Sometimes they were also unpleasantly frequent.

A consequence that we all experience as result of the digitization is that people build opinions – either on their own, or by relying on other people’s opinions, or by use of a variety of means, and then get locked-in to them. This doesn’t need to relate to big issues like the climate change or the anti-vaccination movement but may concern also very specific issues like the example we mention above.

Our aim was to let students but also practitioners from companies test their theories and set them to be validated in practice. We encouraged Rami to get access to data of the public transportation authorities and build a basic repository of all data he considered as relevant. These included the train and bus connections, the frequencies of the routes and also the geography of the routes. Then Rami build a parallel graph that had all the control schedules. Using both he was able to see if the controls were following any specific patterns, e.g. giving emphasis to areas where people with lower income or migrants were living or for journeys that these high risk groups were used to take. He was able to build all the necessary visualisations as 3D maps. Apart from the executed controls, Rami was also able to examine the incidents that have taken place so that he would be now able to examine possible causalities or correlations. Findings like the number of free-riders increases on Mondays and towards the end of the month may give us some food for thought like:

- regarding Monday: financially weak(er) citizens realise their precarious finances at the start of the working week or alternatively after having exhausted all their money reserves during the weekend;
- regarding end of the month: financially weak(er) citizens have consumed all their money reserves

towards the end of the month, therefore they fare-evade.

What is the difference from a student carrying out the above investigation as part of the Digital Lab to the conventional desk research? First of all it is the hands-on approach: the student is not anymore building theories in his head but tries to bring them close to the reality. Secondly there is certainly a design thinking approach in terms of building a wider context that involves both gnoseological as well as epistemological aspects. In the example above, he is also cohabitating the Digital Lab with his girlfriend that brings knowledge from her own experiences. The idea is that students get used in building algorithms, demystifying their power and building the path to explain decision making as a sequence of human-made syllogisms. Improvement or partiality can be embedded within them, same as humans suffer from bias-variance trade-off (Gigerenzer, 2009).

There is no objection that we need to prepare well-educated and skilled professionals for the new digital eras ahead of us, that will be capable to cope with all the challenges related to the development of new algorithms and approaches that improve the accuracy of Artificial Intelligence and Machine Learning applications, and the creation of software services and Apps that will have the capacity to tame the triptych of *density – immensity – complexity* that appears in most aspects of today's business fields. Below we describe for each of these aspects the type of innovations and research contributions that the Digital Lab introduces and validate as part of its operation:

- *Density*: While as practice shows convolutional neural networks are designed for dense data, there is a plethora of data that are often sparse and which cause difficulties in their conversion to a denser form. In the Digital Lab, we take advantage of the computing capabilities offered by edge AI to not interfere in the original pools of the information, as a great part of the problems caused by faulty operations are result of inappropriate densification of the original data sources. Same as in the literal ecosystems, data lakes apart from the efficiencies they bring, also create problems and cascading failures involving also ethics and privacy aspects, that are difficult to cope with in later phases.
- *Immensity*: Immensity of data considered as part of typical Big Data analytics ‘processing routines’ as these appear in many real-world applications in the areas of logistics, telecommunications or smart cities applications is not a problem at all for the computing

hardware. However, what we consider as a comparative advantage with respect to other approaches is the inherent support that the Digital Lab philosophy offers for the support of *transparency - explainability - auditability* of all processing routines and algorithms conducted by the students as users of the Digital Lab.

- *Complexity*: Use of computing hardware may not reduce the complexity of all processing routines and algorithms conducted by the students as users of the digital Lab but shall help them better understand the problems and issues at stake, make sense out of them and also help, where possible, tame the underlying complexity. More specifically, for the aforementioned case of the free-riders problem in the Bern transport network, it might offer an incentive for the city not only to increase the controls but to better understand or earlier identify a social problem that might help avoid future controversies or a potential growing phenomenon related to social segregation.

In the above context the Digital Lab may act as a nursery for new ideas in a variety of fields other than the economy and the technology, offering the means for hands-on applied sociology and experimental and behavioral economics.

We are all of us aware that AI Technologies are data intensive, so in this respect data literacy is a must. To this, the acquisition of some basic skills by the students to understand the rules and the legal limits in sharing and trading data, have some familiarization regarding how data privacy issues force, benefit or prevent the partnership between companies, or how existing or newly appearing business constellations can create value and trade data-based solutions shall better prepare them in their first steps of their professional career paths.

## 4 DISCUSSION

An aftermath we come up with regarding our experiences and experimentation so far with the idea of a Digital Lab as a core component for our teaching and research activities at the Business School of the Berner Fachhochschule is that one should not buy (or respectively: sell) visions but invest on substance. One should not care if what may have started as an applied Artificial Intelligence project may have ended up as a Big Data analytics endeavor. Same also if one's Big Data analytics project ends up in something related to ... Small Data. The important aspect is if it makes sense.

Below we present some of our preliminary findings which we aim to further explore and ground on evidence from the field:

1. The Digital Lab should be designed for letting all involved parties to enjoy learning through them. If the digital transformation process appears or becomes as a stressful imperative, all incremental learning channels will be disabled. We have seen this happening with the students but also with members of the corporate community. So it is a must to design your digitalization projects in a way that there will be little or even no *stress-by-design* or *stress-by-default*.
2. Same as there are cool persons that don't look cool at all – in whichever way one defines and understands coolness – there are cool and exciting and above all useful digitalization projects that make no use of Big Data or AI or machine and deep learning.
3. *Digital doesn't mean necessarily virtual*. One can still keep things analog. And one may even dare to bring back more analog experiences to the people than there already are in the workplace. This applies also for the students. Or as Yogi Berra has been often quoted, 'you can observe a lot just by watching' (Berra, 2009). A lot depends on the quality of the team work and what one understands from the value co-creation process as such.
4. Excellence and quality matter in teaching and research same much as to value the talents of the students and the support one may offer to them beyond the academic curriculum. For a Business School like ourselves, this is our core business and excellence is to be measured and judged not from the relative success of the experimentation that takes place within our Digital Lab, but from the talents that we shall help our students build or further improve and which shall be with them for their entire professional lives.
5. One should design their digitalization project as a journey to Ithaca. For companies especially they may use them as a means to win their people back, be them employees or customers or what one may impersonally regard as an 'installed base'. One may also regard such a digitalization project as a means to revisit one's values or for improving the emotional intelligence of their organization. There are numerous examples of companies shouting with whole page advertisements that they care for our privacy and for the security of our sensitive data, while everything they do speaks for the opposite.

Sometimes a great part of the digital experience is not related to Artificial Intelligence (or Big Data or neural nets) and a mild dose of common sense suffices.

## 5 CONCLUSIONS

Academic institutions as result of the competition we face try to innovate in terms of services and offerings to our students. At the Business School of the Berner Fachhochschule we have designed and proceeded to the establishment of a Digital Lab. In the paper we presented apart from the core idea also its potential value and utility this can bring to both the lecturers and our students' learning paths. To this we consider a wide range of aspects related to teaching as a practice but also as an experience.

The relevance we see to the European Digital Competence Framework is extremely important as it can potentially trigger a number of similar initiatives which – independently on how these shall be named e.g. Tinkerer's labs, FabLabs, makerspaces, etc. – they may all share as common denominator the hands-on and experiential aspect and the freeing from the frontal teaching.

An undisputed challenge that academic institutions need to cope with is that they must take into account the idiosyncracies of Generation Z and offer them the best options to succeed in a socio-economic context that seems to be continuously changing. Our Digital Lab might, apart from its value as a places to help acquisition of highly sought digital skills, may offer valuable experiences for academic teaching and learning at large.

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## REFERENCES

- Berra Y. (2009) You Can Observe A Lot By Watching: What I've Learned About Teamwork From the Yankees and Life, Wiley, New York.

- Broadband Commission for Sustainable Development's Working Group on Education (2017) Working Group on Education: Digital skills for life and work, September 2017.
- Buffett Warren (2017) Testing Mattresses with Warren Buffett, accessed 22 November 2019, <https://www.youtube.com/watch?v=6XFwINVRD5M>
- Carretero, S.; Vuorikari, R. and Punie, Y. (2017). DigComp 2.1: The Digital Competence Framework for Citizens with eight proficiency levels and examples of use, Luxembourg Publication Office of the European Union, EUR 28558 EN.
- Colicchio, Carlo & Giovanoli, Claudio & Grivas, Stella (2015) A Cloud Readiness Assessment Framework for Enterprise Content Management and Social Software (E-Collaboration) in Small and Medium Sized Enterprises, 3rd International Conference on Enterprise Systems, Basel, Switzerland 14 - 15 October 2015.
- Eco U. (2015) Numero Zero, Houghton Mifflin Harcourt.
- Gigerenzer G. and Brighton H. (2009) Homo Heuristicus: Why Biased Minds Make Better Inferences, Topics in Cognitive Science. 1: 107–143.
- Goethe J.W. von (1995) Wilhelm Meister's Apprenticeship, Princeton University Press.
- Van Deursen, A., Helsper, E.J. & Eynon, R. (2014) Measuring Digital Skills: From Digital Skills to Tangible Outcomes project report. Oxford: London School of Economics, University of Twente, Oxford Internet Institute.
- Vuorikari, R., Punie, Y., Carretero Gomez S., Van den Brande, G. (2016). DigComp 2.0: The Digital Competence Framework for Citizens - Update Phase 1: The Conceptual Reference Model, Luxembourg Publication Office of the European Union, EUR 27948 EN.
- Yuhyun Park (2019) DQ Global Standards Report 2019 Common Framework for Digital Literacy, Skills and Readiness, DQ Institute.