

HIGHER EDUCATION DIGITALIZATION - FRIEND OR FOE?

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Abstract

The direction in our university, and indeed in the whole of Finland, regarding the teaching methods in higher education (HE) was rather strongly towards utilization of the digital tools during the first two decades of the new millennia. This translates to creating flexibility for the students to use. Also, whilst working simultaneously with the studies. The digital proficiency of the staff members was constantly under development schemes. The aim of this study is to examine the digitalization in higher education. There are lucrative benefits to be harvested in using digitalization but simultaneously there are significant risks in their use. In this paper these benefits and risks will be studied through practical examples. The results show the need for different pedagogical and didactic approaches in learning events in higher education.

The year 2020 however, with the pandemic, brought the need to alter all at once to the digital mode; lectures for the students were to be held in Teams or in Zoom, the assignments were to be made and presented there too. The change went rather well, we daresay. Seemed that the worst scenario was avoided. Maybe so, but suddenly the news grew ill with various messages proclaiming that the students were feeling ill. Similarly, the university community saw cracks in the traditional institution. The unity of the university was worse than before, the students did not work together as they did before, the staff was driven away from the campus to work from home, i. e. they could not meet with their colleagues and peers to exchange views and pleasantries.

Now, after the ban has been lifted, the university management wishes the return to the campus. However, the staff has witnessed the virtual mode and working from home to be very adequate to say the least and the same applies to the students. An on-campus day was announced, with other similar measures in order to get the staff back on campus together with the students. In addition, the conundrum presented itself, whether to make the on-site learning events obligatory, to stream them, to record them, or a combination of these features. The students, when asked, reported their willingness to take part in the teaching if 'it was worth it'. I. e. the traditional lecturing, with little interaction bore benefits when watched from home. The answer is that there is no silver bullet to solve various issues with one shot, but rather to address the individual questions case-specifically.

Keywords: *Higher education, digitalization, digital tools, learning events.*

1. Introduction

Higher education (HE) is more than just lecturing in a theater. At our university curricula there are assignments, written and presented, prepared, and presented in groups or individually. For this there have emerged various tools for both the faculty and the students. Not more than twenty years ago the transparent rolls were a common sight at our university, as were the blackboards filled with more or less clear handwriting of the teacher. Somewhere they still might be. The last couple of years really promoted strongly for the use of newer ways of working, not only in HE but everywhere. Actually, the newer technologies have emerged in the teaching arena already since at least a decade or two before the corona pandemic. However, the problem may be what is seen as digital tool in the HE. In this paper we discuss the role the technologies play in the HE. The technologies, tools, have been developed and evolved to meet the needs of..., of whom? The developers? The university administration? The university teaching staff, the faculty? The question really is not that simple to answer.

It would be nice to think that the teachers would have the tools they need. Logically the same applies to other areas similarly, for example university administration. However, teaching persons able to

pronounce their needs in a form understandable for the developers responsible for producing the systems is not that common. In the early days, the progress was made on terms of the technologies. There were a number of things that just needed to be executed in a certain way. Because the technological advances weren't as far as they are now. The technical specifications needed to be made in the right way. Thus, the older generation systems are children of that age.

For example, during the first decade of the new millennium, a web page was a default information channel for various purposes. This was the case also for the courses at our university. It was rather strictly formulated what and how information was published. Having said that, already then the use of information and communication technologies (ICT) in teaching at the university level were studied and researched (e. g. Virtanen and Helander, 2005). The use of ICT in teaching was of interest to researchers and teachers alike, both theoretically and practically. The research approached the ICT in HE from multiple viewpoints paving the way for the more modern scrutiny we do today. The best practices for ICT usage in education (Duggleby et al., 2004) were studied but also the relationship between the use of modern technology and pedagogy (Watson, 2001), and also how to compare different innovations in education enhanced by the ICT (Law et al., 2005). This is interesting, because we may find ourselves still pondering similar, if not the same themes.

During the early days the teachers maintained their 'own' pages on the university's server. A teacher might have had an application up and running on the university's server which s/he used in the teaching. Soon thereafter the enrollment onto a university course was also to be executed by using a web application. Since these days gone past, the toolset has grown and become more sophisticated. Already well before the pandemic we moved our examination system to a system. The teacher prepares the exam, the form and the questions, into the system and publishes the exam to the students. The students can enroll to take the exam in the period defined by the teacher on a day and time that suits them individually. The night owls may take the exam in the late hours whereas the other options are obviously around the clock. The lectures may be decided to be delivered solely on-line, or on-premises. Obviously, the question remains whether the lectures are recorded or not and should this be later or simultaneously accessible to the students. And so on, the possibilities are many how to use the technologies in our disposal. These are some of the questions we discuss in this paper to illuminate further the problematics related to the use of digitalization in higher education.

The next chapter describes the more theoretical settings for the area of this paper. Chapter three presents the background from which we have gathered material for our study. Chapter four presents findings and practical examples found in our university. Chapter five discusses and summarizes the findings.

2. Digitalization

Digitalization is a word commonly and frequently used nowadays. It is quite freely used and often without specifically defining what is exactly meant by it. According to one of the more simple definitions digitalization translates to 'create and execute changes associated with the application of digital technology in all aspects of human society' (Stolterman and Fors, 2004, p. 23). In our case, it is rather obvious that the spectrum is wide; some see digitalization to mean merely using electronic means to ease or accomplish tasks whereas some have rethought their work processes anew along the lines of the newer ways of working. Should we like to broaden our horizon, Gupta and Bose (2022) clarify digitalization as a change from designing information systems and designing IT-enabled businesses to designing business models for digitally provided services. The mentioned study observes business environment, but still the exemplary force is there. The university operation may be observed similarly, at least to a degree. Either way, it is possible to use digitalization to aid the initiatives to make the organization and the operation more effective and efficient, perhaps also more streamlined (Hartl, 2019). It is still advised to keep in mind that as all organizations are case-specific structures of men and machines, the actual proceedings are to be studied accordingly.

The area in question and under observation, digitalization, may be further studied and assessed in various ways. One possibility is to divide the developments in addition to the features presented into three categories according to the reference to the time frame: digitization – digitalization – datafication (or digital transformation) (Leonardi and Treem, 2020). Digitization may be understood as a the starting point, when the information was transformed from the analog to the digital form, since the beginning of the computerized age (Bloomberg, 2018). First technologies starting the development were perhaps crude, but they paved the way. Since the nineteen eighties new processes in digitalization emerged as newer approaches to use and utilize technologies. Using newer technologies, the information created, gathered, and stored of and around the organization become more versatile to be used, thus creating more value for the organization as it was also, eventually, more accessible and usable. As this happened, the concept of

digitization turned into digitalization. (Vrana and Singh, 2021) Self-evidently, technologies develop constantly and inevitably. A consequence of the developments is the way technologies are being used as the ways of working develop. This means that many novel things are within the scope of possible innovations. The next step to follow, digital transformation, takes into consideration the well-being of individual people and various qualitative issues, such as whole areas using technologies and information in order to develop the operating models towards more user-centric and user-friendly approach, perhaps even towards more intuitive user experience (Leonardi and Treem, 2020; Zhao et al., 2020). The developments depicted here require not only the technological advances but also developing mindsets of people concerning the way technology is developed, accepted, and utilized.

Yet another approach to investigate digitalization is by studying the interaction it allows and provides, sometimes also demands. In the prior stages the physical object, depiction of reality, was formed into a digital object by hand. There was no virtual linking connection between the two as the mode of operation is offline. The comparison between the digital object and the actual real-life target was formed only by using manual means. This particular mode is typically to be found in the design or planning phase in an operation. (Lattanzi et al., 2021). The following step from the digital modeling is the digital shadow. Digital shadow describes a situation where the digital object automatically gets data from the physical one, but not the other way round. Thus, the feedback the true environment gets, the return loop, is still omitted. This way of executing the operation is most often found in service and maintenance stage. The most refined form of the digitalization is the digital twin. Digital twin means that the data flows back and forth between the physical entities and their virtual counterparts automatically. (Bergs et al. 2021; Sepasgozar 2021) This last form of approach is seen best suited for activities amongst production planning and quality management (Coito et al. 2022; Lopes et al. 2020). The use of the more advanced digital approaches demands a broad know-how and adequate resources from the organization in question aiming to implement these. For example, the use of digital twin type of solution one needs to connect various data sources, operational procedures and processes, and decision-making (Moretti et al. 2022). It seems to be actually rather dependent on well-functioning information management. According to Choo (2002), the goal of information management is to use information resources and capabilities so that the organization may learn from and adapt to its constantly changing environment.

3. Background

Tampere University community is a merger formed by the previous Tampere University of Technology, University of Tampere, and the Tampere University of Applied Sciences. The merger of the two previously mentioned universities became effective from the beginning of 2019, simultaneously the ownership of the University of Applied Sciences was handed over from the city of Tampere to this newly formed Tampere University. The individual universities were founded in the sixties whereas the origins of the University of Applied Science go farther back in time. The newly formed university entails nearly all internationally recognized fields of study. The university's spearheads are research and education in technology, health and society. Tampere University is one of the most multidisciplinary universities in the country. The university community has some 32000 students and over 5000 staff members divided into seven faculties. The operation happens on three main campuses in the city of Tampere, third largest city in Finland. In addition there are three university centers in other cities (Lahti, Pori, and Seinäjoki) addressing the more localized needs of those areas. In this paper we concentrate on the teaching taking place in the Hervanta campus where the previous University of Technology mainly operates. Having said that, it is a noteworthy fact that the university has put a big effort to ensuring the uniformity of the operation on all the campuses. Thus, the observations made in this paper are likely to apply on teaching also in other parts of our university.

More often than not the daily routines of the teaching staff members cover also many research related tasks. There are few individuals that are able to focus solely on one area. The pedagogical and didactic know-how of the staff varies, as there are also many individuals teaching with their background in the research. Similarly, the technical prowess of the staff members varies. There are people for whom the technical tools mean making the lectured material to power points and onward to pdfs, but also individuals who are fluent with using the more sophisticated features of the learning platforms. The actual tasks may be categorized roughly to cover teaching (in the center of this paper), research, and administrative duties. The last one is somewhat ambiguous as it may or may not be in connection to the previous two categories.

4. Findings

One of the more ground-laying tasks in teaching is that of founding a course. Or should a course be 'inherited' from existing curriculum, maintaining and upkeeping the course. There are options for this. We, for example, have two independent systems for this. Firstly the actual system for building the curriculum, aptly named Sisu, as it requires quite a bit *sisu*¹ to soldier through the necessary steps for a course be ready for the students to start enrolling. One issue with the systems seems to be the fact that the systems is meant to cater for the needs of administration, students, and teachers alike. A person with experience in information systems sees immediately that such multitasking requirement needs compromising or a multitude of various settings and views to the system. There has to be a curriculum, a structure, in the system, with individual courses, before the teacher is able to fill in the details of his/her 'own' course, such as the learning goals and possible prerequisites. Similarly the lecture times and teaching spaces are to be booked through an integrated system. Should a person have the routine, this set of tools surely has its benefits to offer. However, if a teacher needs to address these issues rarely, e.g. a couple of times a year at the maximum, there is little chance s/he will be able to get routinized in doing so. Need for a support becomes self-evident. The question remains, how the support is offered. Via the intranet, or is there a support function available? Both require resources, and adequate know-how in their execution.

Students use the same system to find out about the courses as well as to enroll onto them. In addition to the previous the students also need to build their own study contents into the system, according to the requirements of the programme they are registered in. Should a person be interested in a course not directly linked to his/her programme, it may be the case that s/he will not be accepted. In this case a closer scrutiny may alleviate the situation, but not automatically. A byproduct of such procedure is obviously some amount of communication between the student, the student counselor, and the teacher. In the older way of working the previous was handled often in co-operation between the mentioned parties. One obvious benefit seems to be in the end of the studies when the control of the required versus achieved accomplishments is easier to execute.

Another system related to the founding and upkeeping a course or an implementation of it is the learning platform. Our university uses the Moodle. Moodle is a versatile platform on which at least the basic informing about the course practicalities takes place. Depending on the individual capabilities, the teachers may also apply some features from the vast toolset offered by the system. Features may include the publishing of the lecture slides and the lecture recordings, group building, handing in the assignments, but also more sophisticated possibilities like peer reviewing and home exams, to name but a few. The students needed to enroll also in the Moodle, but recently there has been an update so that the Sisu system automatically enrolls student in the Moodle after s/he has enrolled onto a course in Sisu, which is an improvement.

Should we scrutinize teaching more closely, one clear benefit digitalization has brought, is concerning the guest lectures. There was recently a guest lecturer based in a foreign country giving a lecture over the Teams-tool and discussing with student on premises. Both audio and video worked fine between the countries. The lecture was facilitated by the responsible teacher in the class room who also monitored the chat in the system presenting the comments/questions to the lecturer thus enabling the interaction between the lecturer abroad and the students at their home university. When asked, the students responded with having enjoyed a very professional lecture with a Q&A²-part with no complaints about the mode of execution. Similarly, regarding the lecturing, the recordings thereof look like a viable development. This is very well liked among the students, who tend to claim that this way they are able to 'attend' the lectures when they are best fitted for it, in case there are other simultaneous things requiring their attention. Also, the recording enable the following of the teaching in parts or repeatedly. The downside of this approach may be the lack of interaction. The previously mentioned guest lecture was for a class of less than twenty students. If there are more students the possibility for interaction and discussions in the 'room' are limited. On top of that there is reportedly the possibility for those distance learners to do something else at the same time, thus not paying their full attention to the teaching.

The students tell that their (group) work habits have changed too. Now a member of a team may be even permanently in a other city and still be a part of the functioning team. This is enabled by the use of the technological tools. This, we feel, raises the question about network building and similar aspects of more social nature which also are a part of student life, how do these fit into the picture? Same type of issue, without the drawback, is the examination system. As described in the introduction of this paper, the Exam system enables the exams to be taken regardless of the hour or the date in a defined period of time, also in various cities in the country, as long as their universities are members in that particular network.

¹a Finnish word describing determination, grit, perseverance, guts, etc.

²Questions and answers

The teachers are able, and obliged, to mark the papers in a given timeframe which starts when the exam is in the system. After that part they inform the students about their success even with possible individual feedback, if their resources allow this kind of approach.

5. Summary

Higher education (HE) is indeed more than just lecturing in a theater. There are the actual teaching, lectured or 'flipped', there are oftentimes assignments, written and presented, prepared and presented in groups or individually. There is a number of tools that the developing technological advances have brought upon us. These tools are to be skillfully and appropriately used by the faculty and the students. The younger generation is sometimes described as more 'savvy' on the technological issues but in HE there is always the pedagogical side to it to be considered. And also, the university's strategy, regulation, and aspirations to be kept in mind, making the entity multifaceted and complex by its very nature. Having said that, it seems, that whichever tools one decides to go on with, the main thing that there is a sound plan, and justification, behind the actions. The approach needs to be planned and organized. Obviously, the newer technological solutions need to be prepared and learned by their users.

The digitalization is a good tool but it must not be permitted to take the charge over the actual pedagogical side, how the things are done. This requires the teachers to be aware of the possibilities the tools bear within and that in turn requires education and training for the educators.

The findings are gathered in one university from a limited numbers of students and colleagues, more rigid research would bring more reliability to the theme of this paper which now merely discusses the issue. Similarly, it would be highly interesting to learn whether these findings appear in other countries in the same manner or are there national differences and features.

References

- Bergs, T., Gierlings, S., Auerbach, T., Klink, A., Schraknepper, D., Augspurger, T., 2021. The concept of digital twin and digital shadow in manufacturing. *Procedia CIRP* 101, 81–84.
- Bloomberg, J., 2018. Digitization, digitalization, and digital transformation: confuse them at your peril. *Forbes* Retrieved August 28, 2019.
- Coito, T., Martins, M.S., Firme, B., Figueiredo, J., Vieira, S.M., Sousa, J.M., 2022. Assessing the impact of automation in pharmaceutical quality control labs using a digital twin. *J. Manuf. Syst.* 62, 270–285.
- Duggleby, J., Jennings, D., Pickering, F., Schmoller, S., Bola, F., Stone, R., Willis, P., 2004. Innovative practice in the use of ICT in education and training: learning from the winners. *Educ. Train.*
- Hartl, E., 2019. A Characterization of Culture Change in the Context of Digital Transformation. *AMCIS 2019 Proc.*
- Lattanzi, L., Raffaeli, R., Peruzzini, M., Pellicciari, M., 2021. Digital twin for smart manufacturing: A review of concepts towards a practical industrial implementation. *Int. J. Comput. Integr. Manuf.* 34, 567–597.
- Law, N., Chow, A., Yuen, A.H., 2005. Methodological approaches to comparing pedagogical innovations using technology. *Educ. Inf. Technol.* 10, 7–20.
- Leonardi, P.M., Treem, J.W., 2020. Behavioral visibility: A new paradigm for organization studies in the age of digitization, digitalization, and datafication. *Organ. Stud.* 41, 1601–1625.
- Lopes, M.R., Costigliola, A., Pinto, R., Vieira, S., Sousa, J.M., 2020. Pharmaceutical quality control laboratory digital twin—A novel governance model for resource planning and scheduling. *Int. J. Prod. Res.* 58, 6553–6567.
- Sepasgozar, S.M., 2021. Differentiating digital twin from digital shadow: Elucidating a paradigm shift to expedite a smart, sustainable built environment. *Buildings* 11, 151.
- Stolterman, E., Fors, A.C., 2004. Information technology and the good life, in: *Information Systems Research*. Springer, pp. 687–692.
- Virtanen, P., Helander, N., 2005. Bridging the gap between theory and practice—University teaching with a live ERP-system. *Proc. EUROMA Int. Conf. Oper. Glob. Compet.* June 19-22 2005 Bp. Hung.
- Vrana, J., Singh, R., 2021. Digitization, digitalization, and digital transformation. *Handb. Nondestruct. Eval.* 40 1–17.
- Watson, D.M., 2001. Pedagogy before technology: Re-thinking the relationship between ICT and teaching. *Educ. Inf. Technol.* 6, 251–266.
- Zhao, M., Liao, H.-T., Sun, S.-P., 2020. An Education literature review on digitization, digitalization, datafication, and digital transformation, in: *6th International Conference on Humanities and Social Science Research (ICHSSR 2020)*. Atlantis Press, pp. 301–305.