

In the Flow: A Case Study on Self-paced Digital Distance Learning on Business Information Systems

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Abstract: This paper investigates the acceptance of a self-paced digital distance learning environment on courses about Business Information Systems and Management & Control of IT at a university. The aim of the environment was to avoid monotony and to actively involve the students into their learning process. The course content was split into small units arranged onto an online roadmap. Different design elements were used along the progress on the roadmap, each adding to the content, contributing to clarification, understanding, repetition or memorization. Students could proceed at their own pace, but there was a timetable for discussing the content in accompanying videoconferences and corresponding deadlines for the tasks to be completed. The concept was evaluated in a real-life learning situation following the Unified Theory of Acceptance and Use of Technology (UTAUT), slightly modified to the context. The case study contributes to the body of knowledge by providing a selection of design elements that can be combined to enrich students' learning experiences. The outcomes of the evaluation underline the importance of "flow" for the acceptance of e-learning environments.

1 INTRODUCTION

In 1999 Weiser and Wilson propagated video streaming on the internet as a way to provide course content for students geographically isolated from educational and academic institutions. Within their case study, they described the distance learning programs of their time as poor cousins to traditional campus-based programs, stigmatized as a necessary evil, yet unequal to traditional courses (Weiser and Wilson 1999).

In 2020, Anthonysamy et al. characterized digital technology as a "catalyst for transformation in education in this twenty-first century". That was even before the pandemic took hold of academic institutions worldwide and forced them into a rapid learning curve on digitally-supported distance learning.

During the pandemic, many universities closed, separating students from their academic institutions. Distance learning programs were initiated to make up for the lack of personal contact, relying heavily on digital learning materials. And even though massive advances in digital technology now would allow the

"creation of true student-centred learning models" (Weiser and Wilson 1999), the stigma as an inferior learning method and a compromise to circumstances still sticks. The case study presented in this paper aims to extricate or diminish the stigma by providing a case study on self-paced digital distance learning, using a selection of design elements suitable for enriching the learning experience for student learners in an academic context.

Digital learning can be described as any instructional practice relying on digital technology that effectively supports the learning experience (Anthonysamy et al. 2020). Active engagement in the learning process, instead of passive transmission, can be supported by digital means.

Liu et al. (2005) underline that e-learning providers should recognise their users not only as users of a system, but also as learners. They point out that, in mixed-media e-learning environments, the design philosophy should emphasize presentations suitable for building up user's concentration. Self-paced e-learning tools can assist in learning content, preparing lessons or exams as well as in improving personal skills like problem-solving or meta-cognitive skills (Marshman et al. 2020).

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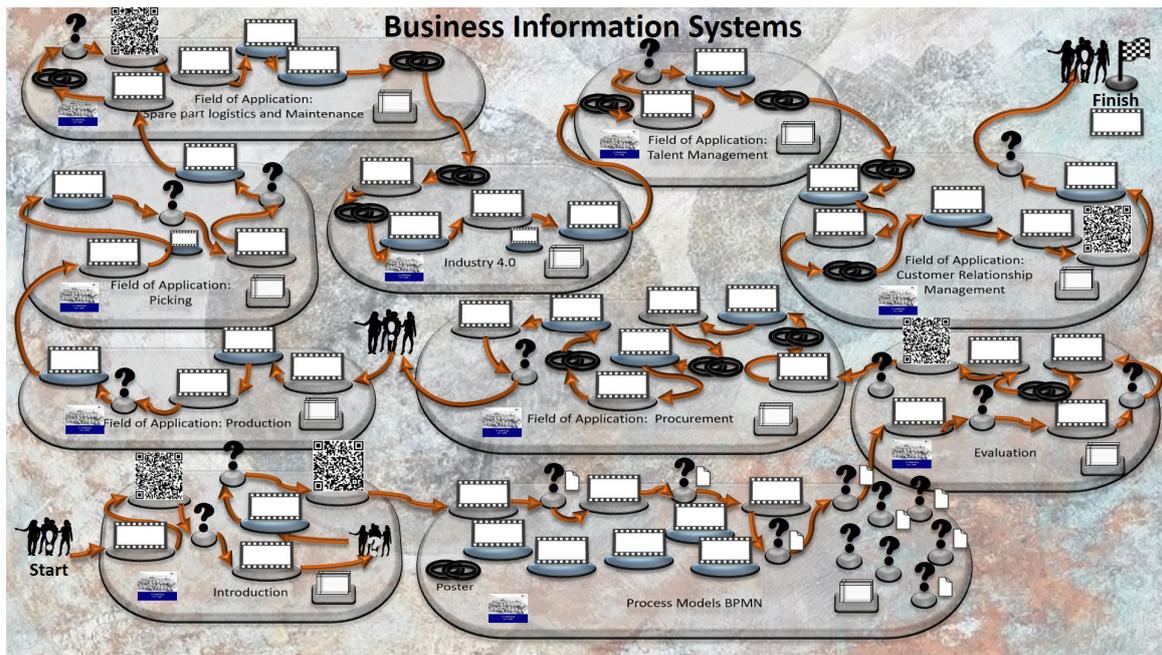


Figure 1: Roadmap of the course on Business Information Systems.

Students have access to the material, anytime and anywhere, thereby enabling them to learn individually, at their own pace (Bautista 2015). Self-paced learning provides availability of the necessary resources for learning and encourages students to organize their learning process autonomously, independently from the lecturer (Anurugwo 2020), thus preparing for lifelong learning.

2 ROADMAP OF THE COURSE

The self-paced e-learning environment presented in this paper was developed in reaction to the pandemic. The sudden necessity to switch from traditional teaching/learning situations to digital distance learning was regarded as a chance to reconsider what the courses are about and to adapt the means to the content. The audience of the course on Business Information Systems are students of BA Business Administration, BA Economics, and BA Business Law. At the end of the course, students should be capable of modeling business processes as a starting point for the development or evaluation and customizing of business information systems. They should be aware of the penetration of businesses with information systems and should be able to engage in digital transformation within selected fields of application.

That successful digitalization goes beyond a mere electrification of existing processes towards a radical rethinking of this process, was a frequently repeated mantra of the course. When considering the challenge of digital distance learning/teaching, a good sip of our own medicine seemed overdue. A thorough look at the learning goals and the content led to the development of an asynchronous, self-paced e-learning platform to cover the course content. The roadmap (figure 1) was accessible on a website. All materials were online at the beginning of the semester.

All courses were held online, due to the covid-19-pandemic. With students spending most of their time in the learning management system of our university, a “non-pedagogical” appearance was decided on to create a more relaxing environment, unrelated to “learning”. Asynchronous learning allows students to access training content anywhere and anytime (Wilson and Weiser 2001). We opted for a rich media approach, as previous studies revealed that the acceptance rate of mixed media-based e-learning content is higher because it generates a high user concentration (Liu et al. 2005). Thus, different media and tools were combined to relieve the monotony. Mini quizzes and learning cards were implemented in ARSnova (ARSnova 2017), an audience response system, to trigger students’ engagement (Gröblinger et al. 2016). As the attention span in digital media is limited, videos last no longer than 20 minutes. For variety, internal videos were enriched by external

videos. URLs were included, linking examples, software applications and case studies into the curriculum, without infringement of copyrights.

Even though the learning environment covered the relevant content, it was accompanied by weekly video conferences to discuss the content and the results of the assignments. Even though limited to the chat function of the video conferencing tool, students made use of these communication channels to speak out, ask questions, or to provide additional examples or recommendations for other students.

The students were encouraged to work asynchronously and at their own speed. The course's roadmap, in combination with a timetable for discussing the topics gave the students the flexibility to proceed at will, while keeping a certain pace, encouraging continuity, and allowing them to connect with their lecturer and their co-students.

The roadmap's design elements are largely self-explanatory (table 1). In the summer semester 2020, another course was transformed into a similar concept: Management & Control of IT. Content,

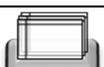
layout and design of the roadmap were different but, except for one, the design elements used for a digitalization of the course were the same: Additional literature recommendations were included that went beyond those already included into the slides.

3 RESEARCH MODEL

The design elements and the students' perception of the self-learning environment could be explored in a natural, real-life context, providing the preliminaries for case study research (Crowe et al. 2011). This case could be linked to hypotheses (Flyvbjerg 2016), followed by a quantitative evaluation. The evaluation of the acceptance of the learning environment was based on the unified theory of acceptance and use of technology (UTAUT) (Venkatesh et al. 2003). The model aims to explain the use of a type of technology by the individual perception of four core constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions (Yang et al. 2019). This model extends the expressive power of the Technology Acceptance Model (TAM) (Davis 1989). With UTAUT2 (Venkatesh et al. 2012) this model was extended to take the specific factors into account that influence customers' use of technology: hedonic motivation, price value and habit (Ain et al. 2016). Within the learning context, several studies are based on TAM (e.g., Saadé and Bahli 2005; Al-Azawei et al. 2015; Ibrahim et al. 2018), UTAUT (e.g., Chao 2019; Almaiah et al. 2019; Salloum and Shaalan 2019; Persada et al. 2019; Raza et al. 2021) or UTAUT2 (e.g., Ain et al. 2016; Raman and Don 2013; Arain et al. 2019; Kang et al. 2015). This study relies mainly on UTAUT and TAM, slightly adopted to the context.

Perceived usefulness (PU) describes the degree to which an individual believes that using a certain type of technology will help to enhance his or her job performance (Venkatesh and Davis 2000). The job for students, or rather the assigned tasks within an academic context, is to accomplish the learning goals. Adopted to this context, PU can be defined as the degree of perceived usefulness for accomplishing the assigned learning goals. E-learning can support learning activities and uplift educational skills and performance (Salloum and Shaalan 2019). Therefore, it is posited that performance expectancy (PE) has a significant and positive influence on PU (H_1). Facilitating conditions (FC) refer to the technical and organizational infrastructure supporting the use of the e-learning system (Salloum and Shaalan 2019). As these factors ease the accessibility of the content

Table 1: Design Elements of the Roadmap.

Design Element	Function
	Each panel corresponds to a chapter of the course, thus providing visual clues of the content structure.
	Arrows lead the way along the roadmap, from start to finish.
	This icon refers to mini videos on the content of the course. Videos with external content (e.g., examples or case studies) are marked in blue.
	URLs link to examples or other practical clarifications of the content.
	This icon is linked with a pdf document containing tasks and assignments, to deepen the knowledge or to research specific content.
	The set of slides for each chapter is linked to this icon as a pdf document.
	QR codes link to mini-quizzes or small evaluations. The icon is linked with a URL, so that access is granted to the quiz, even without scanning the QR code.
	This icon can be found at the bottom right of each panel. It is linked to electronic learning cards for each chapter.
	This icon leads to additional recommendation of selected literature.
	The link to the online survey was included behind this icon.

required to achieve the learning goals, it is posited that facilitating conditions have a positive impact on perceived usefulness of e-learning environments (H₂). As the platform works within a web page requiring almost no support, the focus was shifted onto accessibility and availability of the learning content. Increasing maturity of e-learning environments will improve the user friendliness and will ease the effort to use them (Salloum and Shaalan 2019). This led to the hypothesis that the degree of ease related to the use of an e-learning environment has a positive effect on its usage to achieve the assigned learning goals (H₃). The perceived degree of ease is measured by effort expectancy (EE) (Venkatesh et al. 2003).

Liu et al. (2005) underline that, within e-learning environments, users should be recognized as learners, and the design philosophy should be dedicated to building up users' concentration. Csikszentmihalyi (1990) coined the term "flow" to describe the psychological state when an individual becomes so totally absorbed by their activity that they lose their sense of time or their awareness for their surroundings. When students reach a state of "flow", they concentrate entirely on their learning activity, which can play a major role in online learning behaviour (Liu et al. 2005). A study by Saadé and Bahli (2005), revealed a significant positive effect of cognitive absorption on PU. Therefore, we posit (H₄) that flow (F) has a positive influence on accomplishing the assigned learning goals (PU).

PU is a strong predictor of the intention to use a certain technology (Venkatesh et al. 2003), thus H₅ posits that PU has a positive effect on the behavioral intention (BI) to use the digital learning environment.

Image and social influence describe an effect of compliance to subjective norms by performing a specific behavior that a person perceives to be expected by their social surroundings (Venkatesh and Davis 2000). During the pandemic, students suffered from social isolation, diminishing the impact of social influence. Within this rather exceptional situation, any acceptance or dismissal of a hypothesis on the impact of social influence on perceived usefulness of the e-learning platform discussed in this paper would be biased by the circumstances and incomparable to previous or following studies. Taking this into account, social influence was omitted from the research model with some regret.

An anonymous online survey was conducted among the students enrolled in both courses that are following the same design principles: a course on Management and Control of IT (3rd/5th semester students, summer 2020) and another on Business

Information Systems (1st semester, autumn 2020/21). As the evaluation of students with higher grades preceded the evaluation of the course for minors, the student groups didn't overlap. The students were invited to participate in the survey. The participation was voluntary, there were no incentives, neither gifts, nor credit points. No personally identifiable information was gathered. Analysis of the data was restricted to gaining insights for further development of the learning environments and for research purposes. As all students are undergraduate and of about the same age, and a moderating effect of gender not the interest of our research, demographic items were omitted from the questionnaire. A five-point Likert scale was applied to measure the items (table 2). Some items were inverted. Overall, 361 students participated in the survey. 139 data sets were incomplete and had to be dismissed, leaving 222 data sets for further analysis.

Table 2: Items (PE - Performance Expectancy, FC - Facilitating Conditions, EE - Effort Expectancy, F - Flow, PU - Perceived Usefulness, BI - Behavioral Intention).

Code	Mean	SD	Code	Mean	SD
PE1	3.410	1.106	EE1	4.086	1.335
PE2	3.973	1.301	EE2	4.050	1.299
PE3	4.284	1.324	EE3	4.036	1.252
PE4	4.104	1.357	EE4	4.135	1.273
FC1	3.649	1.140	PU1	3.757	1.172
FC2	4.068	1.325	PU2	3.770	1.149
FC3	3.721	1.246	PU3	3.604	1.247
FC4	3.671	1.327	PU4	3.536	1.176
F1	3.387	1.050	PU5	3.586	1.139
F2	3.189	1.212	BI1	4.018	1.298
F3	3.482	0.985	BI2	3.806	1.298
F4	3.667	1.064	BI3	3.959	1.275
F5	3.554	1.067	BI4	3.383	1.363

4 DATA ANALYSIS

The research model was evaluated using partial least square (PLS) modeling, as this approach is widely used in IS research. Using Smart-PLS (v3.3.3) (Ringle et al. 2015), we first evaluate reliability and validity of the measurement model, followed by an evaluation of the structural model.

Cronbach's alpha was calculated to ensure internal consistency among the items (table 3). The value is greater than 0.7, thus fulfilling the criteria (Tabachnick and Fidell 2014). With a Cronbach's alpha > 0.9 on EE and PE, the value is almost too high for these constructs. The composite reliability (CR) should be above 0.7 to indicate a reliability of the

results (Hair et al. 2006), which is true for all constructs. The Average Variance Extracted (AVE). indicates the convergence validity of the constructs and ranges from 0.661 to 0.952, all well above the threshold of 0.5 (Fornell and Larcker 1981).

Table 3: Scale Reliability (PE - Performance Expectancy, FC – Facilitating Conditions, EE – Effort Expectancy, F – Flow, PU – Perceived Usefulness, BI – Behavioral Intention).

	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
BI	0.888	0.923	0.751
FC	0.871	0.913	0.725
EE	0.975	0.983	0.952
F	0.868	0.906	0.661
PU	0.933	0.949	0.788
PE	0.890	0.925	0.756

Cross Loadings confirm that the loading of each item on its own constructs is higher than on the others, and the item loadings on the construct are all above 0.7, thus confirming individual reliability (table 4).

Table 4: Cross-Loadings (PE - Performance Expectancy, FC – Facilitating Conditions, EE – Effort Expectancy, F – Flow, PU – Perceived Usefulness, BI – Behavioral Intention).

	BI	FC	F	EE	PE	PU
BI1	0.857	0.686	0.628	0.677	0.731	0.705
BI2	0.931	0.743	0.730	0.612	0.780	0.784
BI3	0.907	0.783	0.661	0.714	0.784	0.756
BI4	0.763	0.511	0.581	0.341	0.610	0.589
FC1	0.687	0.883	0.619	0.617	0.692	0.675
FC2	0.736	0.885	0.568	0.812	0.788	0.693
FC3	0.714	0.904	0.612	0.670	0.684	0.677
FC4	0.549	0.721	0.464	0.430	0.490	0.507
F1	0.561	0.515	0.786	0.365	0.538	0.568
F2	0.346	0.292	0.625	0.206	0.306	0.386
F4	0.692	0.633	0.877	0.450	0.599	0.638
F5	0.700	0.638	0.882	0.593	0.631	0.645
F6	0.685	0.565	0.866	0.492	0.576	0.626
EE1	0.658	0.734	0.509	0.982	0.727	0.659
EE2	0.688	0.755	0.555	0.970	0.752	0.679
EE4	0.665	0.720	0.505	0.975	0.719	0.663
PE1	0.653	0.587	0.618	0.402	0.750	0.605
PE2	0.711	0.692	0.549	0.682	0.902	0.665
PE3	0.803	0.759	0.600	0.799	0.925	0.741

PE4	0.751	0.692	0.561	0.693	0.890	0.696
PU1	0.745	0.706	0.625	0.676	0.725	0.885
PU2	0.741	0.738	0.662	0.670	0.746	0.884
PU3	0.727	0.599	0.638	0.576	0.656	0.881
PU4	0.706	0.602	0.617	0.498	0.659	0.901
PU5	0.725	0.688	0.632	0.597	0.670	0.887

Discriminant validity can be confirmed by the Fornell-Larcker Criterion (table 5). The AVE square root is presented as bold values in the upper values of each column. These values should be above 0.5 and higher than the squared correlation of the other constructs (Fornell and Larcker 1981). Table 5 shows that the Fornell-Larcker Criterion is satisfied, thus confirming discriminant validity.

Table 5: Fornell-Larcker Scale (PE - Performance Expectancy, FC – Facilitating Conditions, EE – Effort Expectancy, F – Flow, PU – Perceived Usefulness, BI – Behavioral Intention).

	BI	FC	EE	F	PU	PE
BI	0.867					
FC	0.794	0.852				
EE	0.687	0.755	0.976			
F	0.752	0.668	0.536	0.813		
PU	0.822	0.755	0.684	0.716	0.888	
PE	0.842	0.788	0.751	0.668	0.781	0.869

To test the hypotheses, a bootstrap procedure was applied with 1,000 subsamples and a significance level of 0.05. The path coefficients and the t-values support all hypotheses (table 6).

In this context PU is defined as the degree of perceived usefulness for accomplishing the assigned learning goals. With H₁ it was postulated that performance expectancy has a significant and positive influence on perceived usefulness (PU), which was supported by this data set ($\beta = 0.332$; $t = 4.237$ and $p < 0.05$).

Table 6: Path coefficients (PE - Performance Expectancy, FC – Facilitating Conditions, EE – Effort Expectancy, F – Flow, PU – Perceived Usefulness, BI – Behavioral Intention).

Hypothesis	Path Coefficients	T Statistics ((O/STDEV))	P Values
H ₁ : PE ->PU	0.332	4.237	0.000
H ₂ : FC -> PU	0.206	2.765	0.006
H ₃ : EE -> PU	0.123	1.999	0.046
H ₄ : F -> PU	0.290	5.253	0.000
H ₅ : PU -> BI	0.822	32.754	0.000

This is consistent with previous research in the e-learning context (e.g. Mahande and Malago 2019). Several students used the free text form to elaborate on this. Some sample statements: *“What I liked most was that I could decide myself, if and how much I like to learn in a week.”*

“Better than most, because you could decide on the pace yourself, relisten without hurry and do some research on the internet without missing parts of the lecture.”

“I prefer working on something on my own, therefore I liked the self-paced environment a lot. I think that I could remember the content better than in other courses.”

“I enjoyed the course a lot. The topics don’t drag too long and to every topic there are examples from reality. The practical examples make everything understandable and anchors the knowledge in the brain.”

Students’ learning preferences as well as their perception of the learning setting differ, and the learning environment didn’t work well for all of them. Some statements reveal a more critical perception. Difficulties were voiced in relating the content to the assigned learning goals and in prioritizing the content: *“Not bad, but in some articles and videos it is hard to figure out what to take out of it. They were not uninteresting, but you didn’t really learn a lot. I have no clue what I should have learned out of all these parts.”* Others underlined their preference for traditional lectures: *“[...] I would have preferred learning a bit more dynamically – directly from the lecturer and at the university. Nonetheless, I like having the option to do everything from home.”*

That facilitating conditions have a positive impact on perceived usefulness of e-learning environments (H_2) was also supported ($\beta = 0.206$; $t = 2.765$ and $p < 0.05$). This is in line with, e.g., Mahande and Malago (2019). Within the items, the accessibility of the content of the learning platform was the dominant aspect. Several students commented on a low voice quality in the explanatory videos. These require massive improvement, and some found the layout confusing. With H_3 it was postulated that the degree of ease, related to the use of an e-learning environment, has a positive effect on its usage to achieve the assigned learning goals. The hypothesis was supported by this data set ($\beta = 0.123$; $t = 1.999$ and $p < 0.05$). This is in accordance with literature (e.g., Mahande and Malago 2019), but it is necessary to point out that this hypothesis would not have been accepted at another level of significance.

That flow has a significant influence on perceived usefulness (H_4) was also supported by the data of this

data set ($\beta = 0.290$; $t = 5.253$ and $p < 0.05$). Flow can come with a high concentration on the learning activity. Therefore, it can be an important factor in online learning behaviour (Liu et al. 2005). Several students wrote about “fun” in their comments, e.g., *“It’s really fun to learn like this, and some facts are easier to understand.”* Another student mentioned becoming carried away: *“I finished more than half of the self-learning environment within three days; not because I would like to finish the course, but because it is difficult to stop, once you started.”*

“Some students commented on curiosity: *“The playful roadmap arouses my curiosity”. At the beginning, I thought Business Information Systems would not interest me at all, but my curiosity grew with every panel.”* This is in line with previous literature on learning management systems, in which a significant positive effect of cognitive absorption and pleasure on PU became evident (Saadé and Bahli 2005).

Avoiding monotony and activating the students was an important aspect of this learning environment. One student wrote that *“the many short videos are more motivating to proceed than a [...] script, because of the variation, and it is more interesting.”* The data set and the comments indicate that the concept worked for many but not for all students: *“I can’t complain, but it takes a lot of discipline to work with the learning environment.”*

H_5 posits that PU has a positive effect on the behavioral intention (BI) to use the digital learning environment. This hypothesis was also supported ($\beta = 0.822$; $t = 32.754$ and $p < 0.05$), which is in line with previous studies (e.g. Liu et al. 2005).

5 CONCLUSIONS

During the pandemic, lecturers worldwide struggled to find new ways of distance teaching. They developed new skills in media production, video editing, video conferencing and social media usage. Over the months, they fought their way along a steep learning curve and some innovative learning/teaching concepts evolved. However, even though “digitalization” is the magic bullet transforming business processes worldwide, when it comes to courses, the stigma of digitalization as being an inferior learning method to traditional courses sticks. The case study presented in this paper aims to extricate the stigma. This paper contributes to the body of knowledge on self-paced digital distance learning, by providing a selection of design elements suitable for enriching the learning experience for

student learners in an academic context and by validating the concept in a real-time learning situation. Students appreciate having access to explanatory videos anywhere and anytime. They appreciate the flexibility to choose when and where to learn, thus taking responsibility for their own learning process. The evaluation underlines the importance of “flow” for the acceptance of e-learning environments and shows examples of design elements that can be combined to enrich students’ learning experiences.

There are several limitations to take into consideration: The survey was embedded into the learning environment at the very end. Not all students came that far. Students who skipped the course did not participate in the survey, therefore the results will be biased.

Restricting the analysis on the acceptance of this specific platform, allows an evaluation more pointed towards the learning goal, yet with the price of losing the necessary number of participants to calculate statistically reliable numbers. The self-paced digital distance learning environment presented here, and the evaluation on its acceptance may not generalize well, but the students participating in the survey are the target group. Their impression, their feedback and their hints to further improvements are highly relevant for the next iteration of self-learning environments developed for the next courses in the semesters to come. Evaluating the results on a broader scale would be a suggestion for further research.

Due to the urgency of the situation, the concept had to prove itself in a real-life learning situation. Thus, there is no control group for comparing the results. Another aspect to consider is that, due to the pandemic-circumstances, the platform wasn’t used voluntarily. If students would choose these platforms at will, this would be worth further exploration. As the situation was exceptional, an evaluation of this platform in a standardized situation would be recommended.

Early research on asynchronous learning already raised the concern of lacking interaction between students and faculty, and the fear of some faculties that e-learning would make instructors obsolete (Wilson and Weiser 2001). Within their pilot study, Wilson and Weiser brought up two research questions: Will students quit attending classes when an asynchronous mode of learning is available? Will they use the available technology to assist their learning process or to support their laziness? (Wilson and Weiser 2001). Twenty years later, these questions still need to be answered.

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