The Implementation of an Asynchronous E-learning Course in Higher Education – Lessons Learned

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Abstract

The pandemic boosted the use and impact of electronic learning (e-learning) in many life areas including education (Monira et al., 2022). Based on that externally forced experience, the Business Information Technology Bachelor degree program (BIT) at the University of Applied Sciences and Arts, Northwestern Switzerland (FHNW) radically changed the learning-teaching set-up from traditional face-to-face (F2F) instruction to asynchronous e-learning in the mandatory course "Corporate Finance (CF)." Against initial expectations, the success of the students participating in the asynchronous e-learning course, measured by the mark achieved, was notably higher than compared to traditional F2F instruction. This outcome is even more surprising in light of the current research results. Varkey et al. (2022) addressed the problem with the current literature in their research on asynchronous learning with the lack of guidance in the creation of a high quality and high-fidelity asynchronous courses. The goal of this conference paper is to give insight into the learning design, setting, methods, instruments, concepts, etc. in the newly implemented asynchronous e-learning course CF and highlight lessons learned. The lessons learned might contribute to best practices for other asynchronous e-learning courses and can help to improve such learning settings.

Keywords: Asynchronous Learning, Blended Learning, Bachelor Degree, Distance Learning, E-learning, Face-to-Face Instruction (F2F), Higher Education, Synchronous Learning

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1. Introduction

E-learning went mainstream with the COVID-19 pandemic. Initially, mainly through lecturers' intuition, trial and error, and driven by rapidly changing social distancing requirements to combat the virus, teaching and learning moved from traditional F2F to predominantly synchronous distance e-learning between February 2020 and June 2021. It quickly became clear that the use of an electronic medium such as the Internet between the teacher and the students would bring about a number of new challenges. There was a concern that students might be more easily distracted from e-learning at home. Another concern was the limited social interaction of those involved. This could lead to students feeling of socially isolated (Lin & Gao, 2020, p. 174). Identifying and responding appropriately to these factors can be important in maintaining students learning success. The success of the students was measured in a unidimensional way by the grade obtained in the course.

Students' demand for distance learning did not go away after COVID-19. On the contrary, the demand for formats of study that are independent of time and place has increased. The increased demand for studying independently of time and place may be due to the saving of travel time from home to university. This leaves more time for other activities such as work, leisure activities or spending time with family. The additional factor of cost pressure from the University with campuses in different locations led to implementing the asynchronous e-learning course CF. The course was held for the first time in the autumn semester of 2022 at the University of Applied Sciences Northwestern Switzerland (FHNW). It is part of the bachelor's degree program in Business Information Technology.

Lessons learned from the implementation of this asynchronous e-learning course are presented in this paper. This will be achieved in two ways. Firstly, through a literature review, which will then be enriched with insights into the learning design, setting(s), methods, tools, concepts, etc. in the newly implemented asynchronous e-learning course CF.

Secondly, some of the relevant aspects and terms related to the topics of e-learning, blended learning, and synchronous and asynchronous learning are defined and discussed. The literature review serves to show that some factors are more prominent than others. These factors will be identified, discussed further, and compared against results from a study carried out among students participating in this asynchronous e-learning program. The student's level of success is analyzed and lessons learned from the newly implemented asynchronous e-learning course are derived.

1.1.   Definitions of Terms

We begin by discussing and classifying the key terms used in this article, namely e-learning, blended learning, and synchronous and asynchronous.

1.1.1.   Definition of E-learning

There are different types and definitions of e-learning in literature. Arkorful & Abaidoo (2014, p. 29 based on Algahtani, 2011) conclude that it is difficult to find a common definition for e-learning. In some definitions, e-learning means providing content entirely online, while in other definitions e-learning is already implemented when web-supplementary and web-dependent services are used to provide educational and support processes. A synonym often used in literature instead of e-learning is online learning.

In higher education, the term online learning often means that the courses are delivered entirely online, typically through the use of learning management systems (LMS), such as Moodle (Nortvig et al., 2018, p.47 based on Ryan et al., 2016 and Pellas & Kazanidis, 2015). The most prominent feature of online learning compared to F2F learning is the absence of a physical classroom, which is replaced by the use of web-based technologies. This provides opportunities for learning outside of class, independent of time, place and pace (Nortvig et al., 2018, p. 47 based on Bernard et al., 2014; Chigeza & Halbert, 2014; Northey, 2015, Israel, 2015, Potter, 2015).

1.1.2. Definition of Blended Learning

The terms blended learning and hybrid learning are often used interchangeably (Nortvig et al. 2018, p.48 based on Ryan et al. (2016). Blended learning can be seen as "the combination of instruction from the two historically separate models of teaching and learning: traditional F2F learning systems and distributed learning systems" (Nortvig et al., 2018, p. 48 based on Bernard et al., 2014). Therefore, blended and/or hybrid learning can be categorized between the two opposing notions F2F and online learning, depending on the degree of online usage in teaching and learning.

1.1.3. Definition of Synchronous and Asynchronous

The researchers explain that asynchronous learning is online or distance learning that does not take place in real time, and the instructor provides email and online discussion boards to enable interaction (Lin & Goa, 2020, p. 170, based on Ruiz et al., 2006).

1.1.4. Definition of Asynchronous E-learning Used in This Paper

From the author's point of view it is important for the meaning of asynchronous e-learning that a high degree of independence of time, place and pace is provided to the learner for the majority of the course duration. This can be achieved by making a majority of the learning-material available online, using a LMS, such as Moodle. The course may have synchronous elements such as synchronous assessment and/or synchronous sessions (online and offline). Finally, the course design may even include some limited traditional F2F sequences, i.e. where participants meet physically in a classroom.

Figure 1: Visualization and classification of relevant terms
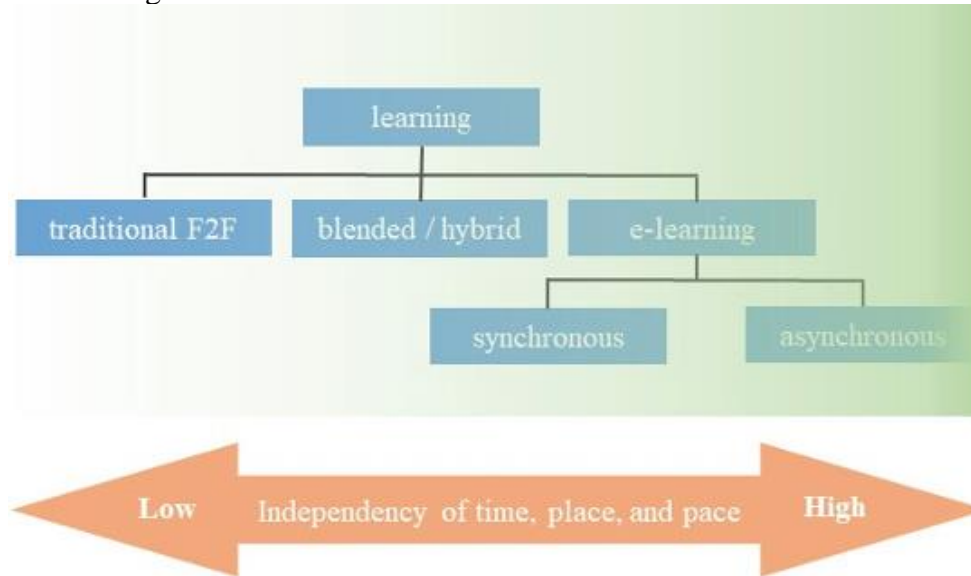
Note: The superimposed square with different shades of green is intended to visualize the classification of asynchronous e-learning: the stronger the color, the stronger the weighting of the corresponding term in asynchronous e-learning.

1.2.   Literature Review

Distance learning, enabled by e-learning technologies such as the Internet in conjunction with LMS is common in education (Brady & Pradhan, 2020, p. 233; Monira et al., 2022). Learning content can be delivered synchronously (in separate physical spaces,) asynchronously (at separate times,) or hybrid (a combination of synchronous and asynchronous learning).

Varkey et al (2022) summarize that several comparisons have been made in literature between different learning modalities, including hybrid, F2F, synchronous online, and asynchronous online courses. The authors criticize, rightly in our view that a much part of this literature has focused on the ways in which these different modalities differ in the students learning experiences, rather than on potential ways to improve students' learning in these environments (Varkey, 2022). Nevertheless, the different modalities may provide an indication of which modalities lead to high levels of student's success and which do not.

According to Wittich et al. (2017, p.7), asynchronous e-learning is commonly used in internal medicine programs. The authors conclude, that e-learning has a positive effect on knowledge acquisition and is approximately as effective as textbooks or lecturers.

Based on their review of studies, Nortvig et al. (2018, p. 48) conclude that, comparing F2F teaching with online and / or blended learning reveals that no inherent feature of any of the three teaching formats leads to better or worse learning outcomes for students. It is not the format that leads to better or poorer learning outcomes for students, but rather the circumstances and context (Nortvig et al., 2018, p. 48). According to Nortvig et al. (2018, p. 50), factors that have a significant impact on e-learning are:

- Spaces, learning community and student identity
- Course design
- Educator roles and relations

Nortvig et al. summarize the most prominent concepts and their importance for the above mentioned factors. For the factor *spaces, learning community and student identity*, they highlight (Nortvig et al., 2018): appropriate teaching and learning spaces (online and offline); engaging and meaningful learning communities; and a strong and salient sense of learner's identity. For *course design*, the most important elements relate to the interactions between online and offline activities, campus-based and practice-based, as well as students, teachers and content (Nortvig et al., 2018). The factors which have emerged as most important to *educator roles and relations* include establishing a strong teacher presence in the online environment and building an online community that fosters positive relationships (Nortvig et al., 2018).

Varkey et al. (2022) used educational psychology literature to provide evidence-based recommendations for the construction of an educational medium in an asynchronous learning environment. They identify three main theories that show promise in the asynchronous classroom:

- Sequential learning
- Metacognition in the asynchronous classroom
- Multimedia principles

Sequential learning refers to the use of spaced learning episodes in time with breaks in between and the use of other learning experiences placed in-between these learning episodes (Varkey et al., 2022).

Asynchronous learning is an advantageous setting, since students can define and use their own retention intervals, time between learning and assessment. Sequential learning can be best used in a classroom that has a sufficient longitudinal reserve, as the very nature of sequential learning requires sufficient time (Varkey et al. 2022). Other researcher have concluded that self-paced online courses (SPOC) can contribute to learner's effectiveness (Southard et al. 2015).

Metacognition in an asynchronous classroom focuses on a person's ability to recognize the learning that is taking place, to create an evaluation of the learning process, and to make changes to the interaction with the materials so that they can increase their overall learning. This is often measured through the writing of reflection papers (Varkey et al. 2022). Through the application of Mayer's 12 (multimedia) principles (Varkey et al. 2022 adapted from Mayer and Moreno, 1998; see figure 2), presentation content is streamlined, and therefore made more effective for teaching students.

Figure 2: Meyer's 12 principles
(Varkey et al. 2022 adapted from Mayer and Moreno, 1998; Meyer, 1997)

The principle	What it means
Coherence Principle	Learning is improved when additional words, sounds and pictures (noise) are removed
Signaling Principle	Learning is improved when there are cues highlighted in the essential material
Redundancy Principle	Learning is improved when graphics and narration are utilized rather than utilizing graphics, narration and on-screen text
Spatial Contiguity Principle	Learning is improved when related words and pictures are presented near to each other
Temporal Contiguity Principle	Learning is improved when related words and pictures are presented at the same time rather than one after the other
Segmenting Principle	Learning is improved when the material is presented in user-paced segments rather than as a singular and continuous unit
Pretraining Principle	Learning is improved when students know the names and characteristics of the main teaching points or concepts
Modality Principle	Learning is improved with graphics and narration as compared to animation and on-screen text
Multimedia Principle	Learning is improved with both words and pictures rather than just words alone
Personalization Principle	Learning is improved when the teaching is written conversationally rather than formally
Voice Principle	Learning is improved when the narration is spoken with a human voice rather than with a mechanistic voice
Image Principle	Learning is not necessarily improved when the speaker's image is added to the screen

In addition, Varkey et al. (2022) highlight the importance of clear and concise feedback from teacher to student. High quality feedback to students enables learning and changes behavior.

According to Lin & Gao (2020, p. 174), two themes emerged regarding the benefits of asynchronous distance learning: self-controlled learning and self-directed learning. Students learned at home, anytime, anywhere and arranged their learning according to their own schedules. In addition, asynchronous learning allowed students to watch course videos repeatedly (Lin & Gao, 2020, p. 174). Self-directed learning is another advantage of asynchronous learning. Lin & Gao (2020, p. 174) reported that students were more focused on learning when they were studying on their own. By repeatedly watching the course videos, students developed a deeper learning. Students were able to stop the video when they had problem with the lecture and searched for resources to dissolve their confusion. The access to rich learning materials and resources motivated students' learning (Lin & Gao, 2020, p. 174), but conversely, it could also lead to students being overwhelmed (course load).

The challenges explored by Lin & Gao (2022) are that students experienced social isolation, as they had less opportunities for class communication and discussion. Additionally, they were unaware of their peers' learning progress, which lead to students feeling distant from others, thus undermining their passion for learning. Previous studies have already mentioned that the vast majority of the statements in an asynchronous learning environment are content related, which might result in the students feeling isolated (Hrastinski, 2008, p. 51).

Not all students fully understand the learning content through self-study. Not getting immediate feedback from the teacher in case of questions and not having the opportunity to interact with peers in real time classroom communication (Francescucci & Rohani, 2019, p. 61) is a challenge. Slow Internet speed, poor quality of the course videos and unfamiliarity with the LMS software are other challenges. Finally, students complained about fatigue due to long time spent concentrating on using electronic devices for learning (Lin & Gao, 2022, p. 175).

Lazarevic & Bentz (2021, p. 9) conclude that ease of access to learning materials is one of the four determinants of students' lower perception of stress in online learning environments (Lazarevic & Bentz 2021, p. 2).

Wasdahl (2022) summarized the advantages and disadvantages of different distance learning settings, more specifically asynchronous, hybrid and asynchronous distance learning. He reported significantly more advantages than disadvantages for asynchronous distance learning. Among the advantages, he included greater accessibility to diverse students (inclusivity), increased time for consideration, reflection and exploration, cost effectiveness (no travel or venue costs) and the ability to scale to potentially thousands of learners at a time. On the disadvantages side, he also mentioned that students can feel socially isolated, that course material can be misunderstood and that students need more self-discipline and motivation to complete their courses.

2. Implementation of the Asynchronous E-learning Course CF

The Business Information Technology Bachelor degree program (BIT) at the University of Applied Sciences and Arts, Northwestern Switzerland (FHNW) has changed the learning and teaching set-up from traditional F2F teaching to asynchronous e-learning in the compulsory finance course CF.

Until February 2020 the CF course was taught in a traditional F2F learning environment. Various restrictions due to the fight against the COVID-19 virus led to the introduction and use of different settings from February 2020 to June 2021. During this period, a mixture of traditional F2F and synchronous e-learning was used in the CF course. The courses that took place in autumn 2021 (September 2021 to December 2021) and spring 2022 (February to June 2022) were again in the traditional F2F setting. At this point, the strategy of returning to a traditional F2F setting seemed more promising than increasing the use of asynchronous e-learning.

The course setting was then changed to the asynchronous e-learning setting and held for the first time starting in September 2022. The change was initiated and driven by several factors, such as higher student demand for asynchronous e-learning courses and cost pressure from the university (student groups from two different locations can be taught together), to name two reasons.

The course CF deals with basics of the mentioned field. There was no change in the LMS used, the course structure or the content between the asynchronous e-learning course and the F2F course. Moodle was used as LMS in F2F and asynchronous e-learning. The same learning textbooks, the same presentation slides, the same questions, exercises and solution manual for the questions and exercises were provided. Finally, quizzes were provided for each topic.

Bonus points could be gained by solving a written case study as a group work. To solve the case study, several topics covered during the course had to be applied. This possibility was given in the traditional F2F format as well as in the asynchronous e-learning setting. Figure 3 compares the original with the asynchronous online setting.

Figure 3: Comparison of asynchronous e-learning with F2F in the CF course

Criteria	Asynchronous e-learning	F2F
Time period	September 2022 to December 2022	February 2022 to June 2022
Content	12 topics	The same 12 topics as in F2F
LMS	Moodle	Moodle
Learning material	Explanatory videos	-
	Discussion forum	Discussion in classroom
	On-demand tutorial	Discussion in classroom
	Two textbooks	The same two textbooks as in F2F
	Presentation slides for each of the 12 topics	The same presentation slides for each of the 12 topics
Bonus points	Possibility of 21 bonus points	Possibility of 9 bonus points
	Limited to 10% (= 9 points) of max. points achievable in the final examination	Limited to 10% (= 9 points) of max. points achievable in final the examination
	Rewarding the correct solution of the case study with a group	Rewarding the correct solution of the case study with a group
	Weekly quizz questions; rewarding the successful solving	Weekly quizz questions; not rewarding the successful solving
Final exam date	January 31st 2023	June 23rd 2022
Form	Paper and pencil	Paper and pencil
Duration	90 minutes	90 minutes

In summary, the following elements have been added to the asynchronous e-learning course:

- Explanatory videos
- Discussion forums
- On-demand tutorials
- Reward for successful completion of weekly quiz questions

An explanatory video has been produced and made available for each topic. The videos are realized as voice-over slides, using standard Microsoft Power Point software. The explanation videos are between 8 to 15 minutes long. The lecturer explains the main content of each topic in a concise way.

If students had questions, they could write them in the discussion forum. The forum was assessable to all students enrolled in the course as well as to the lecturer. There was a time limit for posting questions. Students could post questions up to twelve hours before a topic was scheduled for asynchronous work. Other students or the teacher could then answer the question(s) or add other aspects to the discussion. If the level of activity was high, measured by the complexity and number of questions on the discussion forum, the lecturer invited to a synchronous online session to clarify the enquiries. This possibility is known to the students as on-demand tutorial.

In the asynchronous e-learning format, as in the F2F format, quizzes were also made available. The students had the possibility to solve a quiz every week. The quiz had to be solved at a given date and time within a given time slot. If students answered seven out of ten multiple choice questions correctly, they were rewarded with a bonus point. In the F2F course format, the students did not receive bonus points for correctly completing the quizzes.

3. Analysis

Due to changes in the curriculum, the number of students taking the CF course in autumn 2022 (asynchronous e-learning) more than tripled compared to the number of students taking

the course in spring 2022 (F2F). The average grade increased notably from 4.2 to 4.6 or by 0.4 (explanation of the Swiss grading system below the table in figure 4).

Figure 4: Figures comparing asynchronous e-learning with F2F in the CF course

Criteria	Asynchronous e-learning	F2F
Number of students (=N)	46	14
Passed	40	12
Succesion rate in %	87.00	85.70
Max. exam points possible	90	90
Average points achieved in the final exam	62.2	58.0
Average bonus points achieved	8.8	7.3
Average grade	4.6	4.2
Standard deviation	0.848	0.818

Note(s): The grading scale ranges from 1 (very poor) to 6 (excellent). A minimum grade of 4.0 is required to pass the exam. Tenth marks have been mathematically rounded to half marks. Tenth of grades have been calculated from the points obtained in the exam as follows: (points achieved including bonus points / maximum possible points) * 5 + 1.

The number of bonus points available to students has been increased from 9 (F2F) to 21 (asynchronous e-learning). However, the number of bonus points credited to the final exam is limited to nine. The increased possibility of earning bonus points may have contributed to the higher bonus points achieved per student in the asynchronous e-learning setting, which was 1.5 points (equivalent to 0.08 grade points). After eliminating this effect, the grade increase is reduced by 0.08 to 0.32 when comparing asynchronous e-learning to F2F.

The standard deviation increased from 0.818 to 0.848. The findings of Lin & Gao (2020, p. 174) can help to interpret the increase in the standard deviation. Lin & Gao summarize that self-directed learning is an advantage of asynchronous e-learning because students are more focused on learning when they are studying on their own, watching the explanatory videos provided several times if necessary. The authors of this paper deem it possible that self-directed learning with little or no connection to peers and the instructor, compared to group learning (F2F), will lead to more heterogeneous results, not only in terms of content, but also in terms of grades. This is reflected in the higher standard deviation.

The concise explanatory videos are between 8 to 15 minutes long. The limited duration of the videos should not overstretch the students' concentration span, so the videos might increase motivation. In addition, several principles from Meyer's Twelve Principles were adapted in the production of the videos. For example, multimedia, personalization, voice and image.

The students' own quiz results could be used as a toll to check their own learning progress, both in the F2F setting and in asynchronous e-learning. The results of the quizzes in the asynchronous e-learning environment were used by the teacher to give students overall feedback on the quiz results. The provision of these results gave students an insight into the learning progress of their peers. This feedback had the potential to motivate students (Varkey et al., 2022; Lin & Gao, 2020) and might have helped students in their metacognition process.

In addition, each student received an individual quiz summary that showed which questions they answered correctly or incorrectly. Getting seven out of ten questions in the quiz right in the asynchronous e-learning format resulted in a bonus point. Students could use the quiz results summary to monitor their own learning progress. According to Varkey et al. (2022) the metacognition in the asynchronous classroom contributes to the learning success in an asynchronous e-learning environment.

The possibility to use discussion forum and / or the on-demand tutorials was rarely used by the students. This might be explained by the content of the course, which could be learned by self-study, the clear and logical structure of the course, the quality of the learning material provided and the student's confidence in their self-learning abilities in an asynchronous e-learning environment.

As a prerequisite for the successful course transformation from traditional F2F to asynchronous e-learning, Brady & Pradhan (2020, p. 235) mentioned that student familiarity with the LMS supports success. Another factor that might contribute to the learning success in asynchronous e-learning is the perceived stress level of the students (Lazarevic & Bentz, 2021, p.9). Lazarevic & Benz found that students taking a course in a traditional F2F classroom environment felt slightly more stressed than their counterparts taking the course online. Four factors contribute to students' perceived stress a) finding time to study, b) access to learning materials, c) social stress and d) expectations from family and friends (Lazarevic & Bentz, 2021, p.9).

Strong teacher presence combined with high quality course content are important elements in asynchronous e-learning (Nortvig et al., 2018, p. 52, based on Moore, 2014 and Swan & Shi, 2014). Students participating in e-learning courses need to feel connected to the course content, to the other students and to the instructor (Nortvig et al., 2018, p. 52, based on Southard, Meddaugh & France-Harris, 2015; Martin-Rodriguez, Fernandez-Molina, Montero-Alonso & Gonzales-Gomez, 2015).

Students can take the course in their second or third year at the earliest. Students study in a class environment. This means that students attend courses with the same classmates, giving them time to get to know each other. In the first year of study, the F2F teaching and learning environment is predominant. In the period from February 2020 to June 2021, this effect may have been diminished due to limited F2F teaching. Furthermore, the students know the lecturer, as they worked together in two foundational courses before (during their first year of the Bachelor program). Both elements help to build a student-to-student and teacher-to-student relationship bevor the CF course even started. A good relationship between students and between students and lecturer can contribute to students' learning success (Nortvig et al., 2018).

4. Conclusion: Lessons Learned and Limitations

Based on both, the literature reviewed and the personal experience described from teaching the course, asynchronous e-learning has the potential to increase student learning success (Varkey et al. 2022; Nortvig et al. 2018; Lin & Gao, 2020; Wittich, 2017). Some of the factors that sustain learning success are in the nature of the asynchronous e-learning environment such as student independence in terms of time, place and to some extend to content, which supports students' sequential learning (Varkey et al., 2022).

In order to unlock the positive elements of asynchronous e-learning that contribute to students' learning success, some barriers need to be considered and overcome. Firstly, the relationship between lecturer and students is essential not only in a F2F learning and teaching setting but also in an asynchronous e-learning setting (Nortvig et al., 2018, p.52). Building up a fruitful and respectful relationship takes time and personal interaction. Learning in a group as a class can support the relationship building between students, while limiting the class size to a reasonable number supports the relationship building between students and lecturer.

Secondly, feedback from the lecturer to students can support students' metacognition. Metacognition is considered to have great potential to contribute to students' learning success (Varkey et al., 2022; Hattie & Timperley, 2007, p. 104), while giving feedback to the class as a whole can form the basis for overcoming students' feeling of isolation. According to Lin & Gao (2022), students who did not know their peers in the learning process experienced social isolation. Preventing students feeling socially isolated is seen as a major challenge in an asynchronous e-learning setting (Lin & Gao 2022; Wasdahl, 2022).

Thirdly and finally, quite obviously, students need easy access to the learning materials. This is one of the four factors that reduce stress (Lazarevic & Bentz, 2021, p. 9). The impact of reduced stress on learning success is widely discussed in the literature (Lazarevic & Bentz, 2021, p. 9). Students need appropriate hardware, a stable and fast network connection, an LMS that is easy to use and with which they are ideally already familiar (Brady & Pradhan (2020, p. 235). A clear structure and easy navigation through the online materials (e.g. finding the course syllabus online) helps. Based on the authors' experience, students appreciate the provision of short explanatory videos, as they can watch the video several times, stop it, and adjust the speed, which may maintain a deeper learning (Lin & Gao, 2020, p. 174). Keeping Meyer's 12 principles in mind during the production of the explanatory videos can improve students' learning. In addition, the fact of a reduced concentration span when learning from an electronic medium compared to an F2F situation should be taken into account when producing the explanatory videos.

The findings of this paper are limited by several factors. The grade achieved in a course is not the only indicator to measure students' learning success. Other measures such as student satisfaction may have different results.

The subjects of the studies are students in a bachelor program in business information technology. Due to the students' special interest in information technology, they are more IT affine than students from other disciplines. The subjects are members of (smaller) classes, consisting of 46 and 14 students. For larger classes, the lessons learned may not be useful as it is harder or not possible to build a fruitful and respectful relationship between students and teacher.

Learning and teaching is very complex and differs from person to person. What works for one person may not work for another. Or as Hattie (2015, p. 80) notes in a meta-analysis of influences on student learning: "Almost all of the 65 interventions that are commonly claimed to improve student learning have a positive impact on student learning."

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