The Establishment of an Asynchronous E-learning Course in Higher Education – Challenges and Guidance to Overcome Them

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Abstract
After the Corona period, the use of asynchronous e-learning settings has increased in higher education, including the Bachelor's degree program in Business Information Technology (BIT) at the University of Applied Sciences Northwestern Switzerland (FHNW). In autumn 2022 an asynchronous e-learning course was introduced for a compulsory finance module in the aforementioned program. The comparison of the grades achieved in this course before Corona in a face-to-face setting (F2F) and after Corona in an asynchronous e-learning setting showed that the students' grades increased notably. The literature review shows that asynchronous e-learning has the potential to increase students' learning success. Interestingly, in the second run of the asynchronous e-learning finance course, held in spring 2023, students' grades increased even further. At the same time, the standard deviation also increased. No changes were made to the learning environment, the course content, or the learning materials. The aim of this conference paper, which constitutes a continuation of the previously published work, is to find possible factors for the increased scores and the increased standard deviation comparing the two runs of the asynchronous e-learning finance course. The research is based on a literature review and the results of a survey of students' course evaluations. The identified factors and their consideration might help to improve comparable asynchronous e-learning settings.

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

1. Introduction

The number of students taking e-learning courses in higher education continues to increase since several years (Seaman et al., 2018). The COVID-19 pandemic boosted this trend (Monira et al., 2022). This was driven by convenience and access of online courses (Caskurlu et al., 2020). Researchers highlighted the independency of time, place and pace as reasons enabling convenience and access (Nortvig et al., 2018, p. 47 based on Bernard et al., 2014; Chigeza & Halbert, 2014; Northey, 2015, Israel, 2015, Potter, 2015). In addition, students often experience self-directed learning more meaningful compared to a traditional face-to-face (F2F) classroom setting (Lin & Gao, 2020, p. 171, cited Cho, Kim & Choi, 2017; Hrastinski, 2008, Pratt & Palloff, 2011). Furthermore, students feel more comfortable and flexible to discuss their standpoints in an asynchronous online discussion board. They have more time to think about how to respond to questions, thus reducing the feeling of pressure (Brierton et al, 2016).

The use of an electronic medium such as the Internet between the teacher and the students also introduces challenges. Limited social interactions of those involved could lead to students feeling socially isolated (Lin & Gao, 2020, p. 174).

In this paper, we discuss challenges and try to provide some guidance to overcome these challenges in the design of an asynchronous e-learning course in higher education. We first present a literature review. The results of the literature review are then enriched with the insight gained in the newly established asynchronous e-learning Corporate Finance (CF) course.

1.1. Definitions of Terms

We start with a discussion and classification of the key terms used in this paper, namely e-learning, blended learning and/or hybrid learning (F2F+), asynchronous and synchronous settings.

1.1.1. Definition of E-learning

It is difficult to find a common definition of e-learning. Arkorful & Abaidoo (2014, p. 29, based on Algahtani, 2011) conclude that 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. A synonym of e-learning often used in literature is online learning.

In higher education, the term online learning often means that the courses are delivered entirely online, in general 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 absence of a physical classroom is the key feature of online learning compared to F2F learning. The physical classroom is replaced by web-based technologies. It opens the door for learning outside of a physical classroom, 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; Porter 2015).

1.1.2. Definition of Blended Learning

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). A synonym often used in literature for blended learning is hybrid learning (Nortvig et al., 2018, p. 48 based on Ryan et al., 2016).

Huy et al. (2023) define hybrid or blended learning also as face-to-face learning with online components (F2F+). Their definition supports the standpoint in the present paper, that blended and/or hybrid learning can be categorized between the opposite notions F2F and purely online learning, depending on the degree of online usage in teaching and learning.

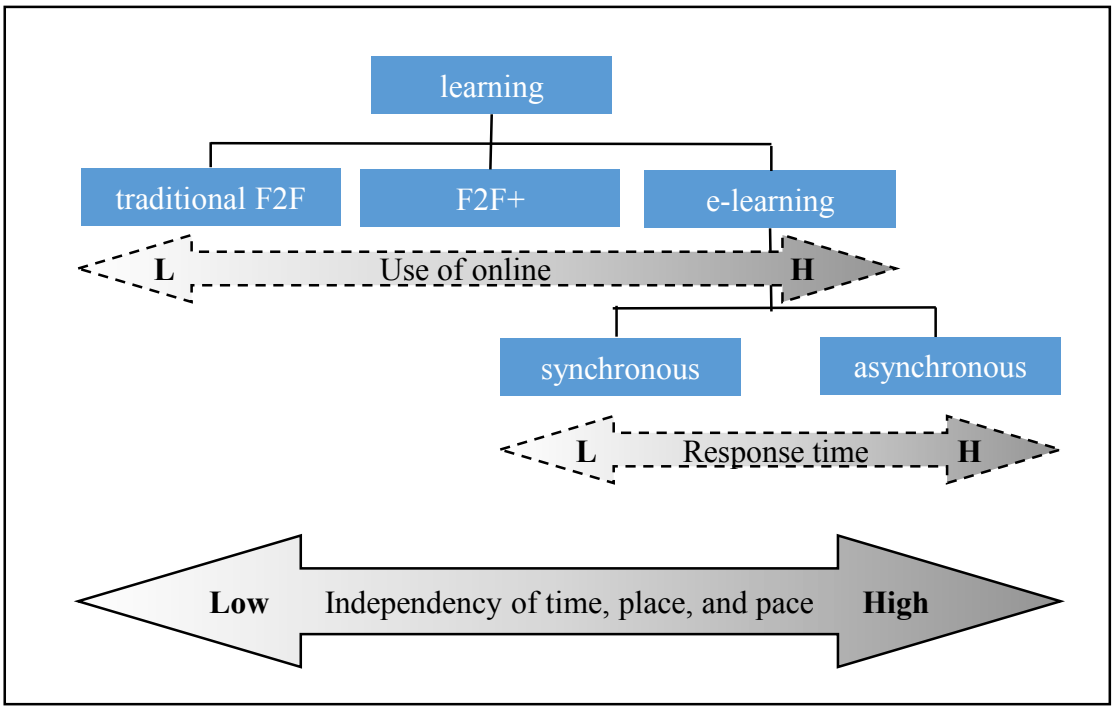
1.1.3. Definition of Synchronous and Asynchronous

Asynchronous e-learning supports teaching and learning relationships between teachers and students when the participants are not online at the same time (Hrastinski, 2008, p. 51). Asynchronous e-learning is online or distance learning that does not take place in real time, and the instructor provides chat, e-mail and online discussion boards to enable interaction (Lin & Goa, 2020, p. 170, based on Ruiz et al., 2006).

In contrast, synchronous e-learning indicates that the participants are online at the same time and therefore are in direct interaction. That means that the difference between asynchronous and synchronous e-learning is often a matter of the response time (Hrastinski, 2008, p. 52). In some instances, e-mail or chat is used near-synchronous when users remain logged in and monitor their e-mail/chat continuously (Hrastinski, 2008, p. 52).

Asynchronous e-learning implies that a high degree of independency of place and time exists for the majority of the course duration. This can for example be achieved by making a majority of the learning-material available online, using a LMS. The course may have synchronous elements such as synchronous assessments and/or synchronous sessions (online and offline). The course design can even include some traditional F2F sequences.

Figure 1 summarizes the terms mentioned above and serves as a scaffold for the rest of the paper.



Note: The difference between the various terms is often a matter of degree. E.g. for asynchronous and synchronous (Hrastinski (2008), p. 52), or the use of online for traditional F2F versus e-learning, and the response time for synchronous and asynchronous (Huy et al., 2023).

Figure 1: Visualization and classification of relevant terms

1.2. Literature Review

Around the turn of the millennium the community of inquiry (CoI) model as a framework concept emerged (Garrison et al., 2010, p. 6). The frameworks' aim is to define the elements of a collaborative and meaningful learning experience in the context of text-based, asynchronous online university teaching (Garrison et al., 2010, p. 5). The authors proposed that learning happens in a community of inquiry because of the interactions of three essential elements: cognitive presence, social presence, and teaching presence (Lee, 2014, p. 41).

In more detail, the three elements of the framework developed by Garrison et al. (2016) are:

- Cognitive presence means that a worthwhile educational model should be based on process of reflective inquiry (Garrison et al. 2016, p. 6 based on Swan et al., 2009). According to Loy (2021, p. 403), cognitive knowledge is gained in a social process of asking questions, searching for solutions and negotiation decisions.
- The essence of social presence is that some form of social presence needs to be developed (Garrison et al., 2009, p. 7). Kreijns et al. (Loy, 2021, p. 403, based on Kreijins et al. 2014, 7) argue that social presence involves two constructs: First, there is the aspect of "social space", by which the authors mean a sense of community and an open atmosphere. Secondly, it is about the actual construct of social presence as the feeling that others are present and perceptive, even if it is a virtual space.
- Teaching presence is about the design and moderation of the learning environment (Loy, 2021, p. 395 based on Anderson et al. 2001). Teaching presence is made up of three categories: design and organization, facilitating discourse, and direct instructions (Anderson et al., 2001, p. 1).

Figure 2 illustrates the community of inquiry framework.

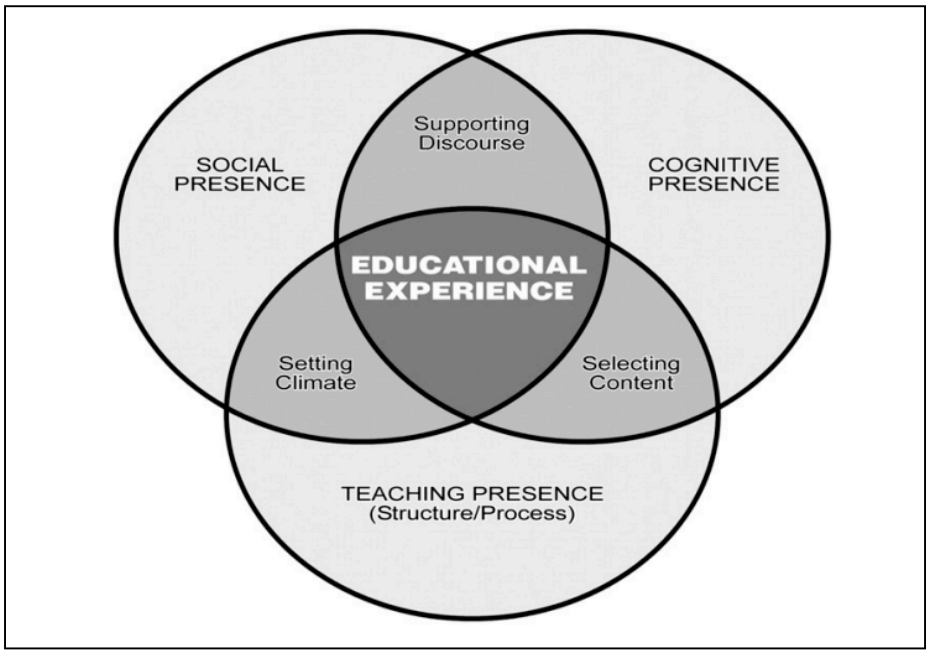


Figure 2: Community of inquiry framework (Garrison et al., 2010, p. 6)

According to Garrison et al. (2010), the sense of community increases not only student's classroom participation and develops deep learning, but it also enhances students' ability to handle stress and emotional well-being. Those factors contribute to higher grades. It is therefore key to build a sense of community for students in the e-learning environment.

Loy (2021, p. 392) beside many other researchers supports Garrisons' framework: "In addition to the technical and spatial challenges posed by online courses, university teaching should also consider the socio-emotional effects of digital teaching formats as students depreciate in particular their lack of physical presence."

Based on Yang's research (2016, p. 162), teaching presence reinforces and sustains cognitive and social processes in the virtual community. In order for this to work, teachers need to learn to serve as subject matter experts. In a study investigating students' learning of a foreign language, the researcher concluded that "teacher's written feedback play a significant role in improving students' writing and supporting their text development. Students often require feedback from knowledge authority so they can learn how to develop their writing skills, in order to write a well-structured and grammatically correct essays as part of their studies" (Yang, 2016, p. 162 based on Ferris & Roberts, 2001; Lockhart & Ng, 1995). Varkey et al. (2022) also highlight the importance of clear and concise feedback from teacher to student. High quality feedback to students enables learning and changes behavior.

Lee (2014) investigates among other things the relationship between cognitive and social presence. She summarizes that "the higher the social presence, the better the quality of cognitive presence". Social presence is positively correlated with cognitive presence (Lee, 2014, p. 49). The single most important element of successful distance learning is the "formation of a learning community through which knowledge is imparted and meaning is co-created" (Lee, 2014, p. 49 based on Palloff and Pratt, 2007).

Alvarez and Palmero (2022) revealed three types of learning engagements in a study using a phenomenological research design, namely: student-content-, student-teacher- and student-student-engagement. The student-content-engagement of Alvarez and Palmero's study is similar to the cognitive presence from Garrison et al. (2010), as Alvarez and Palmero define content-student-engagement as learning through the interaction of students with learning materials. Alvarez and Palmero conclude that this type of learning is highly present in an asynchronous online learning environment while the other two forms of engagement are described as limited or lacking (Alvarez & Palmero, 2022, p. 148).

Caskurlu et al. (2020, p. 4) stress that a sizable number of studies provide quantitative evidence that teaching presence supports learning outcomes in online learning environment. They say, however, that it is difficult to synthesize those findings and to derive generalized conclusions. They found nevertheless moderately strong positive relationships between teaching presence and both student satisfaction and perceived learning. This suggests that teaching presence is a good predictor of learning outcomes and indicates the importance of considering teaching presence when designing and implementing online courses (Caskurlu et al., 2020, p. 11).

In another study, college students reported that they can express themselves better and in more detail and that they interact more efficiently with others when in an asynchronous setting. (Brierton et al., 2016; Sun et al., 2008). This may result in a deeper learning and eventually in higher grades.

Another study, conducted by Lin & Gao (2020, p. 174), describes two benefits of asynchronous distance settings: self-controlled and self-directed learning. Students learned at home, and arranged their learning according to their own schedules. Asynchronous learning allowes students to watch course videos as many times as needed. Another advantage of asynchronous learning is self-directed learning. Lin & Gao conclude that students were better focused on learning when they were studying on their own. Students develop a deeper learning by repeatedly watching the course videos. They can stop the video when they had problems with the lecture and search for resources to dissolve their confusion, or they can increase the video speed in order not to get bored. The access to a wide range of learning materials and resources supports students' learning. However, the researchers also found that students can get overwhelmed by too much content. In the same study, Lin & Gao also found that students might experience social isolation, as they had less opportunities for class communication and discussion. They were unaware of their peers' learning progress, which lead to students feeling distant from others, thus lowering their passion for learning. Previous studies have already mentioned that most of the statements in an asynchronous learning environment are content related, which might indicate that students feel isolated (Hrastinski, 2008, p. 51).

Not all students are able to 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.

As described in our previous paper (Schuler et al., 2023), students learning can be supported by adapting Mayer's 12 multimedia principles listed in figure 3.

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

Figure 3: Mayer's 12 principles (Varkey et al. 2022 adapted from Mayer and Moreno, 1998; Mayer, 1997)

2. The Establishment of the Asynchronous E-learning Course in CF

The significant increase in student performance when comparing the first run of the asynchronous e-learning course held in autumn 2022 to the F2F course held in spring 2022 (Schuler et al. 2023) contributed to the firm establishment of the asynchronous e-learning course in the curriculum. The course design for the spring 2023 course remained the same as for the autumn 2022 course.

The CF course teaches fundamental concepts of valuing and financing a corporation. The main features of the learning design are summarized in figure 4 below. Two textbooks with an extensive number of exercises and questions form the basis of the course. Each topic is supported by a presentation of approximately 30 slides building the theoretical basis of the topic. Explanatory videos provide students with a first taste of each topic. They highlight and explain the most important aspects of each topic. The videos are between 8 and 15 minutes long and use voice-over on MS Powerpoint slides.

Criteria	F2F	Asynchronous e-learning	Asynchronous e-learning
Semester	Spring 2022	Autumn 2022	Spring 2023
Time period	February 2022 to June 2022	September 2022 to December 2022	February 2023 to June 2023
Content	12 Topics	The same 12 topics as in the semester before	The same 12 topics as in the semester before
LMS	Moodle	Moodle	Moodle
Learning material	Discussion in classroom	Explanatory videos Discussion board On-demand tutorial	Explanatory videos Discussion board On-demand tutorial
	Two textbooks	The same two textbooks as in the previous semester	The same two textbooks as in the previous semester
	Presentation slides for each of the 12 topics	The same presentation slides for each of the 12 topics as in the previous semester	The same presentation slides for each of the 12 topics as in the previous semester
Bonus points	Possibility of 9 bonus points Limited to 10% (= 9 points) of max. points achievable in final the examination Rewarding the correct solution of the case study with a group Weekly quizz questions; not rewarding the successful solving	Possibility of 21 bonus points Limited to 10% (= 9 points) of max. points achievable in the final examination Rewarding the correct solution of the case study with a group Weekly quizz questions; rewarding the successful solving	Possibility of 21 bonus points Limited to 10% (= 9 points) of max. points achievable in the final examination Rewarding the correct solution of the case study with a group Weekly quizz questions; rewarding the successful solving
Final exam date	June 23rd 2022	January 31st 2023	June 22nd 2023
Form	Paper and pencil	Paper and pencil	Paper and pencil
Duration	90 minutes	90 minutes	90 minutes

Figure 4: Comparison of the CF course for three semesters (spring 2022 to spring 2023)

A discussion board was installed on Moodle. Students could post questions up to 36 hours before the topic was covered in predefined course program. Other students or the teacher could answer the question(s) or add another aspect to the discussion. If the level of activity was high, as measured by the complexity and number of questions in the discussion board, the instructor invited students to a synchronous online session to clarify the questions.

Students were provided with a large number of exercises and questions with corresponding solutions. The aim was to allow students to apply the theory they had learned, to test their knowledge and to enhance their solutions.

In addition, quizzes gave the students the opportunity to earn weekly bonus points for each topic. Each quiz had to be completed by a certain date and time. If students answered seven out of ten multiple-choice questions correctly (per quiz), they were rewarded with a bonus point. Bonus points were added to the points earned in the final exam.

3. Analysis

As the curriculum of the BSc-program had changed, the number of students taking the CF course in autumn 2022 was significantly higher than in the semester before and after. Comparing the two asynchronous e-learning courses held in autumn 2022 and spring 2023 the average grade increased notably by 0.2 from 4.6 to 4.8.

Course design	F2F	Asynchronous e-learning	Asynchronous e-learning
Period	**Spring 2022**	**Autumn 2022**	**Spring 2023**
Number of students (=N)	14	46	21
Passed	12	40	19
Succesion rate in %	85.70	86.96	90.48
Max. exam points possible	90	90	89
Average points achieved in the final exam	58.0	62.2	66.93
Average bonus points achieved	7.3	8.8	8.5
Average grade	4.2	4.6	4.8
Standard deviation	0.818	0.848	0.881

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.

Figure 5: Figures comparing asynchronous e-learning for the first course held in autumn 2022 and the second course held in spring 2023.

The authors suspect that the teacher's and students' previous Covid-related experience with asynchronous e-learning contributed to the grade increase. They already had an image of the upcoming asynchronous e-learning course, this reducing uncertainties, anxiety, and perceived stress level. Reduced perceived stress level contributes to the learning success (Lazarevic & Bentz, 2021, p.9).

Interestingly, students achieved slightly less bonus points (8.5 instead of 8.8) but performed better in the final exam (increased from 62.2 to 66.93 points). Bonus points could be achieved through the solving of quizzes and/or solving a case study in a group (in written form). The quizzes have been scheduled at a predetermined time interval. The slight decrease of bonus-points through quizzes might indicate that students followed their own learning pace by taking advantage of the asynchronous e-learning. This might indicate that students reached their knowledge peak around the time of the final exam. This supports the results of other researcher that self-paced online courses can contribute to learner's effectiveness (Southard et al. 2015). In a feedback survey, some students mentioned that one of the strength of the course is that it can be learned in one's own speed.

The authors conclude that students' perceive the quizzes as helpful. Students appreciate clear instructions, meaningful guidance and motivations for working through the asynchronous e-learning course. This includes the opportunity to repeat the course content several times, which is not possible in a traditional F2F classroom setting. The quizzes are an important tool to keep students on track, as the weekly quizzes covered the topic of the respective week. The interpretations of students' appreciation of the quizzes can be seen in-line with the before mentioned teaching presence (Garrison et al. 2010, p. 6; see section 1.2) that consist of the three characteristics design and administration, facilitating discourse, and direct instruction (Anderson et al., 2001, p. 3).

The students' quiz results act as a milestone to check their individual learning progress. In addition, the quiz results are used by the instructor to provide students with overall feedback. The disclosure of the quiz results gives 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).

Each student received an individual quiz summary showing the result of each of the 12 quizzes. It shows which questions were answered correctly or incorrectly and allows them to monitor their individual learning progress.

Standard deviation of the grades increased from 0.848 to 0.881 comparing the course runs in autumn 2022 to spring 2023, thus reflecting a higher dispersion of grades. We suppose that self-directed learning with little or no connection to peers and the instructor, compared to group learning (F2F), might lead to more heterogeneous results in terms of grades (Schuler et al., 2023).

We thus conclude that self-directed learning can contribute to higher grades. It is very important to provide high-quality learning material to support students in their self-directed learning. In the finance course under investigation this includes for example short videos, many exercises with detailed solutions, the previously mentioned quizzes, etc. In a survey one out of 21 student answered the question "What is in your opinion the strengths of the module?" with "The high amount of exercises and possibilities to review ones knowledge". Mayers 12 principles (see figure 3) were taken into consideration while producing the explanatory videos. This may have contributed to the teaching presence according to Garrison's CoI framework (Garrison et al., 2010; see also figure 3 before).

The only fixed date for the students who took this course was the date of the final exam. The content could be studied at any time during the course of the semester, thus enabling self-directed learning to a maximum degree.

The course also includes discussion boards and on-demand tutorials. However, these additional tools where not used heavily by the students. We interpret the low usage by the clear content, which could be learned by self-study, the logical structure of the course, the quality of the learning material and the student's confidence in their self-learning abilities (Schuler et al., 2023).

To summarize the analysis we conclude that in the asynchronous e-learning CF course the focus was on teaching presence, with its three sub-categories: design and organization, facilitating discourse, and direct instructions (see section 1.2). Caskurlu et al. define teaching presence as the binding-element together with social presence and cognitive presence (Caskurlu et al., 2020 based on Garrison et al. 2000). Thus, helping further establishing the asynchronous e-learning CF course.

4. Conclusion: Lessons Learned and Limitations

To unlock the full potential of an asynchronous e-learning setting a university has various areas to take into consideration. Teaching presence in the course appears to be a key aspect, which can be influenced from all the elements of the CoI (teaching presence, cognitive presence, and social presence) best by the teacher. Or as one students answer the question

“What was most helpful so support your learning?” with “The way the module is structured fits the content perfectly.”

Social presence (Swan & Sihl, 2014, p. 114) and cognitive presence are other important aspects for successful learning in an asynchronous e-learning environment. The facts that students can take the CF course in their second or third year at the earliest and that they study in class environment, helped to build up social presence. Students know each other, thus maintaining social presence. Social presence is seen as an important element of students’ learning success. Developing a sense of community requires additional work (Moore, 2014, p.). This work not only can be done in the asynchronous e-learning course but ideally already before the course starts, e.g. in the curriculum design.

Anderson et al. (2001, p. 14) contribute an additional area of concern. Part of the challenge in asynchronous e-learning environment is to develop compensatory behaviors for the relative lack of non-verbal and paralinguistic communication in a text-based medium such as computer conferencing. It appears that the explanatory videos, quizzes, discussion boards and the case study contributed to close the mentioned lack in the course under investigation.

The lessons learned from the authors of this paper are well summarized by Caskurlu et al. (2020, p. 11): “(…) course designers should consider the following when designing online courses: being clear, transparent, and consistent in course design. Instructors should consider being active participants in their courses, providing subject matter expertise knowledge, giving direction to course discussions, and providing timely and detailed feedback (…) Moreover, as teaching presence is distributed between students and instructor (Garrison et al., 2000), these findings also provide students practical insights on how to be actively involved in the course thereby constructing their knowledge through collaboration, interaction with others, and experiencing others’ points of views.”

Our findings 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 interest are students in a BSc-program in business information technology, therefore they have a higher compute literacy than students from other disciplines. The subjects are members of (smaller) classes, consisting of 21 and 46 students. For larger classes, the lessons learned may not be useful as it is more challenging to build social presence. Finally, learning and teaching is complex and differs from person to person. What works for one person may not work for another.

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