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The lonely struggle with autonomy: A case study of first-year university students’ experiences during emergency online teaching

Julia Eberle a,b,*, Joyce Hobrecht a

a Faculty of Philosophy and Educational Research, Ruhr University Bochum, Germany
b Department of Psychology, Ludwig-Maximilians-Universität München, Germany

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ABSTRACT

This paper explores how first-year students experienced emergency online teaching during COVID-19 and aims at understanding individual experiences related to basic psychological need satisfaction, considering different levels of contextual facilitators for learning activities involving technology in higher education derived from the C-flat model. Employing a case study approach, interviews of 15 chemistry students were qualitatively analyzed. The results showed negative effects of lacking internet connectivity and concurrence of learning and home spaces but positive effects of ceased commute between home and campus. Teachers’ implementation of digital learning opportunities was perceived as adequate but did not sufficiently address the overwhelming increase in students’ autonomy and decrease in social relatedness. Students’ self-regulation skills as well as skills to initiate and maintain social contacts for interactive learning activities and for motivational support emerged as crucial aspects. Many students were not able to cope appropriately and students’ need satisfaction during emergency online teaching appeared to be related to students’ prior need satisfaction resulting in five groups of students, with two being relatively resilient and three being vulnerable to the disruptions of regular onsite teaching. Implications for further research and practice are discussed.

1. Introduction

The COVID-19 pandemic and the need for emergency online teaching caught most higher education institutions suddenly and ill-prepared, throwing over well-established teaching and learning practices in institutions that were previously centered around onsite learning practices (Marinoni, van’t Land, & Jensen, 2020). For higher education students, the new situation required adaptation to new and often unclear demands for learning as well as navigation in a study setting that was not only new to themselves but also to many of their teachers, who were often relying on learning by doing approaches to online teaching (Marinoni et al., 2020). For first year students, who were just in the process of developing appropriate academic learning processes, practices, and strategies and finding out what it means to be a higher education student in their institution in general, the pandemic supposedly was a severe irritation. However, these irritations of normality may also have come with benefits for more individualized approaches to learning in higher education.

Being a newcomer to a university is a challenge per se and previous research has shown that academic and social integration are essential processes as failure to integrate adequately is strongly associated with student drop-out. Academic and social adjustment depend on students’ experiences with the new educational setting, including curricular experiences as well as peer and teacher interactions inside and outside of classroom settings (Reason, 2009). These experiences have likely been different during the pandemic, influencing students’ satisfaction of their basic psychological needs (Deci & Ryan, 2000). Basic psychological need satisfaction, in turn, has been repeatedly shown to be related to study satisfaction and drop-out intentions in higher education (e.g. Jeno, Danielsen, & Raaheim, 2018).

While many studies have looked into the consequences of COVID-19 related emergency online teaching in higher education, relatively few studies have investigated higher education students’ experiences on a general level that goes beyond individual courses. These studies that have taken the general student experience perspective are mostly quantitative and address general trends in students’ perception during the pandemic. For example, there is an impressive large-scale survey that focuses on students’ overall experiences worldwide (Aristovnik, Keržič, Ravseldj, Tomazevič, & Umek, 2020), several surveys that focus on country-specific student experiences (e.g. on students’ experiences in...
China: Cao et al., 2020) as well as analyses of students’ social media behavior (e.g., Duong, Pham, Yang, Wang, & Luo, 2020). However, deep qualitative research that complements quantitative findings with insights into specific individual differences in students’ experiences of emergency online teaching is still missing. While means and group statistics give a good impression of general trends, they rarely capture individual situations accurately. Consequently, this paper focuses on individual students’ perspectives on the sudden shift from their onsite study program to emergency online teaching and aims at contributing insights about how first-year students experienced and managed the sudden change.

To address these questions, we adopt a basic psychological needs perspective based on self-determination theory (Deci & Ryan, 2000). In order to understand potential causes for satisfying higher education students’ basic psychological needs during emergency online teaching, we draw on the model of contextual facilitators for learning activities involving technology (C-flat-model; Sailer, Schulz-Pernice, & Fischer, this volume). Against this background, we analyze the cases of 15 first-year chemistry students, who experienced their second semester with emergency online teaching. In doing so, we put special emphasis on students’ key prerequisites based on their first onsite learning experience as well as their individual experiences of emergency online teaching with a focus on basic psychological need satisfaction in relation to contextual facilitators of emergency online teaching.

2. Theoretical background

2.1. The role of basic psychological needs

Becoming a higher education student is a long-term process of balancing internal self-concepts and beliefs with experiences resulting from interactions within the academic context (cf. Torres, Jones, & Renn, 2009). Consequently, students’ identity development is closely related to their well-being and satisfaction with the academic context and to self-regulated motivation to continue the study program. According to self-determination theory and related research, the satisfaction of three basic psychological needs within the academic context is an important prerequisite for a successful identity development process (Deci & Ryan, 2000, 2012; Luyckx, Vansteenkiste, Goosens, & Duriez, 2009): the need for competence, for autonomy, and the need for social relatedness.

The need for competence is satisfied when students experience success in their studies, during learning activities and when they are able to extend their abilities (Vansteenkiste, Ryan, & Soenens, 2020). Accordingly, it is vital for higher education students to experience themselves as competent in solving problems related to their studies.

Similarly important is the need for autonomy (Deci & Ryan, 2012). In contrast to K-12 education, higher education emphasizes autonomy in learning even more. This need is satisfied when students can act in line with their own values and goals (Vansteenkiste et al., 2020), are allowed to think and feel independently and do not feel restricted or unguided by the learning environment.

The need for social relatedness is the third basic psychological need (e.g. Deci & Ryan, 2012). In the context of higher education, relatedness to peers and teachers are significant aspects for developing a perception as a legitimate student. It depends on students’ experiences with the new educational settings, including curricular experiences as well as peer and teacher interactions inside and outside of classroom settings (Reeson, 2009). Failure to integrate adequately into the social academic environment is strongly associated with student drop-out.

How higher education institutions can provide a satisfying environment for students and how they can specifically help first-year students to adjust to the new environment has been studied for several decades (Reeson, 2009). Nevertheless, drop-out rates are still a central problem in most universities. For example, recent studies found a drop-out rate of 45% in bachelor of chemistry programs in German universities (Heublein & Schmelzer, 2018), indicating that these programs seem to fail to satisfy students’ basic psychological needs to a large extent, despite students’ initial motivation to enroll in a chemistry program. If this is already the case under normal study conditions, the impact of the COVID-19 pandemic and the sudden switch from onsite learning to emergency online teaching may have both positive or negative consequences, either increasing the drop-out rate as the worst case or providing chances for more student satisfaction as the best case. Therefore, understanding potential causes for satisfying the three basic psychological needs in higher education students is necessary to understand the impact of emergency online learning during the pandemic.

2.2. Sources for satisfying higher education students’ basic psychological needs during COVID-19

How adequately higher education students’ needs are satisfied in the academic context depends on their experiences with academic and social aspects (Finto, 2006). Those experiences during the pandemic can be described using the model of contextual facilitators for learning activities involving technology (C-flat-model = C-model; Sailer, et al., this volume). The C-model is an integrative framework that combines previous research and theoretical models on distal and proximal aspects that influence the success of digital learning and teaching in higher education. According to this model, higher education students’ learning success in a digitalized world depends on three factors: 1) to what extent the infrastructural, institutional, and organizational environment supports digital learning, 2) how teachers plan and implement digital teaching, and 3) how students make use of digital learning opportunities. We assume that aspects on these three levels are not only relevant for students’ learning success but also severely shape students’ experiences during emergency online teaching and, consequently, students’ need satisfaction.

2.2.1. Infrastructural, institutional, and organizational academic environment

During regular onsite teaching in higher education settings, teachers and students have likely adapted to a more or less emphasized digitalization strategy and infrastructure of their institution, meaning that good quality onsite teaching is possible when not all opportunities for digital teaching are available. However, teaching fully online comes with much higher demands for digital infrastructure and equipment on both teachers’ and students’ sides. As a consequence, previously existing shortcomings in this area may have turned from an inconvenience into a situation that does not allow for teaching and learning at all. Available infrastructure and technical equipment are gatekeepers of students’ academic experiences, making the difference for complete dissatisfaction of students’ psychological needs. Insufficient technological or digital infrastructures hinders or hardens students’ access to learning material, teachers, and fellow students and neither the need for competence, autonomy, nor social relatedness can be met.

Infrastructural, institutional, and organizational environment are a central prerequisite for digital learning (Salier et al., this volume). Its importance during COVID-19 is emphasized by the findings of Aris tovnik et al. (2020), who surveyed more than 30,000 higher education students in 62 countries. It showed that students from infrastructurally underdeveloped countries and rural areas had the worst academic experience during the pandemic. Investigations of the higher education experience in Ghana (Owusu-Fordjour, Koomston, & Hanso, 2020) and in West Bengal, India (Kapadia et al., 2020) illustrate that lacking infrastructure regarding bad or expensive internet connectivity and lack of electricity can be detrimental to a country’s whole higher education system. However, lacking infrastructure may not only be an issue in underdeveloped countries but also in certain areas of countries with generally good infrastructure or in individual higher education institutions. For individual institutions, their general digitalization strategy and infrastructure determines if higher education teachers are able
to afford good quality opportunities for digital learning during the pandemic based on how they are equipped, supported, and trained (Sailer et al., this volume).

Students' digital technology equipment plays an important role as it became vital for learning during the pandemic. Furthermore, not only the need of availability of digital equipment at home, but also the technological requirements may have increased during the pandemic, e. g. as video conferences demand more sophisticated technology than reading a digital document. Aristovnik et al. (2020) found similar results for students' equipment as for infrastructural aspects in their comparison between different parts of the world, i.e. students in underdeveloped countries had less access to adequate digital technology equipment at home. In Oceania and the USA, almost every student had their own computer, while this was the case for only 86% of European higher education students. Additional equipment such as printers and other study material was less available in general. These findings show that social inequality comes into play for digital learning during the pandemic and this may not only be the case between different countries but also within countries.

2.2.2. Teachers' implementation of digital learning

Another central influential factor on students' academic experiences, and consequently students' psychological need satisfaction, during digital learning is how teachers implement digital learning (Sailer et al., this volume). From the student perspective, the type of online learning opportunities teachers afford and workload resulting from it seem specifically relevant.

Starting with the type of learning opportunities that teachers afforded during the pandemic, Aristovnik et al. (2020) found that live video conferences were the most prominent and most valued online learning opportunity. Asynchronous online learning opportunities included presentation slides, video recordings, and mere written communication in forums and chats on learning platforms, which most students appreciated.

Regarding students' workload, in a study on more than 1000 German students (Traus, Höffken, Thomas, ) 72% reported a higher workload during summer term 2020 compared to the previous term. A third of them attributed the higher workload to voluntarily taking up additional courses, either because of more flexibility in time, reduction of commuting time, reduction of additional commitments, or because of regular differences in the schedule. Only about 10% reported a reduced workload due to missing courses and additional distractions. Aristovnik et al. (2020) found similar results for Western countries with German students reporting the highest increase in workload. The authors attribute this to lecturers' unfamiliarity with online teaching that may have led to an overload of study material and tasks for their students. At the same time, Aristovnik et al. (2020) state that specifically undergraduate students had problems focusing on their studies due to lacking self-regulated learning skills.

2.2.3. Students' skills and use of digital learning opportunities

For online learning, students' skills and abilities to make effective use of afforded learning opportunities by engaging in beneficial learning activities is even more important than for onsite learning (Sailer et al., this volume). Especially self-regulation skills in relation to time management and basic digital skills seem important. In addition, there are certain types of learning activities that are considered more or less beneficial.

While self-regulated learning and related skills are studied widely, there seem to be no specific data available about students' self-regulation in relation to learning during the pandemic. Regarding basic digital skills, Aristovnik et al. (2020) asked for students' confidence in these skills, which they rated on average as good to medium, with the lowest confidence in using specific web conference tools.

Both skills seem relevant for students to engage in effective online learning activities. According to the ICAP- framework (Chi, 2009), learning activities in which students engage in interactive discourse with others is most beneficial, followed by constructive learning activities, i. e. activities that require students own engagement in the creation of complex problem solving processes or generation of new material. Active learning activities are even less beneficial activities and require that students actively engage with learning material, which is followed by the learning activity with the lowest effectiveness, passive consumption of learning material.

2.3. Research questions

Based on the outlined theoretical and empirical findings, we conclude that looking at three levels of digital learning in higher education is essential in understanding students' experiences of emergency online teaching during the semester: different infrastructural, institutional, and organizational aspects of the academic environment, teachers' implementation of digital learning, and students' skills and use of digital learning opportunities. How factors on these three levels are characterized defines whether students can experience satisfying levels of competence, autonomy, and social relatedness. Regarding these experiences, it seems essential that higher education students feel that their basic psychological needs are satisfied in order to foster beneficial identity development as a higher education student as well as study satisfaction, and, eventually, prevent drop-out. Especially first-year students are vulnerable if their needs are not met on some of these three levels related to digital learning during emergency online teaching but research targeting specific and individual experiences of this student group is still lacking. To come to an adequate understanding of individual students' experiences of emergency online teaching, taking students' need satisfaction in the academic environment prior to emergency online teaching seems crucial. Consequently, we investigate the following four questions in this study.

1) How did first year students' experiences differ based on their need satisfaction in the academic environment prior to emergency online teaching?
2) How did the infrastructural, institutional, and organizational environment during emergency online teaching affect the satisfaction of first year students' needs for autonomy, competence, and social relatedness?
3) How did higher education teachers' implementation of digital learning during emergency online teaching affect the satisfaction of first year students' needs for autonomy, competence, and social relatedness?
4) How did first year students' skills and use of learning opportunities during emergency online teaching affect the satisfaction of their needs for autonomy, competence, and social relatedness?

3. Method

In order to gain in-depths insights into students' experiences, a qualitative study based on semi-structured, problem-centered interviews was conducted. The study focuses on experiences of second semester students in bachelor chemistry programs at German universities. Chemistry programs were chosen as they are already associated with high drop-out rates under normal conditions (45% in the 2018 cohort of graduates according to Heubel & Schmelzer, 2019). The curriculum is characterized by a high workload and large lectures as the central form of teaching and, therefore, a challenging context for students' integration on the academic and social level. Another core teaching form are small group practical laboratory experiments, which seem to be especially hard to transfer into an online format. Therefore, we expected that emergency online teaching during the pandemic had a severe influence on these students’ learning experiences.
3.1. Recruitment and participants

15 students who were enrolled in their second semester during summer term 2020 in bachelor of chemistry programs at six different German universities participated in the study. Participants were recruited with the help of local chemistry student associations and study program coordinators, who distributed advertisements for the study via email lists and social media channels. None of the participants was enrolled at the same university as the authors of the paper and the authors did not know the participants before. Participants received a monetary compensation. Prior to the interview, they received concrete information about the procedure of the study and gave their informed consent. In addition, they filled in a questionnaire asking for their demographics, including a six-item scale that measured students’ study related self-efficacy at the end of their second semester (adapted from Abele, Stief, & Andrä, 2000). Participant demographics are shown in Table 1.

3.2. Interview

Semi-structured interviews were conducted in August and September 2020, the time of summer break in German universities. However, for chemistry students, this is usually the time for participating in time-consuming practical laboratory courses and for writing exams. During this time, the number of COVID-19 cases had dropped and there were no lock-down orders anymore in Germany, allowing universities to conduct exams and laboratory experiments on campus under strict health protection restrictions. Accordingly, individual appointments for the interviews were arranged to accommodate participants’ schedules. One of the authors, who had received previous training and was experienced in conducting this kind of interview, conducted the interviews via Zoom. Each took about an hour and was audiotaped. An interview guideline consisting of two parts was developed and used so that all participants were asked for particular aspects of their experiences and comparability was ensured. The first part focused on students’ experiences during their first semester that had taken place before COVID-19 (October 2019 to February 2020). The second one focused specifically on experiences during the second semester during COVID-19 from April 2020 to July 2020. This paper concentrates on the second part of the interview (see the guideline questions in appendix 1).

3.3. Data analysis

At first, the interviews were transcribed verbatim. After that, the two parts were analyzed separately as follows. The first part of the interviews was used together with the previously filled in questionnaires to identify student subgroups based on students’ experiences during their first (regular onsite) semester. In a first step, a fact sheet of each student was created that summarizes their background and first semester experience based on the essential categories demographics, social relatedness during the first semester, experienced competence and self-efficacy during the first semester, learning strategies during the first semester, and additional study-related aspects (expectations toward the first-semester and reasons for studying in a B.A. chemistry program). To put the fact sheets together, three further steps were taken. First, one of the authors read each interview thoroughly and checked if all relevant aspects were present in the key points and if he agreed with the listed key points. In the final step, the author and the student assistant discussed and dissolved discrepancies and the author adjusted the fact-sheets accordingly. The fact sheets of the individual students were then compared and grouped together based on similarities and dissimilarities by one of the authors. Both authors discussed and finally agreed on the grouping.

For the second part of the interview, that centers on experiences during the second (emergency online teaching) semester, qualitative content analysis according to Mayring (2019) was conducted in a two-step process. First, these parts of the interviews were selected for further analysis that were relevant for answering the research question. In order to do so, a broad category system based on components of the C-flat model and a complementary coding guide were developed in an iterative process. With an initial category system, the first author coded six interviews by assigning parts of the interview texts to categories, using the software MAXQDA. At the same time, category descriptions were refined and coding rules were added to the coding guide. Also, further categories were added to the initial category system when new relevant aspects emerged from the interviews. This led to the final version of the system and a detailed coding guide. Afterwards, the first and second author discussed the category system and coding manual and the second author also coded the first three interviews. The coders compared their results, resolved conflicts and extended the coding guide where necessary. The described procedure was repeated in two more rounds until no adjustments to the manual were needed anymore and the second coder coded the remaining interviews. The resulting categories based on the C-flat model are described in the results section.

In a second step, the text parts within the individual categories were further analyzed with focus on the three basic psychological needs. The two coders summarized individually emerging themes within the different categories, then discussed their results until they reached

### Table 1

Participant demographics.

| Participant | Gender | Age | self-efficacy | Country of birth | Parents born in Germany | mother’s highest professional qualification | father’s highest professional qualification |
|-------------|--------|-----|---------------|-------------------|------------------------|--------------------------------------------|------------------------------------------|
| YWA1        | male   | 20  | 4,8           | Germany           | both                   | university degree                          | university degree                        |
| YWA2        | male   | 19  | 4,5           | Germany           | both                   | master craftsman’s diploma                 | vocational training                      |
| YWA3        | male   | 19  | 5             | Germany           | one of them            | vocational training                        | university degree                        |
| YWA4        | female | 20  | 4,5           | Germany           | both                   | vocational training                        | vocational training                      |
| YWA5        | female | 21  | 2,8           | Germany           | both                   | polytechnic degree                         | polytechnic degree                       |
| ES1         | female | 29  | 4,6           | /                 | /                      | /                                          | /                                        |
| ES2         | female | 22  | 4             | Germany           | both                   | vocational training                        | vocational training                      |
| ES3         | male   | 22  | 4,2           | Germany           | both                   | vocational training                        | polytechnic degree                       |
| SP1         | female | 22  | 4             | Germany           | /                      | vocational training                        | vocational training                      |
| SP2         | female | 21  | 3,3           | Germany           | both                   | vocational training                        | vocational training                      |
| SP3         | male   | 20  | 4,3           | Indonesia         | one of them            | /                                          | /                                        |
| HR1         | female | 19  | 3,2           | Germany           | one of them            | vocational training                        | university degree                        |
| HR2         | male   | 20  | 3,7           | Germany           | both                   | vocational training                        | vocational training                      |
| IS1         | female | 19  | 3,5           | Vietnam           | no                     | none                                       | none                                     |
| IS2         | female | 23  | 4,2           | Mongolia          | no                     | university degree                          | university degree                        |

Note.  
* Student self-efficacy was measured at the end of their second semester. The possible values range from 1 (very low self-efficacy) to 5 (very high self-efficacy).
agreement. Subsequently, the found themes were compared between the student groups identified in the analysis of the first part of the interview. The results of thematic analysis on need satisfaction is reported within the categories in the results section.

4. Results

In this section, the subgroups of students that were identified in the study will first be described. They reflect under which conditions students started into their second semester with emergency online teaching due to COVID-19. These conditions are related to students’ experiences regarding basic psychological need satisfaction in their first (regular onsite) semester as Chemistry students. After introducing the subgroups, a detailed look into students’ experiences during the second semester with emergency online-teaching will be taken. The findings based on the Cl-model can be structured into three levels of students’ experiences: (1) infrastructural, institutional, and organizational academic environment, (2) teachers’ implementation of digital learning, and (3) students’ skills and use of learning opportunities. On each level, students’ general experiences, relations to students’ need satisfaction, and to what extent the student subgroups’ experiences differed or were similar will be described.

4.1. Student subgroups based on experiences during the first (regular onsite) semester

Looking at how students depicted their experiences during their first (regular onsite) semester, all of them reported experiences of stress and failure to some extent, as the higher education setting and the social environment was new to them and on the academic level more demanding regarding the amount and density of content to be learnt. Nevertheless, all students managed academic and social integration in some degree and continued their studies in the second semester. However, students differed noticeable in how their need for competence and social relatedness was met and how they responded to the quite demanding regarding the amount and density of content to be learnt. Even, students’ need for competence, relations to students’ need satisfaction, and to what extent the student subgroups’ experiences differed or were similar will be described.

(a) young and well-adjusted students includes four students (two females, three males), who were aged 19 or 21 and had started the Chemistry B.A. program right after receiving their high school diploma (Abitur). All of them reported to be intrinsically motivated due to long-term interest in science, most have been interested in chemistry for many years. None of these students reported drop-out intentions or severe struggles during the first semester and all remember it mostly in a positive way. These students’ need for competence was well met during the first semester as all of them reported to be satisfied with their academic performance. They passed all exams with average to very good grades. Nevertheless, they perceived the exam preparations as challenging and some were even anxious about certain tests. Regarding social relatedness, all of the students perceived their family chemistry students as helpful and were satisfied with their relationships. All had found some acquaintances (ranging from one to twelve) and some even good friends. Some were part of a study group, others not. Regarding their strategies of managing the autonomous learning situation in higher education, they reported to have found quite effective strategies and were even able to solve content-related problems sufficiently.

(b) experienced and structured students, includes three students (two females, one male), with an age range between 22 and 28. These students had received vocational training as laboratory chemists before entering the bachelor program. They had a strong interest in science and chemistry, but also wanted to improve their career opportunities, especially regarding leadership positions. None of these students had drop-out intentions or had struggled severely. They reported that they had accurately expected the high workload and struggles. Consequently, they approached their studies in a very structured and strategic way. Regarding their need for competence, they were all satisfied with their academic performance and had passed exams with good or very good grades, despite being a bit afraid, specifically regarding exams about subjects not directly related to chemistry such as mathematics and physics. Regarding social relatedness, these students perceived the other students as helpful but were very strategic and selective regarding their social relationships. All of them were part of a regular study group with two to six students and were satisfied with their relationships. These group of students also handled the autonomous learning situation very strategically.

The third subgroup struggling but positive students consists of three students (two females, one male) with an age range between 20 and 22. One of them had previously received vocational training in another area. These students were highly intrinsically motivated and interested in science and chemistry, however, they had experienced their first semester as quite stressful and one of them was thinking about dropping out. Nevertheless, all three were convinced that they did not want to give up because of their great interest in chemistry. Regarding their need for competence, these students were, to some extent, satisfied with their academic performance but struggled to manage the workload and exams. Specifically, they reported problems such as their own or parents’ high standards, self-doubts, fear of failure, or lack of a financial support network to cope with a possible loss of state support in case of repeated failure in exams. Regarding social relatedness, one of them was not well connected to other students as the study group had dissolved during the first semester, one was satisfied with three study friends but not part of a study group and one was part of a study group. Students with self-organization and conscientiousness in the autonomous learning situation were reported in this group.

The fourth subgroup are high risk students and includes two students (one female, one male) aged 19 and 20, who entered the study program right after receiving their high school diploma and were highly intrinsically motivated. These students reported severe struggles during the first semester but only one mentioned drop-out intentions. Regarding their need for competence, both reported to not be satisfied with their academic performance. They were not able to manage the high workload and fully understand the learning content. Both got in social contact with supportive fellow students but did not spend time with them apart from study-related activities. In this group, the response to the autonomous learning situation was quite different from other groups and reflects inadequate self-regulation skills: One student neglected all other activities besides studying during the first semester, did not take breaks, meet friends, or sleep enough and reported severe signs of burn-out. The other student underestimated the need for structured learning in the beginning of the first semester, then struggled with concentrating, and reported severe signs of procrastination.

The fifth subgroup includes two international students from Asia (both female), aged 19 and 23. Both were highly intrinsically motivated to learn chemistry and to increase their career opportunities. Both experienced struggles during the first semester and considered dropping out. Regarding their need for competence, academic learning and passing exams was not a problem. However, both struggled severely with practical laboratory training and related exams and experienced the requirements as an academic culture shock. Also, both reported language problems as well as difficulties following German conversations. Regarding social relatedness, both had found few social contacts and were not satisfied with the quality of their social relations. Getting in contact with fellow German students was challenging for them and both emphasized their desire for more local social contacts. In respect of students’ management of the autonomous learning situation, both international students reported having effective learning strategies.
4.2. Students’ experiences during their second (emergency online teaching) semester

4.2.1. Infrastructural, institutional, and organizational academic environment

Four core themes emerged from interview analysis regarding infrastructural, institutional, and organization aspects of the academic environment during emergency online teaching: digital technology equipment, internet connection, ceased commute between home and campus, and the concurrence of learning and home space with a specific emphasis on the role of university libraries.

Despite the changed demands for learning during the COVID-19 pandemic, most students felt that their digital technology equipment was sufficient. All of them had a laptop, tablet, or a desktop computer, some even had several of these devices and in addition a smartphone. A few students had to purchase a webcam, but no expensive new digital technology equipment was needed. However, some students mentioned that tablets with digital pens seemed very helpful, e.g. for taking notes, for writing down and transmitting chemical and mathematical formula quickly, or for creating “handwritten” homework that was required by lecturers. Having a tablet was, therefore, not essential but not having one seemed to be a disadvantage. In summary, digital technology equipment was not perceived a strong factor for satisfaction or dissatisfaction of students’ needs as the essential digital technology equipment was available to all of them.

Internet connection, in contrast, was a severe problem for some of the students. Students who experienced problems with their internet connection found this to be a source for dissatisfaction of all three basic psychological needs. Lacking internet connection caused restricted access to learning opportunities and social interaction, therefore having impact on experiences of competence and social relatedness. In addition, students with connectivity problems had to specifically allocate time for downloads, which could also mean transitioning to another place with better connectivity. Consequently, students’ autonomy was severely affected as well if they experienced problems with connectivity. Regarding teachers’ internet connection and server issues (e.g. related to video conference software), only few problems were mentioned. In general, students did not experience severe connectivity issues on the institutional side and did not perceive it as particularly problematic or relevant to their need satisfaction, in contrast to individual connectivity issues.

The ceased commute between home and campus was an important aspect for many students in their experience of the emergency online teaching situation. As many students reported to have a quite long commute with up to 2 h one way, the ceased commute was welcomed greatly by them and perceived as an increase in autonomy. It freed time for other activities, especially for sleeping, as sleep deprivation had been an issue for the long-commuters during the regular onsite semester. Other benefits were that commuters were able to engage in more and higher quality learning activities: On the one hand, commuters would sometimes skip onsite lectures due to tiredness, while the emergency online teaching allowed participation even when students were not fully awake. On the other hand, higher quality learning experiences occurred for individual learning activities that students usually scheduled during the commute in an onsite semester. Those learning activities could now be done in a quiet environment, allowing for better concentration.

The other side of the ceased commute was the concurrence of learning and home space, which allowed for higher degrees of freedom regarding the location and timing of learning. Some students perceived the opportunity to choose their learning location as an increase in autonomy at first as students were able to travel and study from somewhere else than home. However, they noticed that a regular learning space is more desirable as it supports concentration and effective learning. Also when learning from home, learning effectiveness differed quite a lot between individual students and was influenced by the learning space available. Several students mentioned that their preferred learning space was the university library, for individual as well as for collaborative learning. University libraries, on the one hand, provide a quiet learning space with access to learning material and a collective, concentrated atmosphere. On the other hand, university libraries are the usual place to meet with learning partners without having to make specific appointments. Consequently, especially those students who had regularly used libraries as learning spaces were overwhelmed by distractions when learning from home, resulting in reduced experiences of competence during learning. One of the high-risk students, who had already reported problems with concentration when learning from home in the first semester and had preferred learning at the university library, phrased it this way:

“The challenge of the pandemic is that distractions are just a click away. This was the biggest challenge, while at the same time logistics got much easier because I didn’t have to commute by train anymore.”

Some students also suffered from a general lack of variability in spaces during lock-downs and quick breaks of chatting with other students as they usually happen during regular onsite teaching. In addition, the concurrence of learning and home space lead to students not separating between dedicated learning spaces and other spaces anymore, i.e. learning in bed or on couches, as well as not separating between learning times and spare time, even when students knew or noticed at some point that this was detrimental for learning and mental health. In summary, the concurrence of learning and home spaces increased students’ autonomy and required better self-regulation compared to regular onsite semesters. Many students struggled with these heightened demands for self-regulation and had difficulties in coping with the situation. In many cases, this was associated with lower perceptions of competence during learning.

Summing up students infrastructural, institutional, and organizational experiences in relation to need satisfaction during the emergency online semester, we found that digital equipment was not a problem while internet connectivity was, depending on where students lived but not from the side of higher education institutions. The ceased commute between home and campus lead to a positively perceived increase in students’ autonomy. The concurrence of home and learning space, in contrast, increased students’ autonomy in a negative way and the lack of access to university libraries as learning spaces lead to negative experiences regarding competence during learning. The different subgroups based on their experiences of the first semester were not systematically differently affected by infrastructural, institutional, and organizational aspects during emergency online teaching.

4.2.2. Teachers’ implementation of digital learning

On the level of teacher’s implementation of digital learning during emergency online teaching, three themes emerged from interview analysis: availability of courses, workload, and digital learning opportunities afforded by teachers.

Regarding the availability of courses, all students agreed that they were able to take all courses they were supposed to in their second semester during regular onsite teaching. Teachers found ways to either transfer their courses into online versions or used strict health protection regulations in order to run onsite courses. The latter was specifically related to lab experiment courses that form a central part of chemistry education. However, developing procedures to conduct lab experiment courses onsite partly led to a change in students’ schedules as these courses were postponed to semester breaks if they had originally been scheduled weekly within the semester. This change gave many of the students more time during the semester but led to a fuller schedule during the semester break when also exams took place.

Regarding their workload perception during the emergency online teaching semester students reported similar experiences. They perceived this semester as harder and more demanding and invested more of the available time into their studies. This was mostly due to increasing
complexity of the learning content as it would also have been the case during an onsite semester. The pandemic and online learning only added some minor aspects to students’ workload related stress, e.g. when lectures started delayed, when it was hard to find the correct online meeting rooms or when lectures exceeded the regular 90 min or were uploaded later than expected. All of the experienced and structured students used the free time during the semester due to postponed lab experiment courses to take additional courses. One of the international students took additional language courses. To sum up students’ perceived workload, some students reported struggles with feeling competent similarly to the first semester but the online teaching situation did not add significantly to this experience.

Looking at the digital learning opportunities afforded by teachers, students experienced different forms of regular online courses: live webinars, video-recorded lectures, annotated slides, online quizzes and online simulations as replacement for onsite lab experiments. Live webinars were often used for lectures and seminars. In addition, lecturers offered them for answering questions about video-recorded lectures. In some cases, all students watched video-taped lectures simultaneously during a live webinar and could ask questions afterwards. In some seminars, students also got the opportunity to be more active, for example when exercises based on students’ homework solutions were discussed and students presented their solutions. Live-webinars were perceived as supportive in navigating the increased autonomy during the emergency online semester. This was especially mentioned by struggling but positive students. Data protection on the lecturer side was also an issue mentioned, as some lecturers did not want students to record live webinars or save recordings on their devices, even though these kinds of recordings would have been an enormous help for international students, enabling them to listen to the lectures more than once.

Mere video recordings were the second common form of learning opportunities provided by teachers and allowed for more autonomous time distribution on part of the students. However, this increase in autonomy also went along with struggles, as especially struggling but positive students reported problems with handling the autonomy in time-management related to this form of learning opportunities. Most students tried to watch video recordings at the regularly scheduled time and when this was not possible – either due to other obligations on the students’ side or due to lecturers not providing video recordings in time – it usually led to students skipping the respective recordings and not catching up anymore. Students with bad internet connectivity and foreign students, in contrast, appreciated video recordings. International students’ feeling of competence during learning was specifically increased by video recordings because they allowed for stopping and re-watching certain parts of the video and solve language problems. Most students reported liking this feature, as it was in general helpful for understanding complex content. However, quality of these video recordings differed based on software and lecturer. Lower quality video recordings were perceived as exhausting, especially for students who only had access to learning opportunities in form of video recordings and had no live webinars at all. Students also mentioned lacking opportunities for direct interaction with lecturers while watching video-recordings, resulting not only in decreased social relatedness, but also in reduced perception of competence that required further engagement.

Additional forms of online teaching included annotated slides, online quizzes and online simulations of certain lab experiments. However, none of these forms was perceived well by the students. Scheduling learning time with annotated slides as a replacement for onsite lectures was even harder for students than scheduling time for watching video-recordings. Online quizzes were often not perceived as reflecting students’ actual knowledge due to bad design on teachers’ side, resulting in low perceived competence during the quiz. Regarding simulation of lab experiments, teachers seemed not confident in using these programs. In combination with technical difficulties and lack of explanations from teachers, students were not able to understand the purpose of simulations and the tasks they had to accomplish with them, resulting in low experiences of competence with this type of learning opportunity.

Nevertheless, all students were generally quite satisfied with the digital learning opportunities provided by teachers. All courses were available although some re-scheduling was necessary at some universities for lab experiment courses. Workload related struggles were rarely attributed to missing or low-quality learning opportunities. Students appreciated live webinars because they helped in dealing with the increased autonomy in time management but also appreciated video-recordings when they were of good quality and available as scheduled. Alternative types of learning opportunities were rare and less well received. One of the young and well-adjusted students drew the following conclusion:

“When I heard that all courses were supposed to take place online, I felt relieved that they would actually take place because I had been afraid that the second semester would simply be canceled. I had lower expectations compared to what happened in the end. I was surprised how positive this turned out. I thought that some professors would just disappear as I had heard from other universities, but everything went very well. I had definitely expected less.”

4.2.3. Students’ skills and use of learning opportunities

Looking at students’ skills and how they used and created learning opportunities during emergency online teaching, we identified four important themes: time management and self-regulation, basic digital skills, use of learning opportunities (passive, active, constructive, interactive), and skills for maintaining social contacts.

The increased autonomy in structuring learning experiences during emergency online teaching and, therefore, the increased role of students’ time management and self-regulation have already been indicated in previous themes and were also highly emphasized by all students in the interviews. Students were required to make their own schedules, to make sure that they followed their plan even when they perceived the content or learning material as uninteresting, to adjust their schedule and learning strategies when necessary and to make sure that they also take enough breaks. An effective strategy that helped to reduce stress and anxiety was setting up a clear schedule that included watching video-recordings, doing individual exercises, and taking breaks. This schedule should ideally be written, clustering learning tasks thematically and planning and working ahead when students knew that onsite lab experiment courses and other tasks may interrupt the regular schedule. For especially hard tasks or during motivational breakdowns, adjusting the schedule according to own interest, taking (more) breaks, doing sports, including pleasures into the day such as a piece of chocolate and communicating with other students were helpful.

It became clear that the trends of the first semester continued and students in subgroups who had reported good self-regulation skills had fewer or no problems during emergency online teaching compared to students who had already struggled with learning during the first semester. Young and well-adjusted students and experienced and structured students described that they were able to handle the increased autonomy well despite the additional struggles and were consequently able to feel competent during learning. However, they often lacked additional study motivation through aspects of social relatedness that usually come naturally during onsite teaching.

Students who showed lower self-regulated learning skills in the first semester also struggled more with time management and self-regulation during the emergency online semester. Some of the struggling but positive students reported that they realized they needed to change specific aspects in their learning behavior drastically, such as switching from just going with the flow to actively structuring their own learning behavior or switching from surface learning based on memorization to deep learning based on understanding. High-risk students also continued to struggle severely but did not find ways to cope with the increased autonomy. They did not actively and concretely make plans for their
learning but were very reactive to interruptions. Consequently, students continued to use ineffective learning strategies – unplanned non-stop learning without any breaks or ends leading to overwhelming breakdowns and procrastination for one high-risk student and unfocused learning that easily got distracted by things more pleasant than studying for the other high-risk student. Consequently, these students did not experience themselves as competent in the learning situation but as constantly stressed and repeatedly failing.

**Students’ basic digital skills or their lack, as a second central student skill for successful digital learning, were not often mentioned in the interviews. Only two students (a young and well-adjusted student and a foreign student) mentioned that they would like to learn more about specific programs or applications. Therefore, students’ basic digital skills seemed not to be a big issue regarding students’ need satisfaction during the emergency online semester.**

Looking at how students used and created learning activities, it became clear that lecturers rarely encouraged learning activities beyond passive engagement with learning material. However, as students reported that this was not different during onsite teaching, they were not surprised and were used to creating their own, more active learning activities. Only few students reported that they had solely relied on passive learning activities during emergency online teaching. Passive learning activities included watching video-recordings or listening to lectures on live textbooks.

Most students, however, engaged in more active learning activities. Note taking while watching or listening to lectures was a very common learning strategy among the students. Video recorded lectures even allowed for more and better note taking than lectures in the onsite semester, specifically for international students:

“Sometimes I thought that it is even better than in the first semester because I was able to understand the lectures much better, what professors and lecturers were explaining, so I was able to take notes. During the first semester I rarely took notes about what lecturers explained because I didn’t have time and didn’t understand it clearly. I like that very much. And when I attend a lecture online, there is only me, my laptop and no disturbances, so I can focus better.”

As a further active learning strategy, students mentioned that they did complementary internet research for additional sources.

Regarding constructive learning activities, solving complex exercises and comparing the results to a sample solution is typical for chemistry in higher education and a basic element of many courses. Chemistry teachers translated this learning opportunity into online formats as well. During the emergency online semester students were able to solve more exercises on their own than in a regular one. However, one of the high-risk students reported her struggle with this constructive learning opportunity:

“I sat down with this exercise and told myself: ‘Okay, just try it.’ And I completed one or two exercises but then I wasn’t able to focus any longer and something else happened. I just can’t focus at home.”

The biggest differences between students’ learning activities are on the interactive level when working on exercises, as students can decide on their own whether they want to do it individually or interactively with other students. Here, striking differences were found. Some of the young and well-adjusted students and all experienced and organized students organized interactive discussions around exercises and study groups via video-conferences or telephone whereas only one of the experienced and structured students reported that she and her learning group watched lectures simultaneously and digitally discussed it at the same time, similarly to an onsite lecture. All other students struggled in initiating interactive learning activities. Although social media groups and Moodle forums existed and were used for asking questions, students did only engage little in such groups and did not initiate video conferences or phone calls and many even hesitated to send private messages to fellow students or teachers. Only around exams, when students were allowed to come to campus or meet in small groups, they engaged in face-to-face interactions.

Only few learning opportunities provided by teachers allowed for interaction between students, such as chatting during live webinars or group work in lab experiments. In summary, when students could handle the increased autonomy of the emergency online semester, they usually were able to experience competence during learning and engaged in active and constructive learning opportunities. Only few students, however, managed to initiate interactive learning opportunities and, consequently, most of the others lacked social relatedness.

We find similar results for students’ skills for maintaining social contacts during emergency online teaching. Most students reported that they had fewer social contacts or even felt completely isolated compared to their first onsite semester. However, most students were able to maintain their social relations with a few close friends, while a few others were even able deepen their friendships. When students did not have such close friends or when these friends had dropped out after the first semester, this led to isolation. Students were not able to initiate new contacts via digital channels and to find ways for maintaining more superficial and group contacts as these are usually based on random encounters on campus. Although general social media channels were set up for and by students, these channels were used for organizational or content related questions only. Motivational and emotional support were neither given nor received through those channels. Specifically, students missed quick chats during breaks, during times of low motivation, or when they were unable to understand aspects of their lectures, as such quick social encounters could help reduce stress. This concerned especially struggling but positive students who had relied on social support for regulating their motivation to learn during their first semester. New contacts were only initiated when face to face meetings were possible, e.g. during lab experiment courses or after onsite exams. Such occasions for face to face meeting increased the number of superficial and group contacts again. Consequently, most students reported a significantly reduced social relatedness during emergency online teaching.

5. Discussion

In this paper, we explored individual students’ perspectives on the sudden shift from their onsite study program to emergency online teaching and aimed at contributing insights about first-year students’ experiences and coping strategies during the sudden change. We found that students’ prerequisites, especially regarding their need satisfaction during the onsite semester prior to emergency online teaching, were relevant for understanding students’ need satisfaction and coping during emergency online teaching. Five distinct groups of students could be identified.

The results show that students’ experiences during emergency online teaching are tied to contextual factors for learning activities involving technology in higher education on three levels. On the infrastructural, institutional, and organizational level, we identified two causes for dissatisfaction of students’ basic psychological needs. Lacking internet connectivity restricted students access to all opportunities for satisfying study related basic psychological needs and the concurrence of learning and home spaces, specifically the loss of university libraries as learning spaces, lead to problems in satisfying students need for competence and social relatedness. The ceased commute between campus and home, in contrast, increased students’ perception of autonomy, as it freed time for other activities. Digital technology equipment turned out to not be a relevant factor for students’ need satisfaction. On the level of teacher’s implementation of digital learning during emergency online teaching, the factors availability of courses and workload during emergency online teaching were not peculiarly related to students’ basic psychological
need satisfaction. A third factor, the form of digital learning opportunities afforded by teachers, in contrast, showed differentiated relations: Video-conferences helped students in coping with increased autonomy, while video-recordings supported international students’ perception of competence; other forms of digital learning opportunities were rather related to dissatisfaction in students’ perception of manageable autonomy and competence. On the third level of students’ skills and how they used and created learning opportunities during emergency online teaching, time management and self-regulation skills emerged as gatekeepers for satisfying all three basic psychological needs. The initiation of interactive learning opportunities and skills for maintaining social contacts were crucial for satisfying students’ needs for social relatedness. In contrast, basic digital skills and use of passive, active, and constructive learning opportunities were not specifically related to students’ basic need satisfaction as all study participants possessed them in a sufficient way.

5.1. The role of contextual facilitators during emergency online teaching for students’ need satisfaction

The results of this study show that the combination of the C-flat model (Sailler et al., this volume) with basic psychological need derived from self-determination theory (Deci & Ryan, 2000) provides a helpful lens for understanding students’ experiences during emergency online teaching. The different levels of contextual facilitators allow to take proximal as well as distal aspects into account that are relevant for gaining comprehensive insights into digital learning in the higher education context. Although this study only takes some aspects that are visible from the student perspective of the C-flat model into account, it is one of the first to apply this model in an empirical setting and provides evidence that this model is promising for guiding future research. However, as the C-flat model focusses on cognitive and merely academic aspects of learning, the addition of the motivational perspective provided by the basic psychological needs theory adds an important component. However, the nature of the results shows that basic psychological needs cannot just be added as an additional factor to the C-flat model but that they are intertwined on all levels. Future research needs to explore if the combination of these two models can also successfully and fruitfully be applied in other study settings that go beyond this case study.

Next, the specific results and their implications on the three levels of contextual facilitators for learning activities, involving technology in higher education, will be discussed. Starting with the infrastructural, institutional and organizational level, the importance of internet connectivity for students’ need satisfaction is in line with the findings of Aristovnik et al. (2020). Our study shows that although European countries generally have relatively good internet infrastructure, individual students – depending on their specific local condition – can be severely affected. Consequently, the development of internet infrastructure is a severe issue that needs to be addressed on the political level. Our results also emphasize the importance of public/university spaces for individual and collaborative learning for students, specifically university libraries. Although students possess digital technology devices that can be used anywhere, academic learning seems to be strongly supported by habitual, dedicated quiet learning spaces. Having such spaces that are also shared with other learners and distinct from home spaces seems to be optimal. Consequently, creating and maintaining such spaces needs to be a priority, not only during emergency online teaching, but also during regular onsite teaching. The third factor, students’ digital technology equipment, was not a strong factor in our study. However, this very likely does not reflect students’ general situation but is rather an effect of our sample, as the study was advertised as looking for interview partners in a web conference and may, consequently, not have attracted students without the necessary digital technology equipment. Similar to the role of internet connection, lacking digital technology equipment has been found to be a gatekeeper during emergency online learning (Aristovnik et al., 2020) and representative studies are needed to deduce to what extent this factor needs to be addressed on the university level and beyond to create fair access to learning opportunities for all students. The positive role of the ceased commute between home and campus as the fourth important aspect on this level of contextual facilitators during emergency online learning also needs further attention. The positive affect was mostly related to more autonomy in prioritizing sleep, with sufficient sleep quantity being an important factor for mental health, wellbeing, learning success, and general need satisfaction in students (e.g. Campbell, Soenens, Beyers, & Vansteenkiste, 2018). Consequently, it seems highly relevant to explore ways for maintaining this positive aspect of emergency online teaching for regular onsite teaching, e.g. by continuing to provide video recorded lectures, even when these lectures take place onsite, as students highly value video recorded lectures for several reasons (Cardall, Krupat, & Ulrich, 2008).

On the level of teacher’s implementation of digital learning during emergency online teaching, the form of learning opportunities provided was a central factor. Among our cases, that is far from representative, students reported that most teachers had provided learning opportunities of similar quality during emergency online teaching compared to onsite teaching, indicating teachers’ willingness and ability to successfully translate onsite formats into online formats. As discussed before, many students appreciated video recordings but live-webinars as replacements for regular scheduled onsite lectures were favored by most. This indicates that a regular schedule for teaching and learning in a real or at least virtual social setting is an important component for students’ motivation and helps reduce self-regulation problems caused by increased autonomy during the online semester. This effect is not a surprising finding and has been repeatedly found in research on e-learning, blended learning, MOOCs, and related research (e.g. Feng, Tang, & Liu, 2019). Other teaching formats, however, were less appreciated by students which may be caused by teachers’ inexperience in using complex alternative teaching approaches. However, specifically simulation based learning has already been implemented in a beneficial and motivating way in first year chemistry programs (Schwedler & Kaldewey, 2020) and also methods of computer-supported collaborative learning, that help students to maintain social contacts among each other during physical distancing and foster high quality interactive learning processes. This finding points to the need for raising awareness and providing further education for university teachers on successful implementation of state-of-the-art digital teaching methods. Additional factors on this level of contextual facilitators, specifically availability of courses and workload, were not perceived as different from regular onsite teaching in our cases. However, the situation looks differently in representative studies worldwide (Aristovnik et al., 2020) and to some extent also in Germany (Traus et al., 2020) and may individually vary between different universities and subjects.

On the third level of contextual facilitators, students’ skills and how they used and created learning opportunities during emergency online teaching, we found that students’ self-regulation skills are crucial. This is not a new finding, as previous studies on self-regulated learning have pointed out it’s importance for success in higher education (e.g. Huie, Wimsler, & Kitsantas, 2014). The need for supporting students in acquiring necessary self-regulation and specifically time-management skills, has, accordingly, been indicated before and is supported by our study, especially during emergency online teaching. Also, students’ social skills need to be supported and trained to enable them to engage in beneficial interactive learning activities on the one hand, but also to initiating and maintaining social contacts for motivational and emotional support. The latter has rarely been addressed so far but are especially relevant when students struggle already and cannot sufficiently regulate problems on their own. Basic digital skills and skills to engage in productive passive, active, and constructive learning activities, in contrast, were not addressed as problematic among the cases in this study. Representative studies are, however, needed to investigate if there are groups of students that also need support in these skills.
5.2. Different experiences of sub-groups of first-year students based on prior need satisfaction

The second contribution of this study is the identification of five different groups of students regarding their prerequisites for the sudden change to emergency online teaching during the pandemic. On the one hand, two groups were relatively resilient towards these changes: young and well-adjusted students and experienced and structured students. For these two groups, phases of need dissatisfaction seemed relatively harmless as they showed good coping strategies. On the other hand, there were three groups, that seemed more vulnerable to temporary lack of need support in the higher education environment: students, who had struggled during their first semester but were still positive about continuing their studies, high-risk students with tendencies for burn-out or severe procrastination and foreign students dealing with language problems. These students’ problems increased during emergency online teaching and may lead to drop-out if students fail to cope well or do not receive support. The identification of these groups shows that individual students were affected differently by emergency online teaching, demanding for individualized support. The results of our case study cannot be seen as exhaustive, meaning that quantitative studies with larger sample may identify even more or different relevant groups to be addressed. Nevertheless, a person-centered approach to understanding students’ experiences during emergency online teaching seems helpful for creating specific support measures. The five groups identified here may be taken for creating hypotheses about relevant student profiles.

5.3. Conclusion

In this paper, we explored how first-year students experienced emergency online teaching and aimed at understanding individual experiences related to basic psychological need satisfaction, considering different levels of contextual facilitators for learning activities involving technology in higher education. The results show that lacking internet connectivity and concurrence of learning and home spaces affected students negatively, while students experienced ceased commute between home and campus as a positive effect. Teachers’ implementation of digital learning opportunities was perceived as adequate. However, students a partly overwhelming increase in autonomy during emergency online teaching and a decrease in social relatedness, which were insufficiently addressed by teachers. This pointed out the relevance of students’ self-regulation skills as well as skills to initiate and maintain social contacts for interactive learning activities and for motivational support. Many students were not able to cope appropriately with these requirements and students’ need satisfaction in the academic context prior to emergency online teaching revealed a trend for students’ need satisfaction during emergency online teaching. We identified five groups of students, with two being relatively resilient and three being vulnerable to the disruptions of regular onsite teaching. These results demand for further research that explores quantitatively the relevance of the identified challenges of emergency online teaching in the larger student population and employs person-centered approaches for investigating the role and development of students’ basic psychological needs satisfaction for study success and drop-out in higher education.

Author contributions

Julia Eberle: Conceptualization; Data curation; Formal analysis; Funding acquisition; Methodology; Project administration; Supervision; Roles/Writing - original draft; Writing - review & editing. Joyce Hobrecht: Conceptualization; Data curation; Formal analysis; Investigation; Project administration; Roles/Writing - original draft; Writing - review & editing.

Declaration of competing interest

None.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.chb.2021.106804.

References

Abele, A. E., Stief, M., & Andra, M. S. (2000). Zur ökonomischen Erfassung beruflicher Selbstverwirklichungserwartungen – neukonstruktion einer BSW-Skal. Zeitschrift Für Arbeits- Und Organisationspsychologie, 44(3), 145–151. https://doi.org/10.1023/A:00024089.443.145
Aristovnik, A., Keržič, D., Ravlić, D., Tomazević, N., & Umek, L. (2020). Impacts of the COVID-19 pandemic on life of higher education students: A global perspective. Sustainability, 12(20), 8438. https://doi.org/10.3390/su12208438
Campbell, R., Sonnen, B., Beyer, W., & Vansteenkiste, M. (2018). University students’ sleep during an exam period: The role of basic psychological needs and stress. Motivation and Emotion, 42(5), 671–681. https://doi.org/10.1007/s11031-018-9699-x
Cao, W., Fang, Z., Hou, G., Han, M., Xu, X., Dong, J., et al. (2020). The psychological impact of the COVID-19 epidemic on college students in China. Psychiatry Research, 287, 112934. https://doi.org/10.1016/j.psychres.2020.112934
Cardall, S., Krupat, E., & Ulrich, M. (2008). Live lecture versus video-recorded lecture: Are students voting with their feet? Academic medicine. Journal of the Association of American Medical Colleges, 83(12), 1174–1178. https://doi.org/10.1097/ACM.0b013e3181b69902
Chi, M. T. H. (2009). Active-constructive-interactive: A conceptual framework for differentiating learning activities. Topics in Cognitive Science, 1(1), 73–105. https://doi.org/10.1111/j.1756-8765.2008.01005.x
Deci, E. L., & Ryan, R. M. (2012). Multiple identities within a single self. In M. R. Leary, & J. P. Tangney (Eds.), Handbook of self and identity (pp. 225–246). New York: Guilford Press,
Duong, V., Pham, P., Yang, T., Wang, Y., & Luo, J. (2020). The ivory tower lost: How college students respond differently than the general public to the COVID-19 pandemic. Retrieved from https://arxiv.org/pdf/2004.09968.
Feng, W., Tang, J., & Liu, T. X. (2019). Understanding dropouts in MOOCs. Proceedings of the AAAI Conference on Artificial Intelligence, 33(1), 517–524.
Heubelín, U., & Schmelzer, R. (2018). Die Entwicklung der Studienabbruchquoten an den deutschen Hochschulen: Berechnungen auf Basis des Absolventenjahrgangs 2016. Hannover: DZHW-Projekbericht.
Huie, F. C., Winsler, A., & Kitamatas, A. (2014). Employment and first-year college achievement: The role of self-regulation and motivation. Journal of Education and Work, 27(1), 110–135. https://doi.org/10.1080/13639802.2012.718746
Jeno, L. M., Danielsen, A. G., & Raaheim, A. (2018). A prospective investigation of students’ academic achievement and dropout in higher education: A self-determination theory approach. Educational Psychology, 38(9), 1163–1184. https://doi.org/10.1080/01443410.2018.1502412
Kapasias, N., Paul, P., Roy, A., Saha, J., Zaveri, A., Mallick, R., … Chouhan, P. (2020). Impact of lockdown on learning status of undergraduate and postgraduate students during COVID-19 pandemic in West Bengal, India. Children and Youth Services Review, 116, 105194. https://doi.org/10.1016/j.childyouth.2020.105194
Luyckx, K., Vansteenkiste, M., Goossens, L., & Duriez, B. (2009). Basic need satisfaction and identity formation: Bridging self determination theory and process-oriented identity research. Journal of Counseling Psychology, 56(2), 276–288. https://doi.org/10.1037/a0015349
Marinoni, G., van’t Land, H., & Jensen, T. (2020). The impact of COVID-19 on higher education around the world. IAU global survey report (France).
Mayring, P. (2019). Qualitative content analysis: Demarcation, varieties, developments. *Forum for Qualitative Social Research, 20*(3). https://doi.org/10.17169/fqs-20.3.3343

Owusu-Fordjour, C., Koomston, C. K., & Hanson, D. (2020). The impact of COVID 19 on learning - the perspective of the Ghanaian student. *European Journal of Education Studies, 7*(3), 88–100. https://doi.org/10.5281/zenodo.3753586

Reason, R. D. (2009). An examination of persistence research through the lens of a comprehensive conceptual framework. *Journal of College Student Development, 50*(6), 659–682.

Sailer, M., Schulz-Pernice, F., & Fischer, F. (this volume). Contextual facilitators for learning activities involving technology in higher education: The C♭-model.

Schwedler, S., & Kaldewey, M. (2020). Linking the submicroscopic and symbolic level in physical chemistry: How voluntary simulation-based learning activities foster first-year university students’ conceptual understanding. *Chemistry Education: Research and Practice, 21*(4), 1132–1147. https://doi.org/10.1039/C9RP00211A

Tinto, V. (2006). Research and practice of student retention: What next? *Journal of College Student Retention, 8*(1), 1–19.

Torres, V., Jones, S. R., & Renn, K. A. (2009). Identity development theories in student affairs: Origins, current status, and new approaches. *Journal of College Student Development, 50*(6), 577–596. https://doi.org/10.1353/csd.0.0102

Traus, A., Höffken, K., Thomas, S., Mangold, K., & Schroer, W. (2020). *StudiCo. – studieren digital in zeiten von Corona.* Hildesheim. https://doi.org/10.18442/150

Vansteenkiste, M., Ryan, R. M., & Soenens, B. (2020). Basic psychological need theory: Advancements, critical themes, and future directions. *Motivation and Emotion, 44*(1), 1–31. https://doi.org/10.1007/s11031-019-09818-1