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**Digital Learning in Time of COVID-19**  
**A Systematic Review and Meta-Analysis of Distance**  
**Learning at Universities and Schools**

**MASTER'S THESIS**

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# Abstract

Due to the COVID-19 Pandemic, which started in Austria in March 2020, schools and universities suddenly had to switch from face-to-face to distance learning. This change posed unprecedented challenges for all involved. Since then, there have been many different surveys at universities as well as at schools in Austria, which show how students fared during the changeover and in the following months during the lockdowns. This thesis is a meta-study and literature review in which studies at universities and schools are presented and compared with each other. Differences and similarities are analyzed and connections are shown. In total, 127 studies are presented in this master thesis on the topics of advantages and disadvantages of distance learning, examinations at universities, social life and communication, technical infrastructure, methods and tools used, learning during distance learning and digital learning in the future. Furthermore, there is a chapter for schools and a chapter for universities, which show what is essential for good e-learning on the basis of the knowledge gained.

Despite the many challenges such as lack of communication, poor internet connection, too many different platforms used, lack of motivation, lack of technical equipment and too much work, the students were also able to describe some positive aspects. The school children often saw the increased digital competences and the improved independence as an advantage. The university students often described the flexibility, the time savings due to the lack of travel time and the availability of online videos as positive aspects. For the future, university students in particular would like to see parts of online teaching, such as lecture recordings, remain. Digital elements will also be increasingly used in schools in the future.

At a closer look at the advantages and disadvantages, it was found that there were many similarities but also differences. Often the same aspects were seen as an advantage as well as a disadvantage. Furthermore, there were differences between the different types of universities in Austria. On some topics, universities of applied sciences performed better than universities. In the studies at schools, it was shown that there are differences depending on the age of the students.

At the end of this paper, the study is compared with meta-studies and literature reviews from other countries and the most important differences and similarities are shown. This comparison shows that the situation around distance learning in other countries was very similar to that in Austria. Students, pupils, parents and teachers in other countries also had experiences with the majority of the advantages and disadvantages mentioned in this paper. The studies showed that lack of technical equipment and poor internet con-

nection were widespread problems. Especially in countries with poor infrastructure, this was frequently described.

# Kurzfassung

Durch die COVID-19 Pandemie, die im März 2020 in Österreich begann, mussten Schulen und Universitäten plötzlich von Präsenz- auf Distanzlehre wechseln. Dieser Umstieg stellte alle beteiligten Personen vor bisher unbekannte Herausforderungen. Seither gab es viele verschiedene Umfragen an Universitäten sowie an Schulen in Österreich die aufzeigen wie es den Schüler:innen und Studierenden während des Umstiegs und in den nachfolgenden Monaten, in den weiteren Lockdowns, ergangen ist. Diese Arbeit stellt eine Metastudie dar, in der einerseits Studien an Universitäten und andererseits Studien an Schulen vorgestellt und miteinander verglichen werden. Unterschiede und Gemeinsamkeiten werden analysiert und Zusammenhänge werden aufgezeigt. Insgesamt werden in dieser Masterarbeit 127 Studien zu den Themen Vor- und Nachteile der Distanzlehre, Prüfungen an Universitäten, soziales Leben und Kommunikation, technische Infrastruktur, verwendete Methoden und Tools, Lernen während der Distanzlehre und digitales Lernen in der Zukunft dargestellt. Des Weiteren, gibt es für Schulen und Universitäten je ein Kapitel, das anhand der gewonnenen Kenntnisse aufzeigt, was für gutes e-learning essenziell ist.

Trotz der vielen Herausforderungen wie mangelnder Kommunikation, schlechter Internetverbindung, zu vieler verwendeter Tools, fehlender Motivation, fehlende technische Equipment und zu viel Arbeitsaufwand, konnten die Schüler:innen und Studierenden auch einige positive Aspekte beschreiben. Als Vorteil wurde auf Seiten der Schüler:innen häufig die gesteigerten digitalen Kompetenzen und die verbesserte Selbstständigkeit gesehen. Die Studierenden beschreiben häufig die Flexibilität, die Zeitersparnis durch die fehlende Anfahrtszeit und die Verfügbarkeit von Online-Videos als positive Aspekte. Für die Zukunft wünschen sich vor allem Studierende, dass Teile der Online-Lehre, wie zum Beispiel Vorlesungsaufzeichnungen, erhalten bleiben. An Schulen werden ebenso digitale Elemente auch in Zukunft vermehrt Verwendung finden.

Bei den Vor- und Nachteilen wurde häufig festgestellt, dass es viele Gemeinsamkeiten aber auch Unterschiede gibt. Oftmals wurden die gleichen Aspekte als Vor- sowie als Nachteil gesehen. Des Weiteren gab es Unterschiede zwischen den verschiedenen Arten von Universitäten in Österreich. Bei einigen Themen schnitten Fachhochschulen besser als ab als Universitäten. Bei den Studien an Schulen wurde aufgezeigt, dass es Unterschiede abhängig vom Alter der Schüler:innen gibt.

Am Ende dieser Arbeit wird die erstellte Studie mit Metastudien aus anderen Ländern verglichen und es werden ebenso die wichtigsten Unterschiede und Gemeinsamkeiten

aufgezeigt. Dieser Vergleich zeigt, dass die Situation rund um das Distance Learning in anderen Ländern sehr ähnlich war wie in Österreich. Mit dem Großteil, der in dieser Arbeit genannten Vor- und Nachteile, machten auch die Studierenden, Schüler:innen, Eltern und Lehrer:innen in anderen Ländern Erfahrungen. Die Studien zeigten, dass fehlendes technisches Equipment und eine schlechte Internetverbindung weit verbreitete Probleme waren. Vor allem in Ländern mit schlechterer Infrastruktur wurde dies häufig beschrieben.

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# List of Acronyms and Symbols

AHS	Allgemeinbildende Höhere Schule - Lower and Upper Secondary School
BHS	Berufsbildende Höhere Schule - Upper Secondary School
LMS	Learning Management System
ECTS	European Credit Transfer and Accumulation System - 1 ECTS = Work of 25 Hours
WS	Winter Semester
SS	Summer Semester

# 1 Introduction

Due to the COVID-19 pandemic, operations at universities had to be suspended shortly after the start of the summer semester in 2020. The government of Austria announced the closure of all universities on March 16. By then, all universities had to switch to distance learning, some of them had already closed before this date. The universities had to immediately develop contingency plans and switch to distance learning. Later on, on-site examinations could again take place, but only under very strict rules and hygiene regulations. Classes, except labs, were held online only for the entire semester at most of the universities.

The schools were also closed several times during the COVID-19 pandemic and the pupils had to study at home. The lecturers, students, pupils and teachers were suddenly and unforeseeable confronted with distance learning. The first school closure in particular was very sudden and, therefore, a great challenge for the students, teachers and parents.

Some lectures at universities were cancelled or shifted and many were converted to distance learning. At Austrian schools the entire operation was converted to distance education. While some teachers were very open for new methods, others were intimidated by them or had too little experience and knowledge of how to use them. It was a very hard situation for students, they had no interaction with their classmates and not everyone had suitable technical equipment and a working place at home. The situation was especially hard to manage for parents whose children were still in elementary school. Most of them had a job and had to teach and help their children at home.

Every school and university handled the situation slightly different. The experiences of teachers, students and lecturers during distance learning in the COVID-19 pandemic was subject of many surveys at different schools and universities. The aim of this thesis is to analyze these studies and compare it with each other. This paper answers the following question:

“How have students experienced distance learning in Austria and what are the similarities and differences?”

## 1.1 Motivation

The COVID-19 pandemic affected almost everyone in Austria, but especially schoolchildren and students. I was also strongly affected by the sudden closures of the universities.

We were no longer allowed to attend lectures and exams at the university. Lectures were canceled, seminars postponed and some courses were switched to online. The most formative memory for me was in a language subject at Graz University of Technology. Learning a new language requires a lot of oral communication, but from one day to the next this subject was only taught through a book. Assignments had to be completed and handed in. No live lessons were offered for this subject and I learned much less than the year before. In addition, in other subjects the exam situation was unclear and some seminars were simply cancelled. I also got to know the situation at schools through my nieces. Distance learning worked rather poorly for them. Because of my own experiences, it is even more interesting to research and analyze how other students and pupils fared during the COVID-19 pandemic.

## 1.2 Method

This thesis compares 127 different surveys from universities (n=59) and schools (n=68) in Austria. All surveys were retrieved from online sources and were searched using the following German key words:

- “Distance learning Universitäten Umfragen”
- “Distance learning Universitäten Studien”
- “Home schooling Umfragen”
- “Distance learning Umfragen schulen”
- “Distance learning Umfragen nms”
- “Distance learning Befragungen”
- “Distance learning surveys”
- “distance learning umfragen covid-19”

The homepages of Austrian universities were also searched for surveys. The detailed process of identification and selection can be viewed in figure 1.1. Duplicates and surveys conducted before 2020 were removed and only surveys with respondents from Austrian universities and schools were selected. Surveys with results from different countries without differentiation are not included. Furthermore, only surveys in which distance learning was the main topic are included. After the literature research, the surveys were categorised and sorted by type of university or school. The surveys were then analyzed and compared by topic and the figures were generated using Microsoft Excel<sup>1</sup> and Flourish<sup>2</sup>.

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<sup>1</sup><https://www.microsoft.com/de-at/microsoft-365/excel>

<sup>2</sup><https://flourish.studio/>

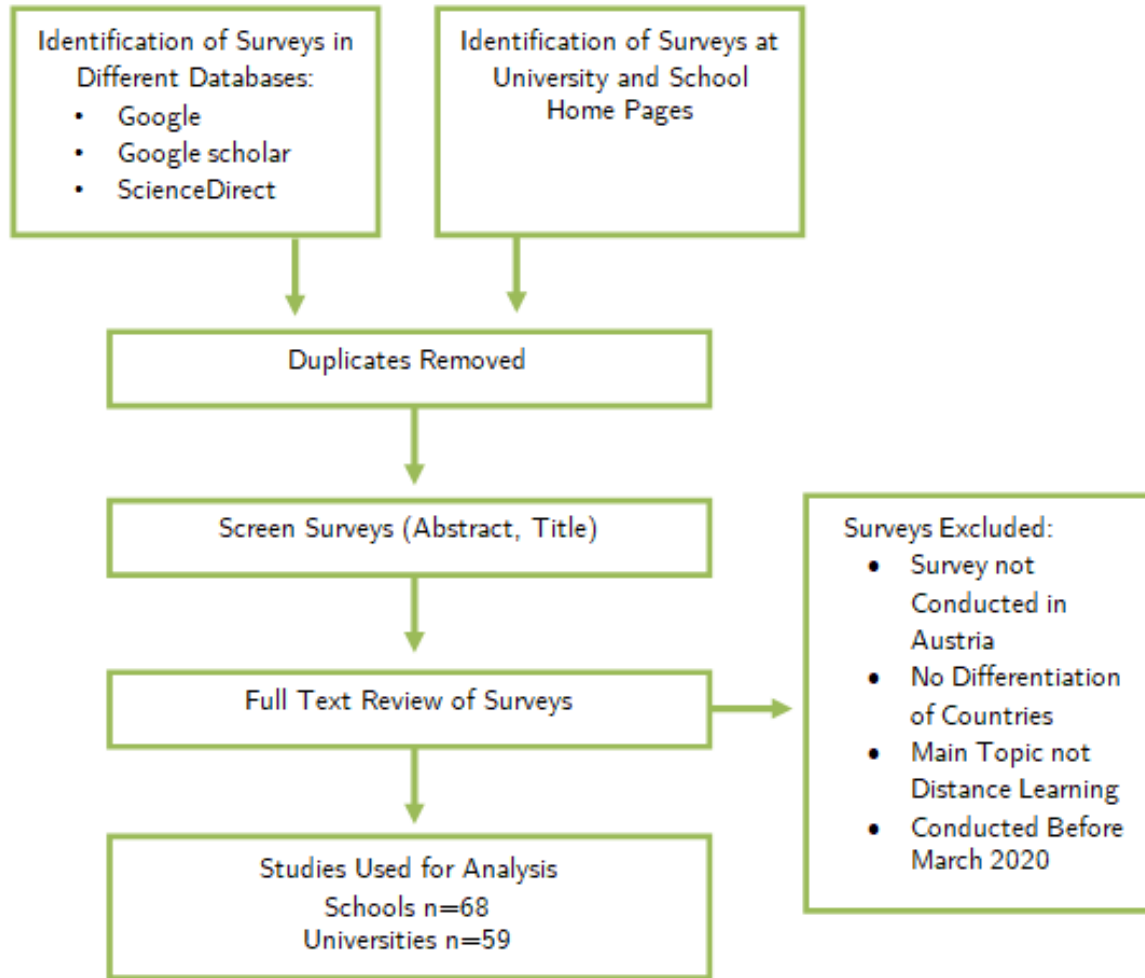


Figure 1.1: Flowchart with the process of identification and selection of surveys, according to PRISMA (Moher et al., 2010)

In the fourth chapter “Digital learning in Austria vs. other countries” 15 different meta-analyses from different countries were conducted to compare it with the meta-analysis from this work. The studies were retrieved from online sources and were identified using German and English search strings:

- “meta analysis distance education corona”
- “schools meta analysis covid”
- “meta analysis online learning covid”
- “covid 19 distance learning meta analysis”
- “systematic review distance learning covid”

Duplicates and meta-analyses conducted before 2020 or analyses that included surveys conducted before 2020 were removed. Only English references were used and only analyses from other countries than Austria were included. The comparison contains only reviews and analyses which were open source or were available with the network of the Graz University of Technology. Furthermore, only surveys with distance learning as the main topic were included. Figure 1.2 shows the detailed process of identification and selection of papers. After the literature search, the surveys were analysed and compared with the meta-analysis from this paper.

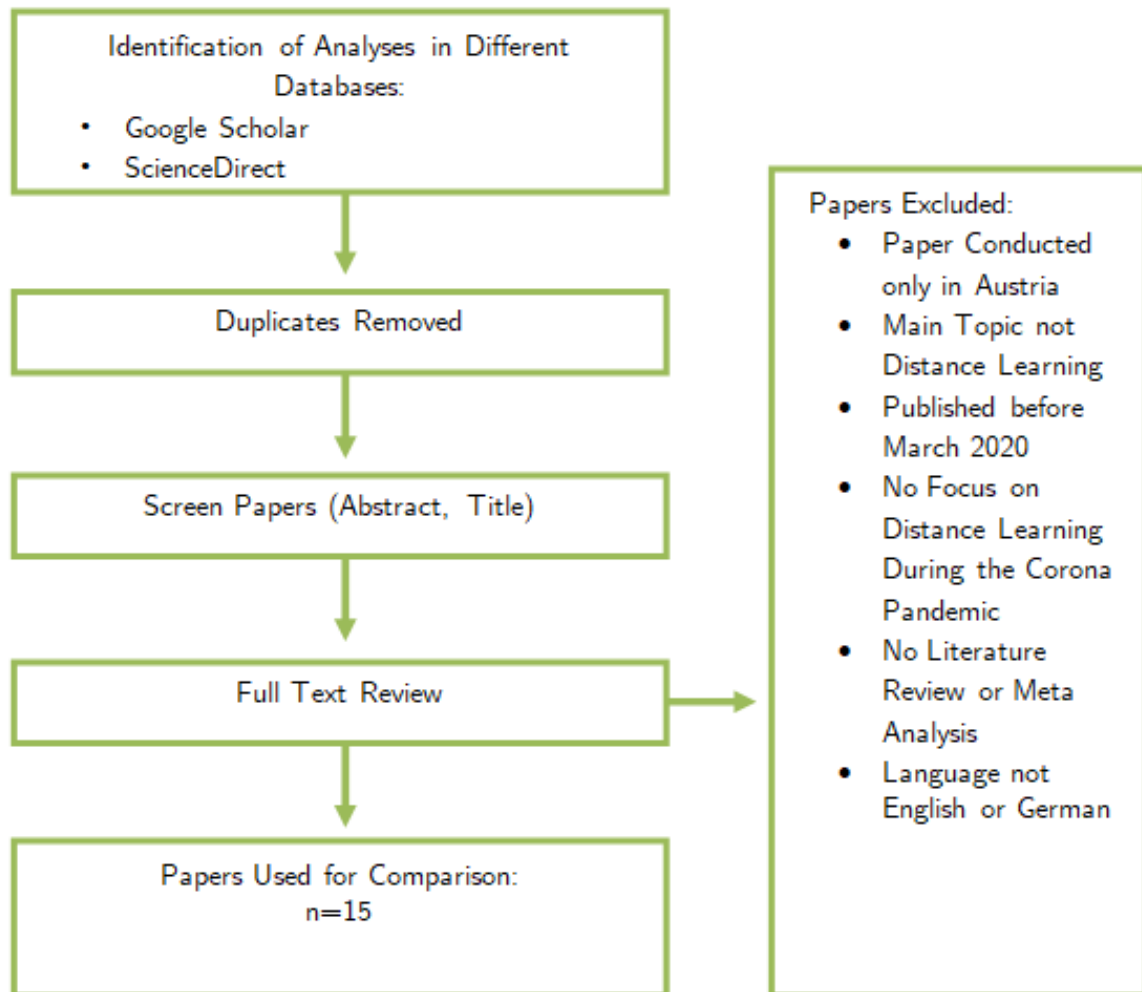


Figure 1.2: Flowchart with the Process of Identification and Selection of Meta Analyses and Literature Reviews, according to PRISMA (Moher et al., 2010)



## 1.3 Structure of Work

The work is structured into five main chapters. Following the introduction the master thesis starts with a chapter about the situation during the distance learning at universities. It analyzed 59 different studies about e-learning at universities in Austria. First, the meta data of the studies are described, then the advantages and disadvantages are discussed and some of these points are discussed in more detail. Chapter three focuses on pupils at schools in Austria. 68 studies are analyzed and it starts also with the advantages and disadvantages of distance learning in schools. Furthermore, it discusses the situation for disadvantaged children and some other challenges such as communication, technical infrastructure and teaching methods. The fourth chapter compares the situation of students in Austria with 15 meta analyses and literature reviews from other geographic locations. This chapter describes the commonalities and differences of students in Austria and other countries all over the world. The last chapter is a conclusion of the written master thesis.

## 2 Situation at Universities in Austria during COVID-19

This chapter describes the situation of digital teaching and learning at public universities, private universities, universities of applied sciences and university colleges of teacher education. A total of 59 surveys are compared and similarities and differences identified. Many surveys were carried out by the universities themselves and by the Austrian Student Union (Österreichische Hochschülerinnen- und Hochschülerschaft). In total, excluding those surveys that included students from different institutions, the surveys come from 25 different institutions. Several surveys were conducted at the same institution. In table 2.1 the 25 institutions are shown. Additionally, eleven surveys were conducted at multiple institutions. Frequently, especially at universities, surveys were often conducted in different programs at the same university.

<b>Institution</b>	<b>Surveys</b>	<b>Institution</b>	<b>Surveys</b>
Graz University of Technology	2	University of Applied Sciences Joanneum	2
Vienna University of Technology	2	University of Applied Sciences Burgenland	1
University of Vienna	5	University of Applied Sciences Upper Austria	1
University of Graz	6	University of Applied Sciences Vienna	1
Johannes Kepler University Linz	7	University of Applied Sciences Technikum Wien	1
University of Salzburg	2	University of Applied Sciences CAMPUS 02	1
University of Innsbruck	3	University of Applied Sciences Wiener Neustadt	1
Vienna University of Economics and Business	2	University of Applied Sciences BFI Vienna	1
University of Natural Resources and Social Science	1	University of Applied Sciences Kufstein	1
Music and Arts University of the City of Vienna	1	University of Applied Sciences Krems	1

University of Christian Teacher Education Vienna/Krems	College of Churches Education	2	University Teacher Education Carinthia	College of Education	1
University Teacher Education Lower Austria	College of Education	1	University Teacher Education Styria	College of Education	1
University Teacher Education Vienna	College of Education	1	Mix of Institutions		11

Table 2.1: Overview of Different Institutions (n=59)

As shown in figure 2.1, most of the surveys were made at public or private universities. 19% of the surveys were from different types of higher education institutions. In addition, 19% of the surveys were conducted at universities of applied sciences. The fewest surveys come from university colleges of teacher education (10%).

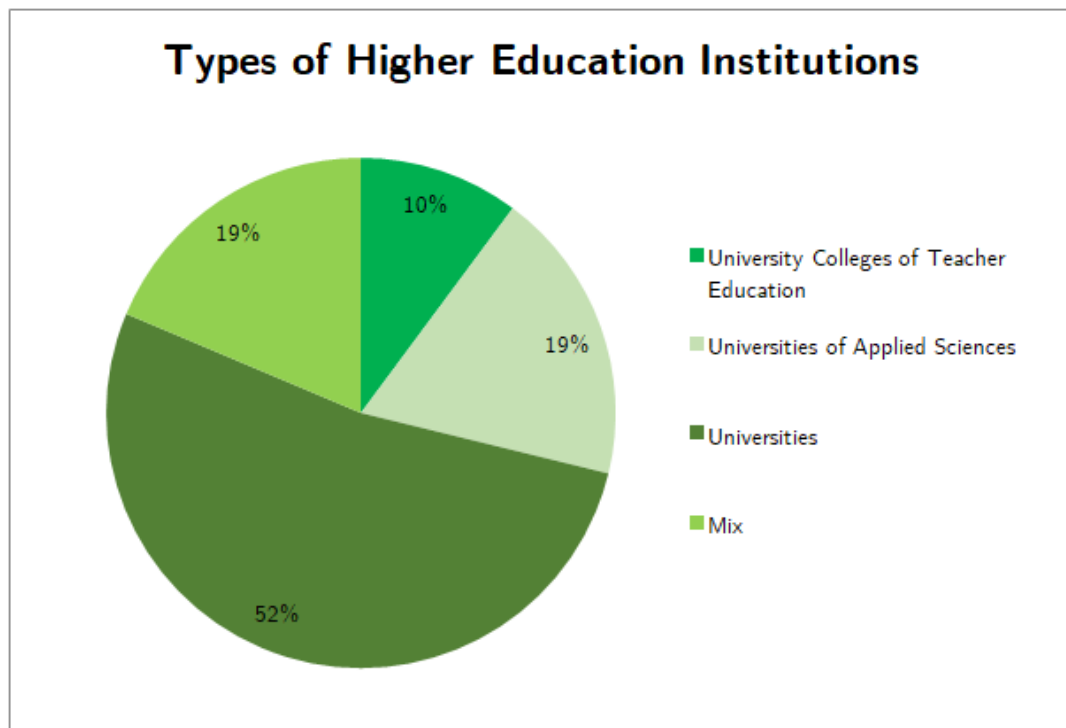


Figure 2.1: Distribution of Types of Higher Education Institutions (n=59)

Table 2.2 shows the main topics of the surveys. It shows that the general situation was part of almost every survey. Furthermore, methods, disadvantages, communication and tools were content of almost half of the surveys. Figure 2.2 is a network graphic which shows the connection of the topics.

Main Topic	Number of Surveys
General Situation	48
Disadvantages	33
Communication	32
Methods	30
Tools	27
Workload	26
Future	23
Advantages	22
Exams	20
Equipment	18
Psychological Issues	17
Teachers	12
Study Delay	11
Working Place	5
Financial	4
Digital Skills	2
Technical Issues	2
Distraction	1
Disadvantaged Students	1

Table 2.2: Overview of Main Topics (n=59)

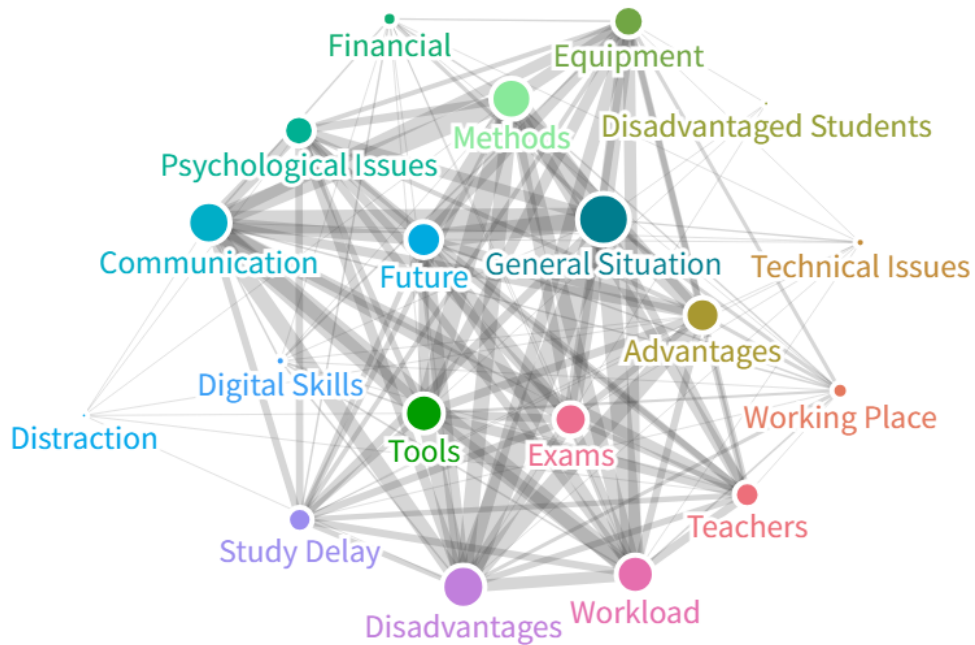


Figure 2.2: Main Topics of University Surveys (n=59)

As shown in figure 2.3 the majority of the surveys (92%) were quantitative studies (questionnaires) and there were also five qualitative studies (interviews). Most of the surveys were conducted at universities with a large number of students and especially at the beginning of the pandemic, a quick overview of the overall situation was needed. It is therefore understandable that there are almost only quantitative surveys.

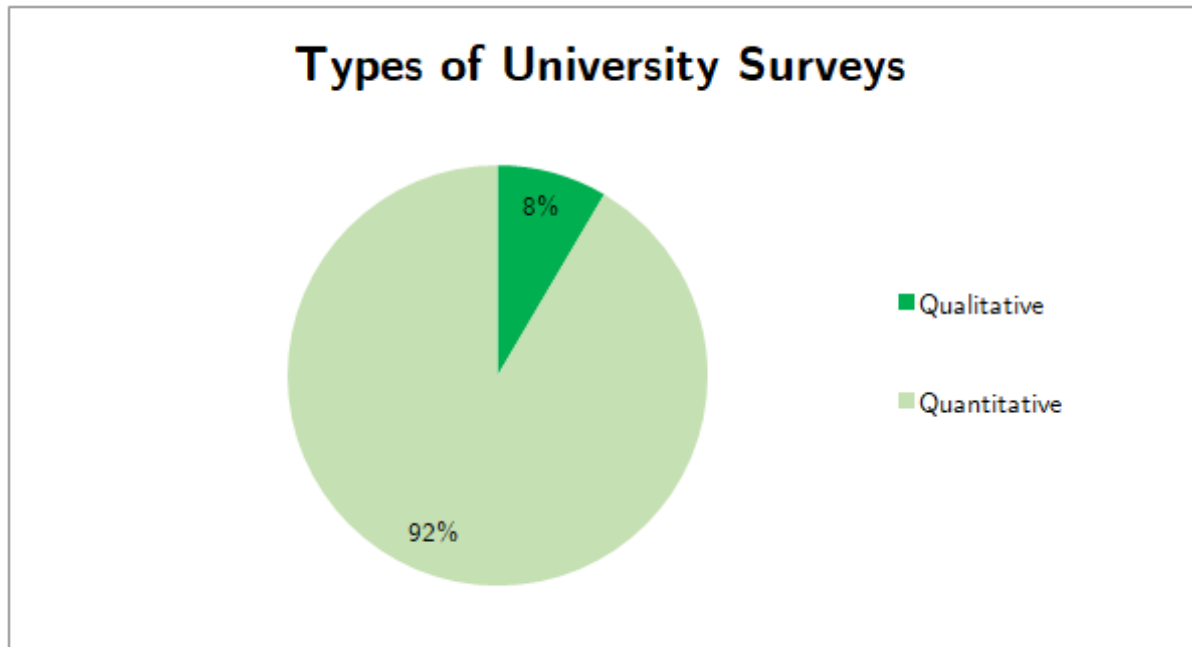


Figure 2.3: Distribution of Survey Types (n=59)

As shown in figure 2.4, in 10% of the surveys there was no indication of how many students took part in the survey, and 10% have between zero and 100 participants. Most surveys have between 100 and 500 participants. Surveys with more than 3000 participants (12% of the surveys) were only carried out at large universities or with students from all over Austria. 21% asked between 100 and 2000 students about their experiences with distance learning and 15% had between 500 and 1000 participants.

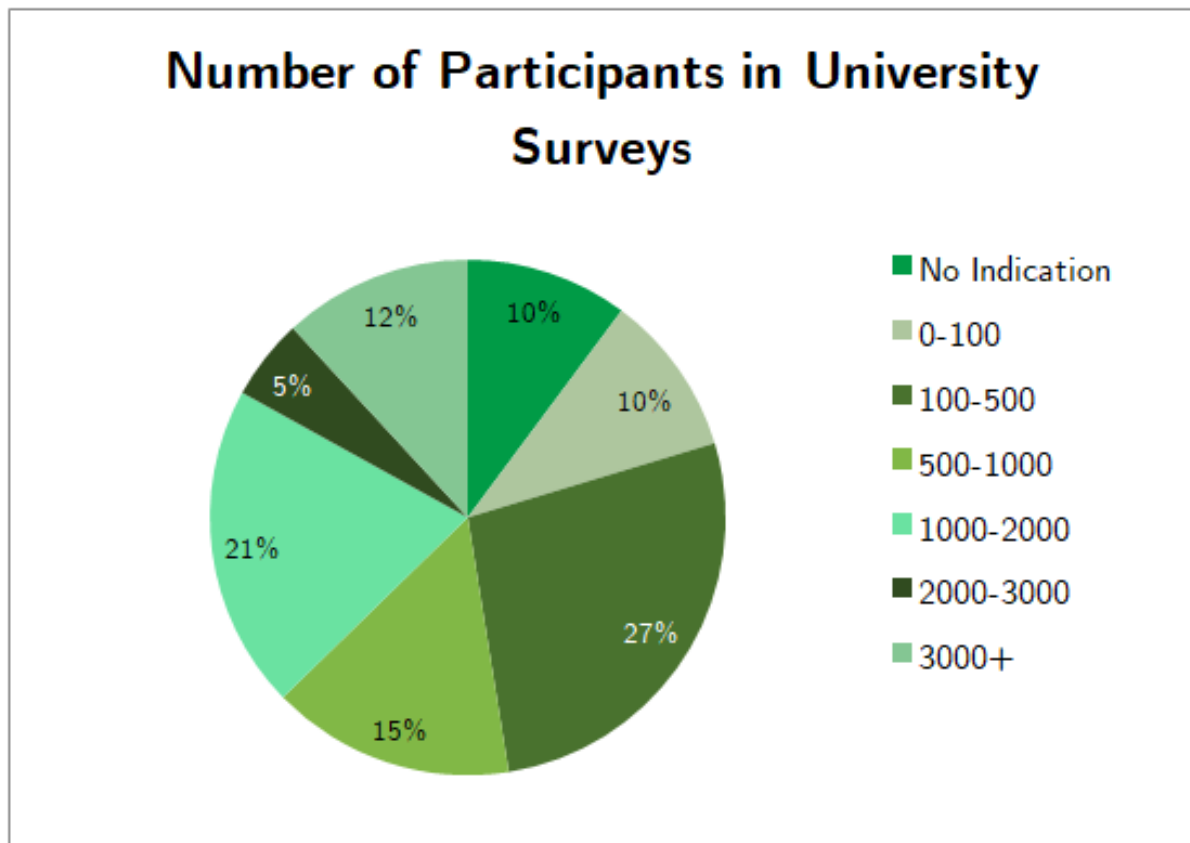


Figure 2.4: Overview about the Distribution of Participants in the University Surveys (n=59)

As figure 2.5 and 2.6 show, the surveys were conducted between March 2020 and October 2021. (For surveys collected over several months, the last month is displayed. For surveys where only the semester was specified, the last month of the respective semester is used.) It is not surprising that three quarters of all surveys took place in the summer semester of 2020, as the pandemic began in that semester. Most surveys were conducted in April, May and June 2020, as it was important for universities to know how students experienced the change and what needed to be improved, especially at the start of the pandemic. 14% were conducted in the winter term 2020/2021. After this semester, not many surveys were conducted. In five surveys there was no indication about the survey date.

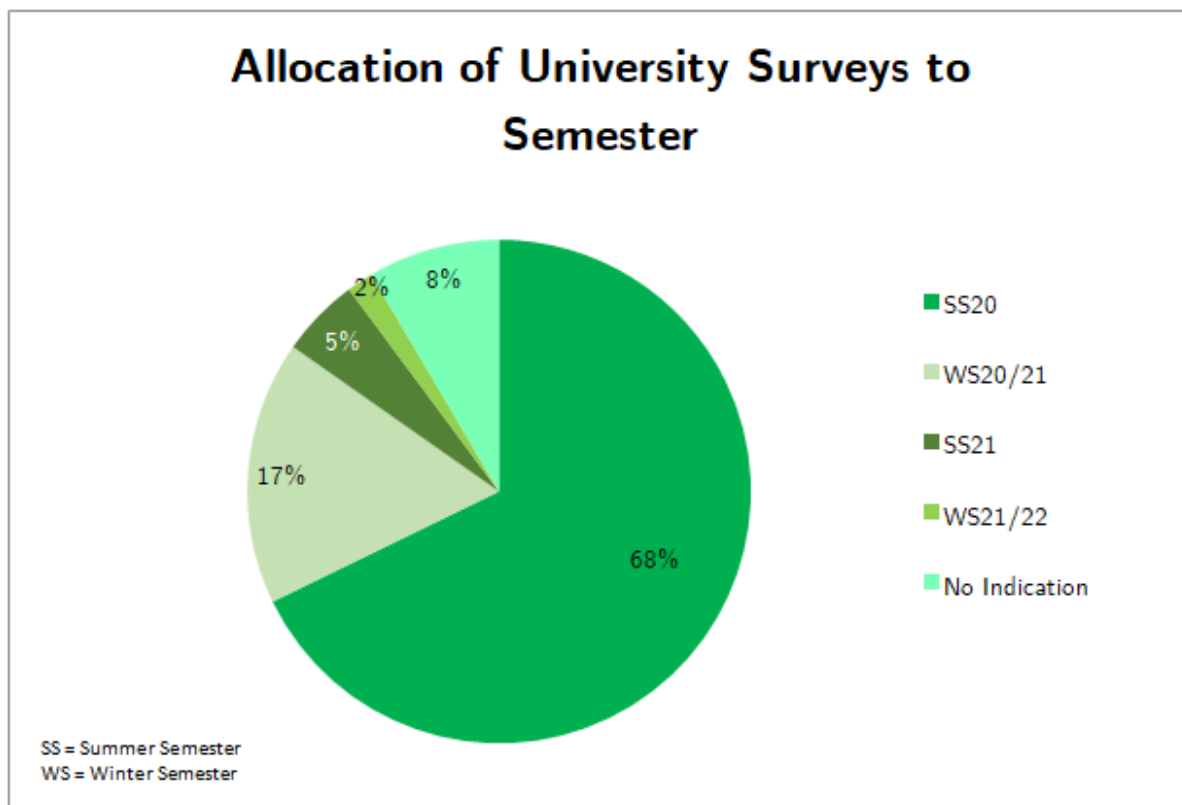


Figure 2.5: Allocation of the Semesters when the Surveys were Conducted (n=59)

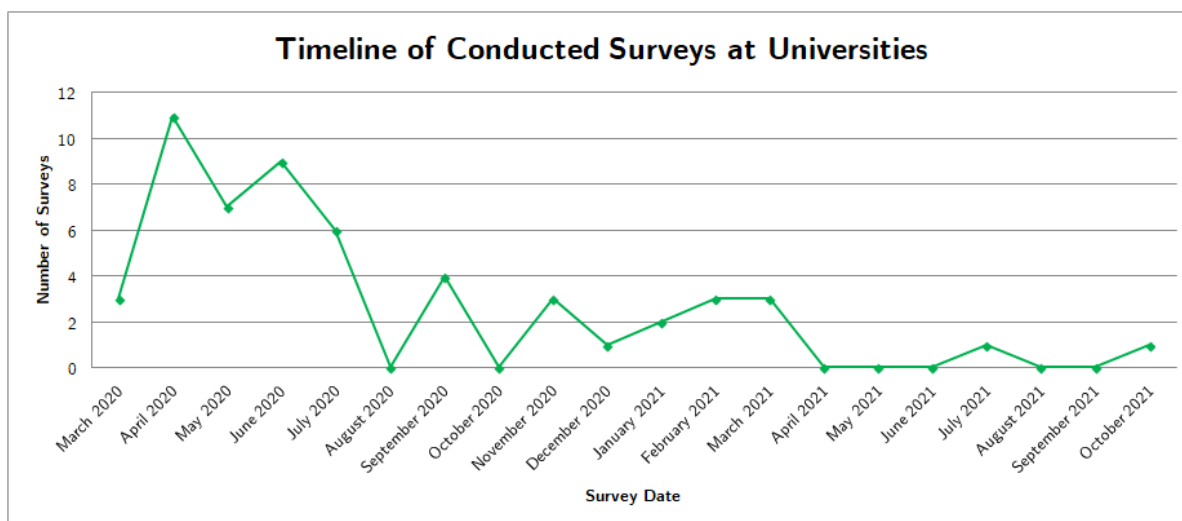


Figure 2.6: Timeline of Data Collection (n=54)

## 2.1 General Situation and Experiences During the Transition to Online Teaching

The COVID-19 pandemic came very suddenly and universities, teachers and students were unprepared for the rapid transition to distance learning. Especially in the first weeks after the announcement of the closure of the universities, there were many difficulties for all parties involved. The sudden change caused a lot of chaos and uncertainty among the students. No one really knew what to do next and there were many unanswered questions. When can exams be taken? When can students go back to university? Will there be classes? Will the semester even continue? These questions were just a small selection of the many uncertainties. The first section of this paper looks at how students experienced this switch and how they fared in general. (Prietl, 2021)

After the shift to distance learning, lack of planning was a problem for many students. They also wanted more information from the government about the COVID-19 regulations and more information from the teachers about the exam regulations. (Schober et al., 2020a, 2020e) The switch in the first lockdown was very challenging for the students and also for the teachers. In the second lockdown, the change was much easier for them, but it was still a big challenge. (Boyer and Preis, 2021)

It was difficult to change a course with a lot of practical work, such as labs or internships, to distance learning. (Prietl, 2021; Weinzettl and Koglbauer, 2021) Labs could not be held at all at first and it was unclear to students how to proceed. It took a long time until they announced when universities would reopen. Experiments were often run online in an abbreviated form, so students learned less than normally. They were described as chaotic and hectic, and stopping these exercises caused a delay in learning. (Prietl, 2021)

In general, satisfaction with the transition depended very much on the course. The biggest problem was the lack of communication and information shortly after the university closed. Some lecturers found a way to respond quickly, others did not contact students for weeks. (Prietl, 2021) A study of various students in Austria showed that more than 60% rated the transition as good. More than 30% gave it a bad rating. More than 30% said that the online offer had not changed or hardly changed. 20% were even of the opinion that the online offer had deteriorated since the outbreak of the COVID-19 pandemic. (Hajek and Kernecker, 2020) In addition, the COVID-19 pandemic was a major burden on everyday university life for many students. (Hajek and Siegl, 2021) These numbers show that many lectures were not well adapted to the online format. Since communication with lecturers and feedback from lecturers were also rated poorly by roughly the same number of students in this survey, it is obvious that there is a connection. Good communication is one of the characteristics of good teaching practice. (Schön et al., 2020)

Many students reported that the new teaching methods worked well (Schön et al., 2020;



ÖH Universität Salzburg, 2020; ÖH TNF JKU, 2020; Schober et al., 2021b; Pfeiffer et al., 2020), but there were also a large number of students who had difficulties. (ÖH Universität Salzburg, 2020; Fachschaft::Architektur, 2020; ÖH Innsbruck, 2021; AktionsGemeinschaft, 2020) At the Vienna University of Technology, in the study program architecture, for example, the students who did well and those who did badly with distance learning are pretty much the same. However, it is noticeable that there were very few students who did very well. This is probably due to the fact that many students in this survey complained about a lack of examination opportunities and the lack of contact with the lecturers. The majority of the students also stated that they understood the course content worse than they did before. (Fachschaft::Architektur, 2020)

The shift to distance learning was also rated well by many students, (ÖH TNF JKU, 2020) especially at universities of applied sciences. (Staab, 2021; FH Oberösterreich, 2020; Krizek, 2020; Weiß, 2020) The survey of AktionsGemeinschaft, 2020 differentiates in its results between universities and universities of applied sciences. It confirmed that the switch to distance learning was rated better at universities of applied sciences than at universities. Overall, 50% of the university students said that the lectures adapted well or partly well to distance learning. In comparison, students at universities of applied sciences were more satisfied (75%). (AktionsGemeinschaft, 2020)

19 different surveys included questions about the satisfaction with the switch to distance learning and how the students doing with the new teaching methods and transition. Furthermore, they were asked if the situation was well adapted to the new situation. The results of these questions can be seen in figure 2.7. It shows the number of students who answered the questions with very well or partly well. The average satisfaction is 64%. There are many surveys where more than 70% of the students were satisfied. (Schober et al., 2021b; AktionsGemeinschaft, 2020; Staab, 2021; FH Oberösterreich, 2020; Krizek, 2020; Campus02, 2020; ÖH JKU, 2020b) As already mentioned, when comparing the numbers, it can be observed that the results at universities of applied sciences (displayed in blue) were better than those at universities (displayed in orange). The results from surveys of different types of institutions (shown in green) and university colleges of teacher education (displayed in purple) are mediocre. More than 80% of the students from the University of Applied Sciences CAMPUS02 and Upper Austria were satisfied with the distance learning. (Staab, 2021; FH Oberösterreich, 2020) This may be due to better communication at universities of applied sciences and the lower number of students. The worst result was obtained by the survey of the Vienna University of Technology with students in the study program architecture. As mentioned above, this could be due to the bad examination situation, which was rated as very bad by many students. (Fachschaft::Architektur, 2020)

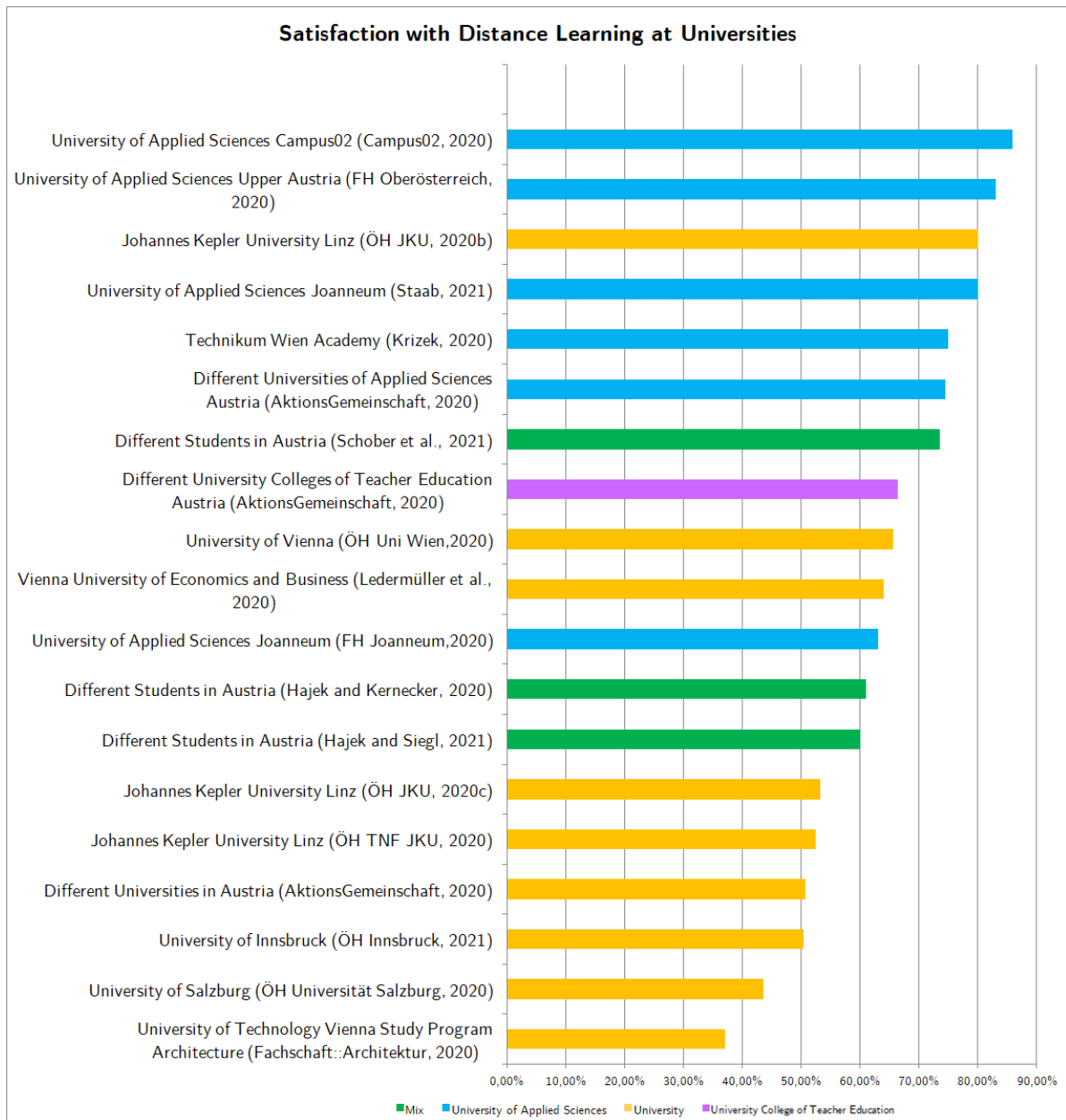


Figure 2.7: Overview of Students who Rated Distance Learning either Well or Very Well (n=19)

## 2.2 Positive and Negative Aspects for Students of Distance Learning

Commonalities among many surveys were the main advantages. The elimination of travelling time (Schober et al., 2020e; FH Oberösterreich, 2020; Campus02, 2020; ÖH WU Wien, 2021; Schober et al., 2020g; Kremer et al., 2021; ÖH JKU, 2020a; Bork-Hüffer

et al., 2021; Gabriel and Pecher, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Rührnößl, 2022; Verein Pilotprojekt, 2021) and the provided flexibility (Prietl, 2021; Schober et al., 2020e; Weinzettl and Koglbauer, 2021; Schön et al., 2020; FH Oberösterreich, 2020; Campus02, 2020; Kremer et al., 2021; ÖH JKU, 2020a; Bork-Hüffer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Rührnößl, 2022; Verein Pilotprojekt, 2021; Gabriel and Pecher, 2020; FH Joanneum, 2020; Ledermüller et al., 2020; ÖH Uni Wien, 2020; Schwab et al., 2020b; Dorfer et al., 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Hansl, 2021). Especially for those students who do not live in the same city as the university, this saving of time was a great benefit. (Kremer et al., 2021) For those students who had jobs, this flexibility was a great advantage as well. (Prietl, 2021; Schober et al., 2020e; Kremer et al., 2021; ÖH JKU, 2020a; Stabsstelle Qualitätsmanagement der BOKU, 2020; Rührnößl, 2022; Verein Pilotprojekt, 2021; ÖH Uni Wien, 2020; Schwab et al., 2020b; Dorfer et al., 2021; Hansl, 2021) They were able to organize their day and study at their own pace. (Kremer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Verein Pilotprojekt, 2021; Gabriel and Pecher, 2020; Schwab et al., 2020b) Although the flexibility was mostly seen as positive, some students saw the organization of the learning as a challenge. (Schober et al., 2020e; Hajek and Kernecker, 2020; Gabriel and Pecher, 2021, 2020; Schmölz et al., 2020; Fachhochschule Wiener Neustadt, 2020; Krottenauer et al., 2021) The self-organization of a study day, often with too few specifications, as well as the lack of information about the requirements and the lack of personal contact with the lecturers sometimes faced obstacles. (Hajek and Siegl, 2021; Gabriel and Pecher, 2020; ÖH Uni Wien, 2020) At the University of Salzburg, for example, half of the students in the communication science program found it difficult to organize a structured daily routine themselves. (ÖH Salzburg Stv Kommunikationswissenschaft, 2020) The same situation can be observed at the University College of Teacher Education Vienna. (Krottenauer et al., 2021)

For some students, the provided flexibility meant that they had more time for their studies, and some reported that they were able to complete more lectures than usual. For some students, this led to a faster progress in their studies. (ÖH WU Wien, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; ÖH JKU, 2020c) An example for this is the University of Natural Resources and Life Sciences, 27% of respondents stated that they were able to complete more ECTS than planned. (Stabsstelle Qualitätsmanagement der BOKU, 2020) 32% of the students at Johannes Kepler University Linz stated in December 2020 that they progressed faster in their studies and only 5% said that digital teaching hindered their progress in their studies. (ÖH JKU, 2020c) On the contrary there were also many who felt that their studies were delayed (Hajek and Kernecker, 2020; Hajek and Siegl, 2021; Fachschaft::Architektur, 2020; FH Oberösterreich, 2020; ÖH WU Wien, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Ledermüller et al., 2020; Dorfer et al., 2021; Zick, 2020; ÖH, 2020). Reasons for this were increased workload (Boyer and Preis, 2021; Hajek and Kernecker, 2020; Hajek and Siegl, 2021; ÖH Universität Salzburg, 2020; ÖH TNF JKU, 2020; Fachschaft::Architektur, 2020; ÖH Innsbruck, 2021; AktionsGemeinschaft, 2020; Staab, 2021; FH Oberösterreich, 2020; Krizek, 2020; Campus02, 2020; Kremer et al., 2021; ÖH JKU, 2020a; Ledermüller et al., 2020; ÖH

Uni Wien, 2020; Schwab et al., 2020b; Dorfer et al., 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Schmölz et al., 2020; Fachhochschule Wiener Neustadt, 2020; Zick, 2020; ÖH FH BFI Wien, 2020; Albaner et al., 2020), lack of motivation and communication (Stabsstelle Qualitätsmanagement der BOKU, 2020), stress (Hajek and Siegl, 2021; Fachschaft::Architektur, 2020; ÖH WU Wien, 2021; Dorfer et al., 2021) and missing or postponed courses (Stabsstelle Qualitätsmanagement der BOKU, 2020; HTU Wien, 2020). There were too few opportunities to complete courses and too few places to take exams. (Fachschaft::Architektur, 2020; ÖH, 2020; HTU Wien, 2020) Another problem was the short notice and shifting of exam dates. (ÖH JKU, 2020b, 2020a) In addition, many examinations were cancelled. (Stabsstelle Qualitätsmanagement der BOKU, 2020) Exams were very stressful and often too hard. (ÖH WU Wien, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Verein Pilotprojekt, 2021; Dorfer et al., 2021) Students often had the problem that they did not get enough information about the examination modalities. (Schober et al., 2020e; Hajek and Kernecker, 2020; Hajek and Siegl, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Schwab et al., 2020b; Dorfer et al., 2021) The examination time was often too short to answer all the questions. (Kremer et al., 2021; ÖH Uni Wien, 2020; Dorfer et al., 2021) This was often done by teachers to avoid cheating. (Ledermüller et al., 2020) Another problem was the technical equipment, many students were afraid that their technical equipment or the internet connection would not work well during the exams. (Campus02, 2020; Schober et al., 2020g; Kremer et al., 2021; Meyer and Mara, 2020)

Increased screen time has been reported in many surveys. Many students find it tiring to sit in front of a screen for long periods of time. (Prietl, 2021; Boyer and Preis, 2021; Hajek and Siegl, 2021; Campus02, 2020; Verein Pilotprojekt, 2021; FH Joanneum, 2020; Schwab et al., 2020b; Dorfer et al., 2021) The physical stress increased (Dorfer et al., 2021) and it was difficult to pay attention during long lectures (Kremer et al., 2021). Monotonous work and constant sitting at home has led to a lack of exercise and also to back and neck pain. (Verein Pilotprojekt, 2021) Therefore, regular breaks are very important for the students. (Dorfer et al., 2021)

In addition to the physical stress, the uncertainty also caused psychological stress. The uncertainty of planning, the fear of not completing their studies as planned and the lack of communication were a big challenge and often led to anxiety among the students. (Schober et al., 2020a; Fachschaft::Architektur, 2020; ÖH JKU, 2020b, 2020a; Stabsstelle Qualitätsmanagement der BOKU, 2020; Dorfer et al., 2021; Thaler, 2021) Especially at the beginning of distance learning the change and the difficulty of planning was hard for the students. (Prietl, 2021; Weinzettl and Koglbauer, 2021) Predictability and also the completion of courses were very important for the students. (Schön et al., 2020)

Another benefit was saving money on public transport, parking and renting an apartment in the university town. This was an advantage for many as the financial situation was already difficult. (Campus02, 2020; ÖH WU Wien, 2021) For many students, it

was more comfortable, less complicated and quieter to study at home. (Prietl, 2021; Schön et al., 2020; ÖH JKU, 2020a) For others, it was difficult because they did not have a suitable place to work and could not study undisturbed. (Schober et al., 2020a; ÖH Universität Salzburg, 2020; Campus02, 2020; HTU Wien, 2020) This depended very much on the living situation. It was therefore difficult for many when the study rooms and libraries were closed. (Prietl, 2021; ÖH WU Wien, 2021; Gabriel and Pecher, 2020; Schwab et al., 2020b; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Schmölz et al., 2020; ÖH, 2020) Before the COVID-19 pandemic, the library was not only used to obtain literature, but also as a place to study. About 37% of the students at the University of Innsbruck regularly learned in the library before the pandemic. (Bork-Hüffer et al., 2021) The closure of the library was especially problematic for writing economic papers, as it was difficult for students to obtain literature elsewhere. (Gabriel and Pecher, 2020; ÖH, 2020; ÖH FH BFI Wien, 2020)

Another disadvantage of distance learning was the distraction by smartphones and social media at home. (Campus02, 2020; Schwab et al., 2020b) At the University of Vienna, almost two thirds of the students agreed with the statement that they immediately look at their smartphones as soon as they hear a sound or signal. (Schwab et al., 2020b) Another problem was that not everyone had a good Internet connection (Prietl, 2021; Boyer and Preis, 2021; ÖH Universität Salzburg, 2020; ÖH TNF JKU, 2020; Rührnößl, 2022; Dorfer et al., 2021; Hansl, 2021; Schmölz et al., 2020; ÖH, 2020) and the necessary technical equipment. (Prietl, 2021; Campus02, 2020; Schmölz et al., 2020; Dorfinger, 2021) In addition, some students had technical problems. (Campus02, 2020; ÖH Uni Wien, 2020; Dorfinger, 2021)

For many students, the balance between studying and free time was no longer there. (Schober et al., 2020e; Boyer and Preis, 2021; FH Joanneum, 2020; HTU Wien, 2020) They stated that it was difficult to study at home and sit in front of a laptop every day. (Hansl, 2021)

The surveys also showed that the productivity had decreased and that many students had difficulty concentrating and lacked the motivation to study alone at home. (Prietl, 2021; Schober et al., 2020a; Boyer and Preis, 2021; Hajek and Kernecker, 2020; Hajek and Siegl, 2021; ÖH Universität Salzburg, 2020; Campus02, 2020; ÖH JKU, 2020b; ÖH WU Wien, 2021; Bork-Hüffer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Verein Pilotprojekt, 2021; ÖH Uni Wien, 2020; Schwab et al., 2020b; Dorfer et al., 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Hansl, 2021; Fachhochschule Wiener Neustadt, 2020; Krottenauer et al., 2021; HTU Wien, 2020; Dorfinger, 2021) An example is the University of Vienna. In the survey more than half of the students said that their productivity had decreased. (HTU Wien, 2020) According to a survey of students throughout Austria, 44% had learning and concentration difficulties. (Hajek and Kernecker, 2020) At the University of Salzburg, more than half of the students of communication sciences stated that they had problems concentrating. (ÖH Salzburg Stv Kommunikationswissenschaft, 2020) According to a survey conducted by the University

of Vienna, the number of students who had fun during their studies dropped drastically. (Schwab et al., 2020b)

The limited social life was a major challenge. (Hajek and Kernecker, 2020) In addition, some indicated that they felt lonely. (Hajek and Siegl, 2021; ÖH WU Wien, 2021; Verein Pilotprojekt, 2021) This was often due to a lack of communication and social contact, which was a major challenge for many students. This problem was mentioned in 25 different surveys. (Prietl, 2021; Schober et al., 2020a, 2020e; Boyer and Preis, 2021; Hajek and Siegl, 2021; ÖH TNF JKU, 2020; Fachschaft::Architektur, 2020; Staab, 2021; Campus02, 2020; ÖH JKU, 2020b; ÖH WU Wien, 2021; Kremer et al., 2021; Bork-Hüffer et al., 2021; Gabriel and Pecher, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Verein Pilotprojekt, 2021; Gabriel and Pecher, 2020; FH Joanneum, 2020; ÖH Uni Wien, 2020; Schwab et al., 2020b; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Hansl, 2021; Krottenauer et al., 2021; FH Kufstein, 2021) According to a survey by the University of Vienna, the percentage of students who were able to establish contact with other students decreased. In addition, the proportion of students who knew many fellow students with whom they could exchange information on subject-specific topics decreased. The change was most noticeable in the number of students who had personal contact with others. (Schwab et al., 2020b) In some courses there was too little contact with the lecturers (Fachschaft::Architektur, 2020; Staab, 2021; Kremer et al., 2021; Ledermüller et al., 2020; Baerwolf and Mitterauer, 2021), and at some universities the students reported a very good communication with the lecturers (Boyer and Preis, 2021). This depended very much on the teacher. (Baerwolf and Mitterauer, 2021) A good communication structure is an important characteristic of good teaching practice. (Schober et al., 2020a; Schön et al., 2020; Ledermüller et al., 2020) Communication with all groups (students, faculty, university) has deteriorated compared to the pre-pandemic period. (Hajek and Kernecker, 2020; Schwab et al., 2020b) Especially for those who started their first semester in 2020, it was difficult to make friends and get to know fellow students. (ÖH WU Wien, 2021; Verein Pilotprojekt, 2021; Ledermüller et al., 2020) Many courses required students to work in groups. This was very challenging for the students without any face-to-face communication. (ÖH WU Wien, 2021; Bork-Hüffer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Verein Pilotprojekt, 2021; Gabriel and Pecher, 2020; Schwab et al., 2020b) Some students were afraid that others would not cooperate properly. (Schwab et al., 2020b) 40% of the students at University of Natural Resources and Life Sciences stated that group work was difficult. (Stabsstelle Qualitätsmanagement der BOKU, 2020)

The lecture live streams, online meetings and recorded videos were rated very positively. Being able to watch the videos over and over again was a great advantage in learning (Boyer and Preis, 2021; Schön et al., 2020; ÖH TNF JKU, 2020; FH Oberösterreich, 2020; Campus02, 2020; Bork-Hüffer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Rührnößl, 2022; Verein Pilotprojekt, 2021), but there were some courses that did not have these recordings and live streams, which was mentioned as a great disadvantage. (ÖH WU Wien, 2021) In some lectures the students had to learn the

whole content by themselves, only a script or lecture slides were provided. (Schober et al., 2020a; ÖH JKU, 2020a; ÖH Uni Wien, 2020) These self-study lectures were generally rated very poorly. (ÖH TNF JKU, 2020; Campus02, 2020; ÖH JKU, 2020a; Ledermüller et al., 2020) In some seminars the students had to participate with their own video. Some felt that was an invasion of privacy. (Campus02, 2020; ÖH, 2020) Some students stated that in online lectures it is easier for shy students to ask questions. (Prietl, 2021) The variety of tools used was evaluated positively. Breakout rooms, slides with sound, surveys and quizzes were popular. (Prietl, 2021)

The surveys showed that there were many challenges, especially at the beginning of distance learning in the summer semester 2020. The later the surveys were conducted, the less anxious the students were about delays in their studies and the better they were able to plan their studies. Some students reported only challenges, while others were very positive about learning. Sometimes the same situation was seen as both an advantage and a disadvantage. For example, the organization of the study day.

A summary of all the benefits is shown in figure 2.8. Flexibility, time saved by not having to travel, the availability of live streams and recorded videos were the top three benefits reported by students. The flexibility offered by distance learning was the most frequently mentioned benefit. It can be seen that there were far fewer advantages than disadvantages mentioned in the surveys. This is because many surveys focused only on the challenges and did not ask about the benefits.

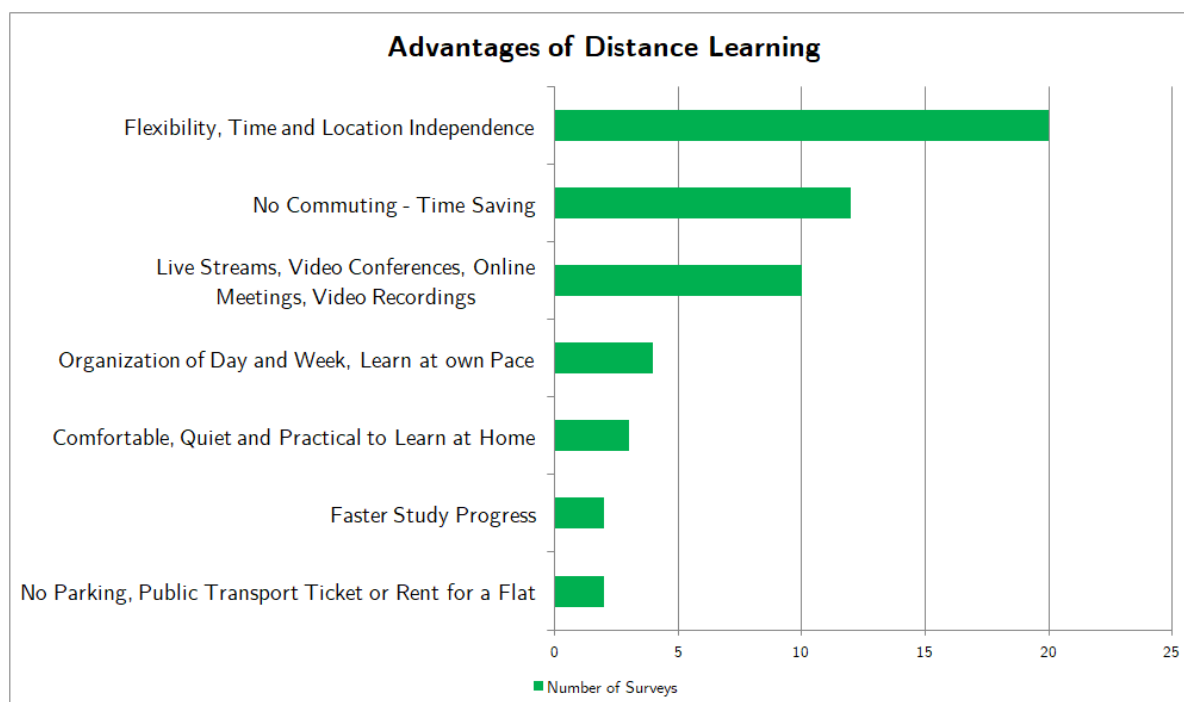


Figure 2.8: Overview of Benefits Reported by University Students (n=26)

To sum up, the three biggest disadvantages for students were the increased workload, the lack of social contact, and the lack of motivation and concentration. Privacy and distraction were only mentioned twice. All disadvantages mentioned in more than one survey are shown in figure 2.9. It shows that the students faced 15 different challenges.

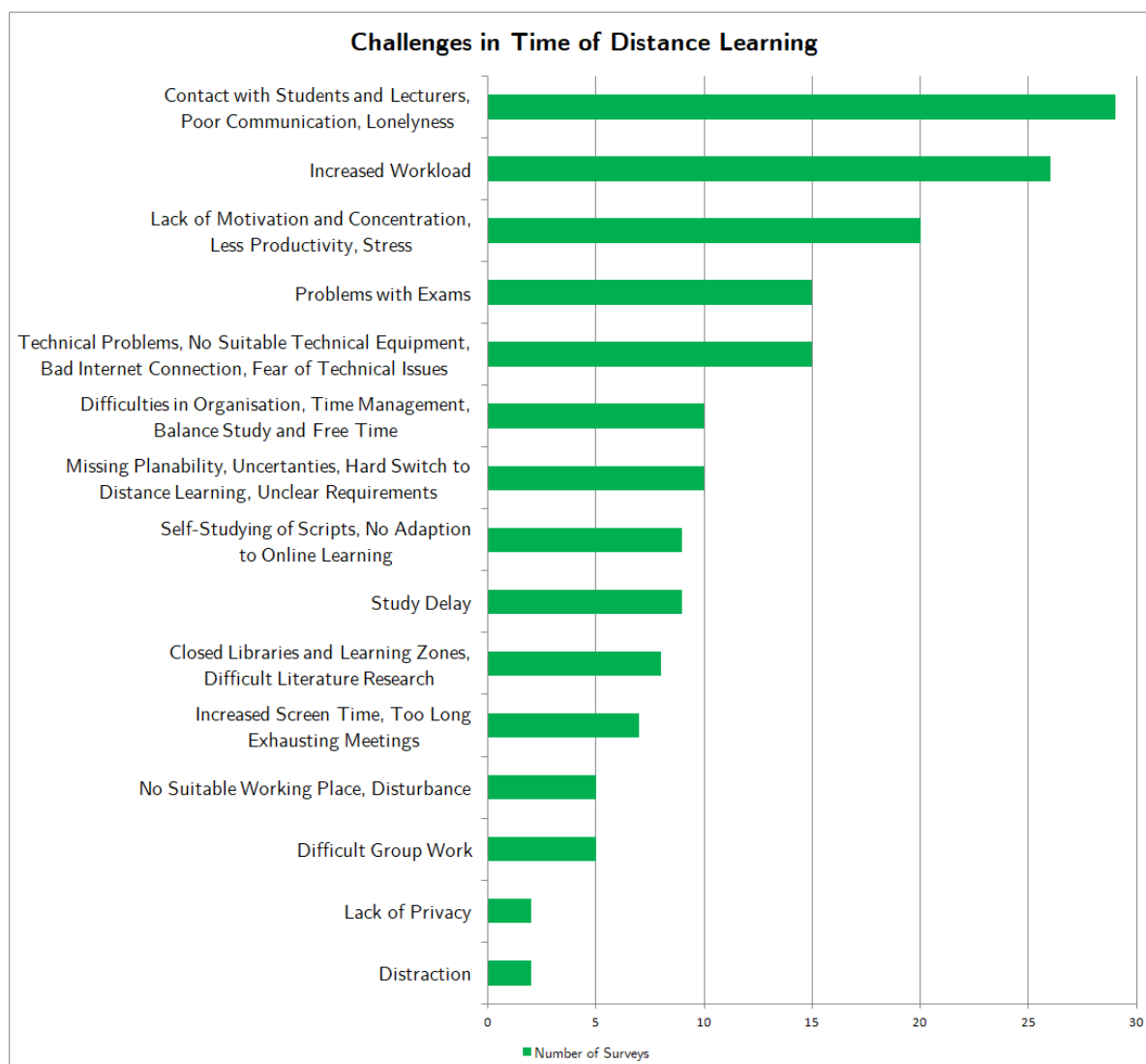


Figure 2.9: Overview of Challenges for University Students (n=48)

Some of these issues are discussed in more detail in the following chapters.

## 2.3 Digital Implementation of Courses

In terms of teaching methods, we distinguish between synchronous and asynchronous learning. Asynchronous learning means self-study of content provided by the teacher. Pre-recorded videos, documents, homework or exercises are uploaded and students have



a certain amount of time to work on them. This method creates a sense of responsibility and encourages self-organization. A big advantage is the flexibility, students can watch the videos as often as they want and work on the content whenever they want. Each student can learn at their own pace and repeat as many times as they like. Technical difficulties are not a major problem. A big disadvantage is the lack of communication, there are no direct face-to-face meetings, communication is often done by e-mail or in a forum. Synchronous learning is similar to face-to-face lectures, often with compulsory attendance and collaboration. Students and teachers meet via a video conferencing tool in an online course or for a question and answer session at a fixed time. Students use their own PC with a webcam and microphone. The advantage of this method is the direct interaction. Students can get immediate answers to their questions, but they need a fast Internet connection, appropriate technical equipment (laptop, webcam, microphone...) and a quiet place to work. This method requires more time and technical effort of the teacher. (Wintemute, 2022) University teachers used many different ways, and sometimes a mixture of both, to deliver digital learning.

Figure 2.10 shows the most frequent used methods mentioned in the different surveys. It can be seen that both methods were used equally often. In eight surveys it was reported that synchronous teaching such as video conferences and live streams were most frequently used. In eight surveys the students reported that synchronous teaching such as PowerPoint slides, learning management systems and recorded videos were mostly used.

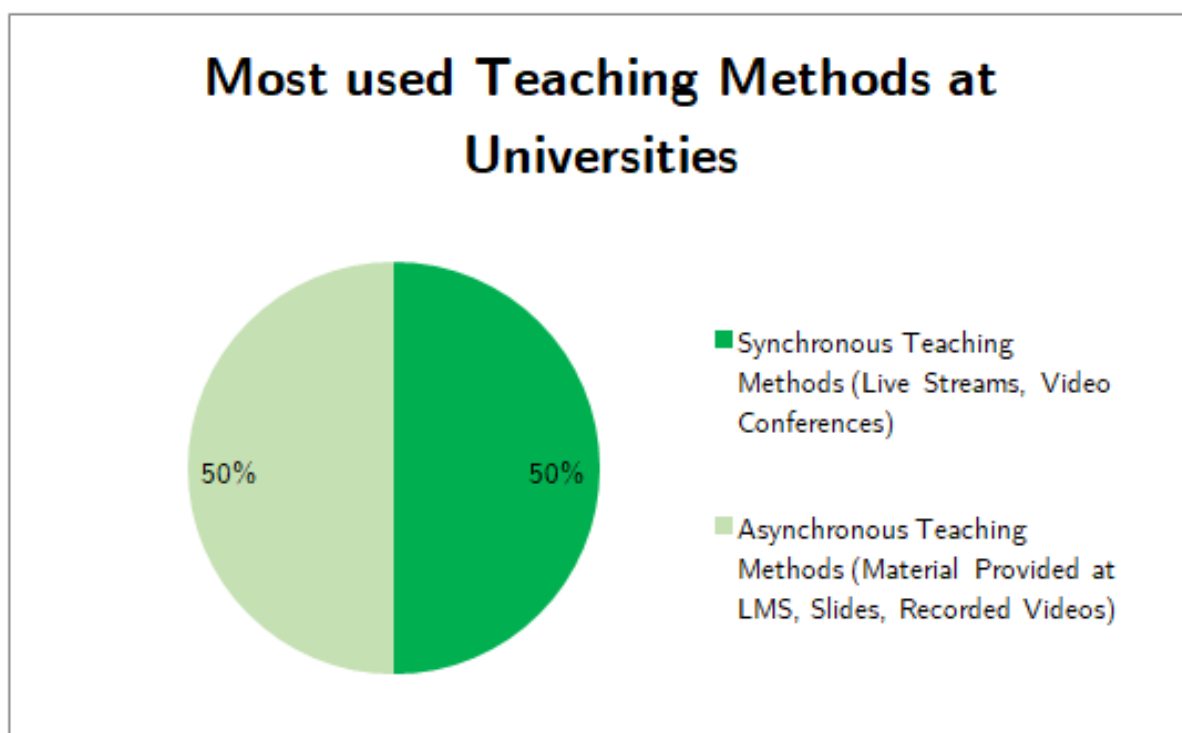


Figure 2.10: Overview of Used Teaching Methods at Universities (n=16)

At many universities, a mixture of both methods was used, as teachers implemented distance learning in different ways. Many students reported about lectures which were implemented through live streams (video conferences) (Weinzettl and Koglbauer, 2021; Hajek and Kernecker, 2020; Hajek and Siegl, 2021; Schön et al., 2020; ÖH Universität Salzburg, 2020; ÖH TNF JKU, 2020; Pfeiffer et al., 2020; ÖH Innsbruck, 2021; Kremer et al., 2021; Bork-Hüffer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; ÖH Uni Wien, 2020; Schwab et al., 2020b; Dorfer et al., 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Fachhochschule Wiener Neustadt, 2020; Albaner et al., 2020), virtual classrooms (ÖH Innsbruck, 2021), recorded videos (Hajek and Kernecker, 2020; Hajek and Siegl, 2021; Schön et al., 2020; ÖH TNF JKU, 2020; ÖH Innsbruck, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; ÖH Uni Wien, 2020; ÖH Salzburg Stv Kommunikationswissenschaft, 2020) and various learning management systems such as Moodle or Blackboard (Weinzettl and Koglbauer, 2021; Hajek and Kernecker, 2020; Hajek and Siegl, 2021; Schön et al., 2020; ÖH Universität Salzburg, 2020; ÖH TNF JKU, 2020; Pfeiffer et al., 2020; ÖH Innsbruck, 2021; Staab, 2021; Gabriel and Pecher, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Dorfer et al., 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Albaner et al., 2020). But there were also surveys where students reported that there was less live teaching. (Gabriel and Pecher, 2021) The fact that pre-recorded videos can be watched several times was mentioned as a great advantage. (Campus02, 2020) Students also reported about lectures in which they had to study completely on their own, e.g. from scripts. (Schober et al., 2020a; ÖH Universität Salzburg, 2020; ÖH TNF JKU, 2020; ÖH Innsbruck, 2021) For example, at Johannes Kepler University Linz more than 60% had to study at least one lecture completely on their own. (ÖH TNF JKU, 2020) Some lecturers provided PowerPoint slides with audio (ÖH TNF JKU, 2020), slides without audio (ÖH Innsbruck, 2021; ÖH Uni Wien, 2020) or written learning material (ÖH Uni Wien, 2020). For example, the semester survey of ÖH Uni Wien, 2020 shows that 84% of the students had lectures where PowerPoint slides and written materials were provided. Two thirds had courses where lecturers provided video and audio recordings and video conferences. (ÖH Uni Wien, 2020) Another survey at University of Vienna showed a similar picture. Students indicated that almost 66% of the lecturers used videos and almost 73% used theoretical and practical parts. (Schwab et al., 2020b) Many students reported that the best distance learning methods were live streams (Schober et al., 2020a; ÖH TNF JKU, 2020; AktionsGemeinschaft, 2020; FH Oberösterreich, 2020; ÖH JKU, 2020b; Leder Müller et al., 2020; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; HTU Wien, 2020; Pezenka et al., 2020) and additionally recorded videos to watch the lecture again if something was unclear (Schober et al., 2020a; ÖH TNF JKU, 2020; FH Oberösterreich, 2020; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; HTU Wien, 2020; Baerwolf and Mitterauer, 2021). Digital learning materials provided on a learning management system were also important for many students. (AktionsGemeinschaft, 2020; ÖH JKU, 2020b) Group work continued despite the lack of face-to-face communication. (Pfeiffer et al., 2020; Pezenka et al., 2020)

The study from Hajek and Kernecker, 2020 shows, compared to the time before the

COVID-19 pandemic, the number of lectures with online streams (without interaction) has almost doubled. Courses with videos, blogs and podcasts were increasingly offered. (Hajek and Kernecker, 2020)

It can be concluded, that both, asynchronous and synchronous methods were often used at universities. Many lectures were changed to live streams and video recordings, but there were many lectures where only written material or PowerPoint slides were provided. Students preferred live streams and video recordings. Only live streams are often not sufficient. Almost all students had lectures where they had to study the content completely on their own. This was a big challenge for the students.

## 2.4 Tools to Implement Digital Learning at Universities

There were many different tools and platforms used for digital learning. Examples are Moodle, Microsoft Teams, Zoom, BigBlueButton, LEARN, Skype, WhatsApp, Blackboard and Jitsi MEET. Each university used the tools in another way, some used their own platforms and others a mix of tools. Table 2.3 provides an overview and a brief description of the distance learning tools which were mentioned in the studies.

Tool Name	Tool Type	Description
Moodle	Learning Management System	Open source course management system where teachers can create their own personalized course page to upload work and learning material. It provides a grading system, a forum and group management. (moodle.org, n.d.)
BigBlueButton	Video Conferences	Open source virtual classroom tool to connect teachers and students live. Features are whiteboards, polls, chats, document uploads, screen sharing and breakout rooms. (docs.bigbluebutton.org, n.d.)
Zoom	Video Conferences	Video conference tool which can be used as desktop or mobile app. Videos can be recorded, screen sharing and team chat are supported. (explore.zoom.us, n.d.)
JitsiMeet	Video Conferences	Open source software for video calls without registration of the user for different operating systems. (jitsimeet.eu, n.d.)
WhatsApp	Communication	Messenger Software from Meta mainly used on smartphones for the communication between the students. Beside chats, there is also the possibility for audio and video calls. (whatsapp.com, n.d.)

Skype	Communication	Free video and audio communication software. Can be used for screen sharing, group calls and the call can be recorded. (skype.com, n.d.)
Discord	Communication	Discord is organized into servers and has text and voice channels. It is used for text, audio, video communication and desktop sharing. (discord.com, n.d.)
Microsoft Teams	Video Conferences	Tool from Microsoft for chat, meetings, calls and collaboration. Features are screen sharing, group calls and co-working with other Microsoft Tools like Word or Excel. (microsoft.com, n.d.)
TU Graz TeachCenter & TeachCenter Exam	Learning Management System	Web based learning platform from the Graz University of Technology based on Moodle. (tugraz.at, n.d.)
uniMEET	Video Conferences	Video Conference tool from the University of Graz which allows group rooms, whiteboards and desktop sharing. (unimeet.uni graz.at, n.d.)
TUbe	Video	Video portal from the Graz University of Technology to watch lecture videos and events. (tube.tugraz.at, n.d.)
YouTube	Video	Platform to upload and watch videos.
E-Mail/ Web-mail	Communication	For communication teachers and students often used e-mails.
WebEx	Video Conferences	Video conferencing tool with many features such as screen sharing, polling, messaging, recording, breakout sessions, digital real-time whiteboards and calendar integration. (webex.com, n.d.)
Adobe Connect	Video Conferences	Tool for virtual classrooms with features such as breakout rooms, polls, tests, whiteboards, interactive content and chat rooms. Other learning management systems (such as Moodle) can be integrated. (adobe.com, 2023)
OpenOLAT	Learning Management System	Open Olat is a Swiss open source learning management system which integrates Big-BlueButton and offers many features: evaluations, exams, videos, collaboration, calendars, documents and e-mails. (openolat.com, 2022)

LFU Online	Learning Management System	Student portal at the University of Innsbruck. (Universität Innsbruck, 2019)
Blackboard	Learning Management System	E-learning platform at the University of Salzburg which is used for learning material, recorded videos, uploading of homework and communication. (Universität Salzburg, 2023)

Table 2.3: Overview of Different Tools for Distance Learning

Moodle was a very often used tool at universities. (Weinzettl and Koglbauer, 2021; ÖH TNF JKU, 2020; Staab, 2021; Kremer et al., 2021; Gabriel and Pecher, 2020; Dorfer et al., 2021; Albaner et al., 2020; Baerwolf and Mitterauer, 2021) It was mainly used for document exchanges, but also for the communication between students and teachers, grading and student collaboration (group work). (Dorfer et al., 2021) The usage of Moodle was rated good, the courses were structured well and clearly laid out. (Kremer et al., 2021; Albaner et al., 2020) For communication many e-mails were written (Staab, 2021; Gabriel and Pecher, 2020) and additionally mobile applications such as WhatsApp (Bork-Hüffer et al., 2021; Albaner et al., 2020) or Telegram (Bork-Hüffer et al., 2021) were in use. For video conferences the teachers frequently used Microsoft Teams (Weinzettl and Koglbauer, 2021; FH Oberösterreich, 2020), BigBlueButton (FH Oberösterreich, 2020; Bork-Hüffer et al., 2021), Zoom (Weinzettl and Koglbauer, 2021; Bork-Hüffer et al., 2021; Albaner et al., 2020), WebEx (Wieser, 2020) and Skype (FH Oberösterreich, 2020). Additionally, the universities often used their own hosted platforms such as uniMEET (Dorfer et al., 2021), TeachCenter (Wieser, 2020), TUBE (Wieser, 2020) or LFU Online (Bork-Hüffer et al., 2021). Furthermore, Discord, YouTube and Twitch were also mentioned as frequently used tools. (Wieser, 2020) In a comparison of different platforms (Moodle, BigBlueButton, Zoom and Jitsi) at the University of Vienna, Moodle performed best and BigBlueButton caused the most problems. (Schmölz et al., 2020)

In summary, most tools worked very well. Many universities used Moodle or their own platforms to upload content and grade assignments. Zoom and BigBlueButton were often used for live video conferencing. It seems that the frequent use and fewer problems with the use of Moodle is because it was used by many universities long before the COVID-19 pandemic began. Therefore, students and teachers had enough time to build up competences.

## 2.5 IT Infrastructure & Working Place

In order to participate in online courses and learn well, students needed a good IT infrastructure and an undisturbed learning environment at home. It was no longer possible to use the study rooms, computers or libraries at the universities. These changes were a big challenge for many students.

The lack of access to the library was a major disadvantage and caused difficulties for many students. (Gabriel and Pecher, 2020; Schwab et al., 2020b; Schmölz et al., 2020; ÖH, 2020) Books were not available online and it was very difficult to get the required literature. (ÖH JKU, 2020a; Gabriel and Pecher, 2020) Online research seemed to be unknown to some students. This situation was particularly hard for those students who worked on seminar papers, bachelor or master theses. (Gabriel and Pecher, 2020) The opening of the libraries was therefore very urgent. (Hajek and Siegl, 2021; ÖH WU Wien, 2021) Many of the students would like more digitization of literature because many books were only available in libraries. (Bork-Hüffer et al., 2021; Schwab et al., 2020b) The closure of the libraries was also a problem for the students because they often learned in the library before the COVID-19 pandemic. (ÖH Universität Salzburg, 2020; Bork-Hüffer et al., 2021) For example, more than 37% of students at the University of Innsbruck used the library before the pandemic and 78% studied at home. During the pandemic this number increased to 100%. (Bork-Hüffer et al., 2021)

The sudden shift to learning at home caused significant challenges. Many students had no suitable place to learn at home and were often disturbed by others. (ÖH Universität Salzburg, 2020; ÖH WU Wien, 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; HTU Wien, 2020) At the University of Graz most of the students reported they had enough space to study at home. (Dorfer et al., 2021)

A similar situation can be observed with the technical devices needed to attend the online lectures. Most of the students were technically well equipped (ÖH Universität Salzburg, 2020; Campus02, 2020; Dorfer et al., 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020) The surveys from ÖH Universität Salzburg, 2020, Hajek and Kernecker, 2020 and Schmölz et al., 2020 showed that more than 90% of all students had a computer or laptop and continuous access to it. Although most students were well equipped, some students reported that they had difficulties. For example, about 8% of students at Johannes Kepler University Linz, the technical infrastructure was a challenge at the beginning of the COVID-19 period. They had bad internet connection, technical issues or problems with the equipment. In the survey six months later, the situation was much better. Only 2% of the students had technical problems. (ÖH JKU, 2020a, 2020c) The surveys from Hajek and Kernecker, 2020 and Hajek and Siegl, 2021 show opposite results. In April 2020, 10% of the students had technical problems and almost a year later even 19%. (Hajek and Kernecker, 2020; Hajek and Siegl, 2021) Resources such as hardware or software licences were also a problem for some students. (Hajek and Siegl, 2021) These results show that most Austrian students were well equipped, but there were also some who had deficits.

While the situation was good in terms of technical devices, it was much worse in terms of internet connectivity. For example, at the University of Salzburg only 55% of the students had an appropriate internet connection and 6% of the students bought more data volume. (ÖH Universität Salzburg, 2020) Other surveys showed a similar situation,

internet speed and less data volume were major challenges. (Hajek and Kernecker, 2020; Dorfer et al., 2021; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Schmölz et al., 2020) The study by Hajek and Kernecker, 2020 showed that only 38% of the students had a powerful internet. There was also a survey at the Vienna University of Technology where students had fewer problems with the internet. (HTU Wien, 2020) Figure 2.11 shows a comparison of five universities, where students reported a good internet connection.

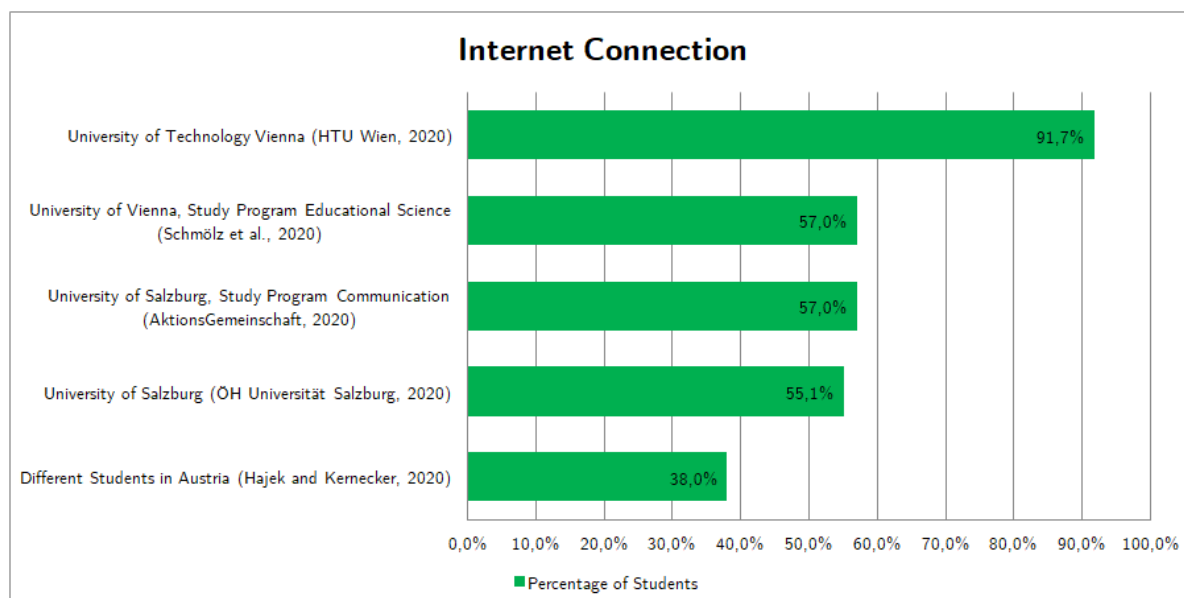


Figure 2.11: Overview of Students with a Good and Stable Internet Connection (n=5)

Both, good internet connection and suitable technical equipment were essential for students to participate in the online lectures. In many of them, especially seminars and exercises, attendance was compulsory. Some students had problems to join the live lectures. (Albaner et al., 2020) Additionally, they often reported about quality issues with the online lectures. They had video, audio or connection problems. (ÖH TNF JKU, 2020; ÖH Uni Wien, 2020; ÖH, 2020) Especially students living in rural areas had problems with this. (ÖH TNF JKU, 2020) About a third of the students at Graz University of Technology mentioned lectures with a good audio and video quality, but there were also many lectures with poor quality. (Schön et al., 2020)

In summary, some students did not have the necessary technical equipment or internet connection at home. It affected only a few students but it can be concluded that students who did not have these technical devices, and therefore could not fully participate in the online teaching, were at on disadvantage.

## 2.6 Performance Assessment

The switch to distance learning in March 2020 suddenly changed not only teaching, but also the performance assessment. One of the most important issues for the students was to pass the exams in order to pass the lectures and progress in their studies, despite the fact that the universities were closed. The standard before COVID-19 was written exams in the university lecture halls, but as this was no longer possible, the lecturers had to find new ways of assessing student performance. This created new challenges for all parties involved (university, professors and students). Lecturers often used different methods to assess student performance. Three different examination formats were identified:

- **Assignments, Exercises and Seminar Papers:** Students have to work on assignments, exercises or seminar papers in a specific time frame. There is no significant change compared to the time before the COVID-19 disease. The results are often submitted via a Learning Management System (LMS) such as Moodle and then assessed. This method was also used before the pandemic, thus many students were already familiar with it. (Zullus and Archan, 2020) Sometimes seminar papers or other work have to be presented in a group of students. (Horn and Schmees, 2021)
- **Online Oral Exams:** Remotely using online video conferencing tools such as MS Teams or Zoom. Students have to give an insight into their private sphere via video systems and certain technical equipment is required (microphone, camera, loudspeaker, good internet connection). (Zullus and Archan, 2020) A whiteboard can be useful as a supplement to paper and pencil. Many videoconferencing tools already have this feature and it can be useful for sketches or calculations. (Horn and Schmees, 2021) One problem with this method is that it is not suitable for courses with a large number of students.
- **Online Written Exams:** For written exams often a LMS such as Moodle and a video conferencing tool such as MS Teams, BigBlueButton or Zoom for monitoring is in use. There is also special software called “proctoring software” which monitors the computer and shows whether students have opened unauthorized programs. Proctored written exams are more challenging for both students and instructors. Cheating prevention and identity verification are just two of the many challenges for the teachers. (Zullus and Archan, 2020)

Open book exams (e.g. case studies or computational examples) require students to complete and submit assignments using documents within a given time frame. Talking to other students is not allowed. (Horn and Schmees, 2021) At some universities (e.g. University of Graz) there was no supervision. (Hauser and Linschinger, 2020)

One option is the “remote take home exam”. This exam can be started individually within a certain time frame. The time for the exam is limited and usually relatively short. Students can download the exam, complete the tasks and then upload the



results. Students have the advantage of flexibility and the risk of technical problems is not as high. One problem with this method is authorization. It is not possible to prove that the student worked alone. For this exam method, it is also necessary for the lecturers to create an exam with complex tasks that cannot be solved easily on the internet. (Horn and Schmees, 2021)

Most of the closed book exams require online supervision. Tasks and questions are completed directly online. In most cases, continuous camera monitoring and screen sharing are required to prevent cheating. Students need the same equipment as for the oral exams, but a stable internet connection is particularly important. (Chen et al., 2020) At some universities, students have to use two cameras, one directly at the PC and one at a distance to watch the hands and the screen. (Zullus and Archan, 2020) In some cases, live recordings are also stored and reviewed afterwards, but this requires a lot of storage space and time. It is also not optimal from a privacy point of view. (Horn and Schmees, 2021)

Another type of closed book exam is the not proctored exam, where no type of aid is allowed. In most cases the time is very short, so there is no opportunity to look things up or do research. Often students work on the exam (on a paper) and then have to scan the paper and upload it to a learning management system. (Horn and Schmees, 2021)

Overall, students were mostly satisfied with online examinations, but they also faced many new challenges. A lack of information about the exam was often reported. (Schober et al., 2020g; ÖH Uni Wien, 2020) In most of the surveys the students coped well with the online exam format. (Campus02, 2020; Schober et al., 2020g; ÖH Uni Wien, 2020; Meyer and Mara, 2020) Online oral examinations and open book exams were generally well received. The advantage of open book exams is that they focus more on understanding than on memorisation and are application rather than concept oriented. (Schober et al., 2020g; Kremer et al., 2021; ÖH Uni Wien, 2020) There were not many concentration problems during the exams. (Meyer and Mara, 2020)

The views of the students at the University of Graz were very similar, the assessment criteria and procedures were clear to most of the students. Even though there was clarity for the majority of students, there were still some who saw it as a challenge but it got better and better with time. (Dorfer et al., 2021) This is also confirmed by the studies from Peter Hajek, one from the beginning of distance learning in April 2020 and the other from February 2021. One of the biggest challenges were uncertainties about exam opportunities. In the first survey 60% of the students said this was a challenge, but this changed over time to only 22%. (Hajek and Siegl, 2021) This improvement over time can also be seen in other surveys. (ÖH JKU, 2020b, 2020a)

Several students saw the exams as a challenge because they were more difficult than before. (ÖH JKU, 2020b; ÖH WU Wien, 2021; ÖH JKU, 2020c) One reason for this was the exam time. There was feedback that the time was so short that there was

not enough time to answer all the questions or to reread them. (Kremer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; ÖH Uni Wien, 2020; Dorfer et al., 2021) Almost half of the students at the University of Vienna had experienced too little time for at least one exam. (ÖH Uni Wien, 2020) In September 2020, 63% of the students at the University of Graz said that the time was too short, in February 2021 the proportion was lower but with almost 50% still very high. (Dorfer et al., 2021) For many students the short time leads to stress. (ÖH WU Wien, 2021; Dorfer et al., 2021) The reason for the short time frame was the cheating prevention. When the students had little time to answer the questions, they could not search the internet or read in the lecture documents. (Kremer et al., 2021; Dorfer et al., 2021) Another reason was the difficulty of the exam itself. Some students stated that the level of difficulty increased significantly. The additional time for downloading, opening, saving and uploading was not considered by the lecturers in the exam time. This caused additional stress for the students. (ÖH WU Wien, 2021)

At some universities, students had problems with the availability of exams, there were too few exam places and exam dates. (Fachschaft::Architektur, 2020; HTU Wien, 2020) At Vienna University of Technology, for example, more than 50% said that the situation had worsened when asked whether there were enough opportunities to take exams. (HTU Wien, 2020) Especially the students of the study program architecture complained about too few exam places. Many students were in their home country and they did not know when they were able to come back to Austria for exams. Therefore, the demand for online exams was very high. (Fachschaft::Architektur, 2020)

The surveys showed that students preferred face-to-face exams to online exams. (HTU Wien, 2020; Meyer and Mara, 2020) At the Johannes Kepler University Linz, for example, the preferred form for 60% of the students were on-site exams. (Meyer and Mara, 2020) As mentioned earlier, some students did not feel comfortable showing their personal environment at home, some felt that exams with video invaded their privacy. (Campus02, 2020; ÖH, 2020) Furthermore, they felt monitored. (Meyer and Mara, 2020) In addition to the technical equipment, a stable and fast internet, specific software and hardware and also a suitable and quiet working place were essential for taking an exam. Not all students had all this equipment. (ÖH WU Wien, 2021) Furthermore, some students were afraid of technical problems and internet failures during the exam. (ÖH WU Wien, 2021; Kremer et al., 2021; Meyer and Mara, 2020) These fears often caused stress and sometimes it was hard to write exams at home because of the family and pets. (ÖH WU Wien, 2021) Mostly the worries were unfounded as not many students reported technical difficulties. (Campus02, 2020; ÖH Uni Wien, 2020; Dorfer et al., 2021) For example, almost 90% of students at the University of Vienna said that the technology worked well. (ÖH Uni Wien, 2020)

Overall, the exams were a big challenge and students saw many advantages and disadvantages. Most students were happy about the existence of online exams, but they also had negative associations. They were confronted with the fear of technical or pri-

vacy problems, stress, nervousness and the large amount of exams. (Campus02, 2020) In most cases these fears were unfounded, but the stress could have had a negative impact on exam results. The elimination of travel time was positively emphasized. (Schober et al., 2020g) Many students would like to see online exams in the future. (ÖH JKU, 2020b)

## **2.7 Social Life and Communication During the COVID-19 Pandemic**

The rapid shift to distance learning has severely limited communication between students and their peers and also between lecturers and students. Information provided by the university and the lecturers about the university's approach was very important for the students. Good communication is an important feature of good teaching practice for the students. (Prietl, 2021; Schön et al., 2020) Especially at the beginning of distance learning good communication was necessary to avoid chaos and uncertainties. (Prietl, 2021)

A disadvantage that almost all surveys had in common was that the students reported about a limited social life. A common topic in almost all the surveys was that one of the biggest problems related to studying was a lack of communication. This was reported by students in 29 surveys and was therefore the biggest disadvantage for the students. (Prietl, 2021; Schober et al., 2020a, 2020e; Boyer and Preis, 2021; Hajek and Kernecker, 2020; Hajek and Siegl, 2021; ÖH TNF JKU, 2020; Fachschaft::Architektur, 2020; Staab, 2021; FH Oberösterreich, 2020; Campus02, 2020; ÖH JKU, 2020b; ÖH WU Wien, 2021; Kremer et al., 2021; Bork-Hüffer et al., 2021; Gabriel and Pecher, 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020; Rührnößl, 2022; Verein Pilotprojekt, 2021; Gabriel and Pecher, 2020; FH Joanneum, 2020; Ledermüller et al., 2020; ÖH Uni Wien, 2020; Schwab et al., 2020b; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; Hansl, 2021; ÖH JKU, 2020c; FH Kufstein, 2021; Baerwolf and Mitterauer, 2021) They missed the contact with other students, student activities and events. (FH Oberösterreich, 2020) Many students were not satisfied with the information provided by the university, directorate and lecturers about the handling of the pandemic. (Hajek and Siegl, 2021; Fachschaft::Architektur, 2020; Stabsstelle Qualitätsmanagement der BOKU, 2020) Compared to the time before the COVID-19 pandemic, students were more dissatisfied with the communication than before. (Hajek and Kernecker, 2020)

From the point of view of many students, the communication with other students has become worse. (Baerwolf and Mitterauer, 2021) It was more difficult to make contact with other students and the number of personal contacts was significantly reduced. At the university Vienna for example, the number of students who had no personal contact with other students increased from 6.5% to 60%. (Schwab et al., 2020b) Group work and exchange with colleagues was more difficult than before. Students missed study

learning groups and it was difficult to make new friends. The situation was particularly difficult for first year students. (ÖH WU Wien, 2021)

At the University of Applied Sciences CAMPUS02 the situation regarding communication between students was better. A large proportion of students stated that personal contact with other students was also possible online. (Campus02, 2020) It was also rated positively at the University of Teacher Education Carinthia. (Albaner et al., 2020) These results showed that although communication was more difficult, many new ways were found to maintain contacts online. It is also noticeable that communication at universities of applied sciences worked better.

Communication with teachers was often a challenge for students, they reported that there was either limited or no contact. (Hajek and Siegl, 2021; Fachschaft::Architektur, 2020; ÖH Uni Wien, 2020) In some lectures the support from the lecturers was not rated well and they were not available for questions. (ÖH Universität Salzburg, 2020; Fachschaft::Architektur, 2020; Dorfer et al., 2021) However, it was also stated that most of the lecturers tried hard to implement the online teaching well. (Schön et al., 2020; ÖH Universität Salzburg, 2020; Kremer et al., 2021; Gabriel and Pecher, 2021; Dorfer et al., 2021; ÖH, 2020) The results at the University of Graz show that the support from the lecturers was rated as mediocre but it improved over time. (Dorfer et al., 2021) At the University of Applied Sciences CAMPUS02 most of the students felt well supported by the teachers but the communication was more difficult than before. (Campus02, 2020) This result shows again that the communication structure was better at universities of applied sciences.

In conclusion it can be said that a common aspect of almost all the surveys was the communication difficulties for students in distance learning. The lack of social contact and communication between students was a major challenge for them. The lack of communication with the teachers caused problems especially in the beginning. As time went by the communication got better but there were still some courses where the lecturers were not available for questions. The surveys also showed that the satisfaction with the lecture communication depends strongly on the teacher. Furthermore, the communication with peers and teachers worked better at universities of applied sciences than at universities.

## **2.8 Workload and Delay in the Completion of Studies**

The workload of lectures and whether the workload was appropriate in relation to the amount of ECTS was the subject of many surveys. Some students were not able to acquire the ECTS they had planned due to postponements, which often led to a delay in the completion of their studies.

Many students reported that the workload of lectures was too high. (Hajek and Siegl,

2021; ÖH Universität Salzburg, 2020; ÖH Innsbruck, 2021; Campus02, 2020; Dorfer et al., 2021; Schmölz et al., 2020; Fachhochschule Wiener Neustadt, 2020; ÖH FH BFI Wien, 2020) It was often mentioned that distance learning required additional effort compared to face-to-face teaching. (Boyer and Preis, 2021; AktionsGemeinschaft, 2020; Staab, 2021; FH Oberösterreich, 2020; Krizek, 2020; Stabsstelle Qualitätsmanagement der BOKU, 2020; Ledermüller et al., 2020; ÖH Uni Wien, 2020; Schwab et al., 2020b; ÖH Salzburg Stv Kommunikationswissenschaft, 2020; ÖH, 2020) In a survey of ÖH Uni Wien, 2020 more than half of the students considered the workload to be higher or much higher. For 36% the workload remained the same. (ÖH Uni Wien, 2020) At the Vienna University of Economics and Business the workload increased from 25 to 30 hours per week. The main reason for this was the high number of assignments and self-study. According to the students, the performance requirements also increased enormously. (Ledermüller et al., 2020) Students complained that lecturers did not properly assess the additional workload. (Schwab et al., 2020b) The amount of work, according to the ECTS foreseen for the course, was often rated as too high. (Prietl, 2021; ÖH Universität Salzburg, 2020) In April 2020, 69% of students at the University of Graz stated that they were not able to complete the amount of ECTS as planned. In a later survey (July 2020), this number was reduced to 46%. (Dorfer et al., 2021)

In the survey of Zick, 2020, it was noticed that the effort for students from universities was easier to manage than for students from universities of applied sciences. The learning effort was also higher for students from universities of applied sciences. (Zick, 2020) Not all surveys showed that the workload was much higher, at some universities the workload was almost the same as in face-to-face teaching. (Weinzettl and Koglbauer, 2021) Almost 70% of the students at the University of Teacher Education Carinthia stated that the workload corresponded to the ECTS. (Albaner et al., 2020) Some surveys came to the conclusion that the workload did not change (Hajek and Kernecker, 2020; Fachschaft::Architektur, 2020) and they did not complete less ECTS than expected (Kremer et al., 2021). Figure 2.12 shows the number of surveys where the majority of the students reported a higher workload or the same workload as before.

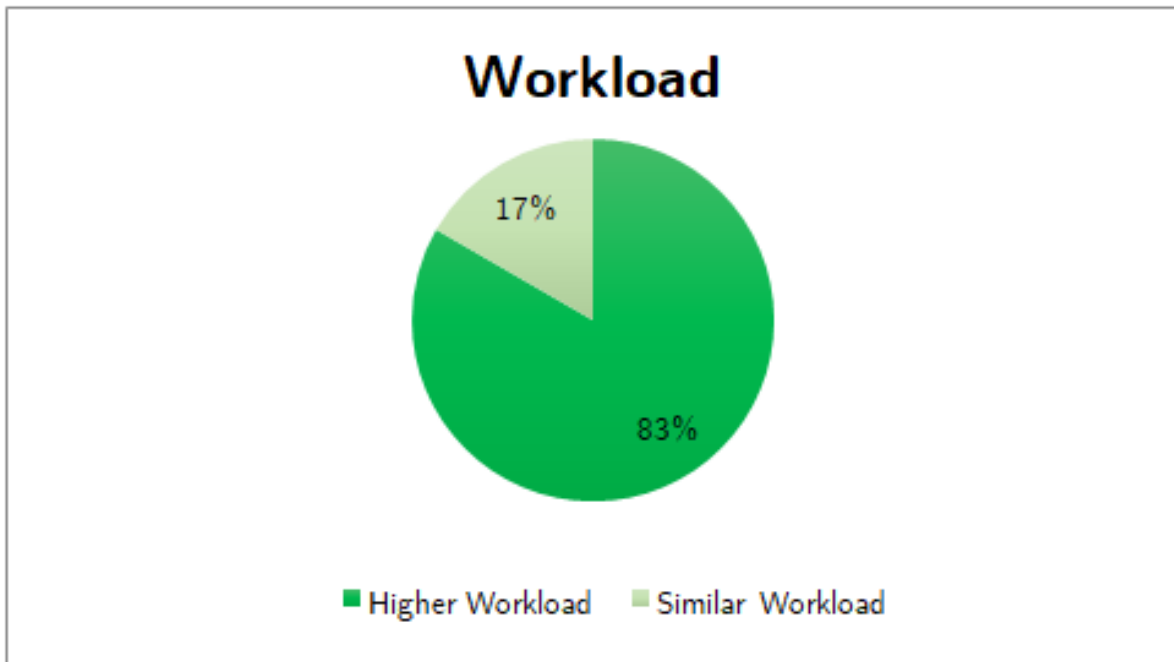


Figure 2.12: Overview of the Perceived Workload of the Students (n=18)

Many of the respondents stated that their studies would be delayed by distance learning. (Fachschaft::Architektur, 2020; Dorfer et al., 2021; Zick, 2020) There was a time disadvantage due to postponement of courses, the inability to complete internships or study abroad and graduation disabilities. (Hajek and Siegl, 2021; FH Oberösterreich, 2020) Other reasons for the delay were the postponement or cancellation of exams, difficulties in concentrating during learning, limited access to literature, unclear performance requirements (Dorfer et al., 2021) and lack of motivation for self-studying (Ledermüller et al., 2020). Especially at the beginning of the home learning, the fear of delaying studies was high. In the end the number of students who reported delayed studies was not high as expected. This is shown by surveys conducted by the University of Graz. In April 2020, almost 77% were of the opinion that their studies would be delayed. In a later survey (July 2020), 53% were of this opinion. By February 2021, the number of students reporting an actual delay had fallen to about 42%. (Dorfer et al., 2021) A similar situation can be observed at the Vienna University of Economics and Business. (ÖH WU Wien, 2021) Figure 2.13 shows in chronological order nine surveys in which students answered yes or partly yes to the question whether they have/will have a delay in their studies. It can be seen that all the surveys with a result above 50% were conducted at the beginning of the pandemic. As time went on, the number became smaller. All surveys conducted after the first distance learning semester showed results below 50%.

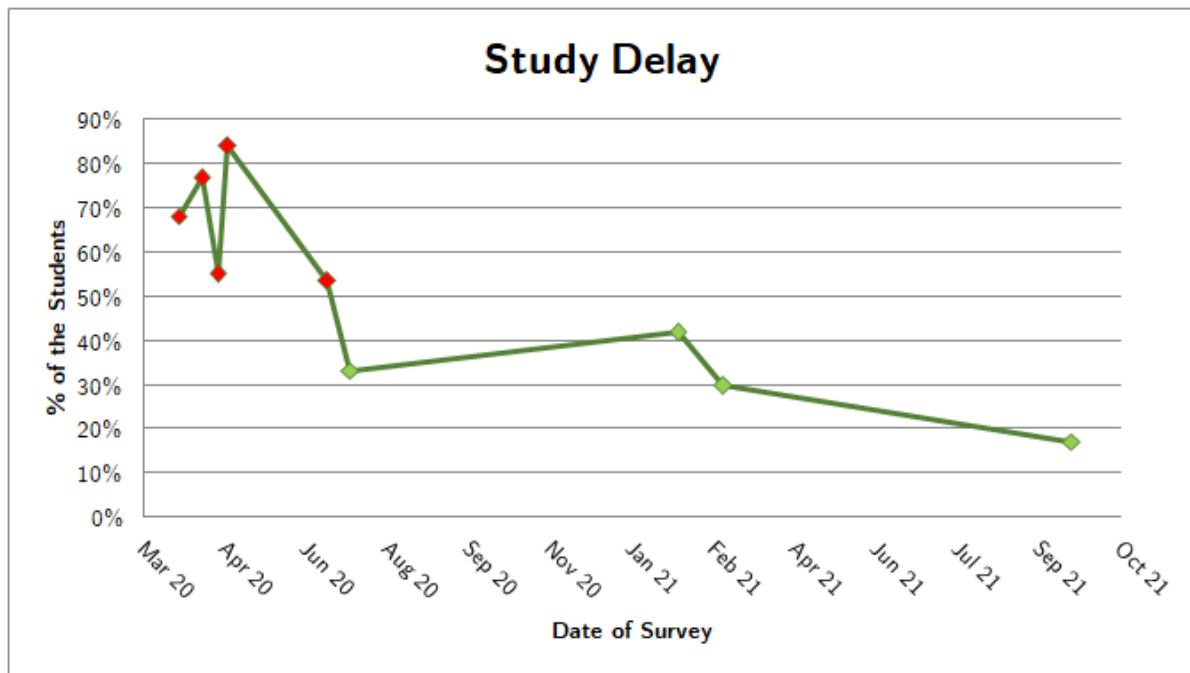


Figure 2.13: Overview of Surveys where Students were Confronted with a Study Delay (n=9)

In addition to students, the lecturers also had a considerable amount of additional work. (Boyer and Preis, 2021; Weinzettl and Koglbauer, 2021; Staab, 2021; Campus02, 2020; Ledermüller et al., 2020; Schwab et al., 2020b; Dorfer et al., 2021; Baerwolf and Mitterauer, 2021) Preparing the materials for self-study required more effort. Synchronous contact with the students was low, but the pre- and post-supervision was important, especially answering the students' questions took a lot of time. (Ledermüller et al., 2020; Baerwolf and Mitterauer, 2021) Most of the teaching materials had to be newly created or adapted. (Baerwolf and Mitterauer, 2021)

In summary, it can be seen that many surveys indicated that the workload for students was often too high or higher than before the COVID-19 pandemic. Many students completed less ECTS than before. Therefore this was the main reason for delays in their studies. It seems that the high effort for the teachers in the sudden shift to distance learning was a reason for the high amount of work for the students. The lecturers had more work due to adaption and creation of learning material. At the beginning of the pandemic, the fear of study delays was very high but often these worries were unfounded. In later surveys less students reported about study delays.

## 2.9 Distance Learning in the Future

Students' wishes for the future of distance learning reflect the main challenges and benefits described in the previous chapters. They would like to see lectures with lower

workload, more direct contact with lecturers, direct feedback, more live lectures, recorded videos, regular meetings and high-quality learning materials provided in a timely manner. They would also like lectures to be streamed live after the COVID-19 pandemic to preserve the time advantage of distance learning. (ÖH Universität Salzburg, 2020) The students said they want more exam dates and places in the future. (Fachschaft::Architektur, 2020)

The students missed the classroom teaching very much (Schober et al., 2020e) and they judged the pure home learning in the next study year as negative. (Schober et al., 2020g) It is noticeable that students rated the continuation of distance learning in the next semester negatively when social integration, well-being and learning success were low. (Schober et al., 2020g) Furthermore, students want more detailed information about the course for the next semester and were concerned about their progress and health. (Schober et al., 2021b) Better communication would also be important for the future. (Stabsstelle Qualitätsmanagement der BOKU, 2020)

Many students expected more information from the university about how to proceed (Hajek and Siegl, 2021) and about the opening of the libraries (Hajek and Siegl, 2021; ÖH Universität Salzburg, 2020). Therefore, students would like to see more digitization of libraries in the future (Bork-Hüffer et al., 2021) and more face-to-face teaching (Hajek and Siegl, 2021; Bork-Hüffer et al., 2021; Stabsstelle Qualitätsmanagement der BOKU, 2020), especially for courses that require discussions and group work (Kremer et al., 2021). Online teaching would be useful for short meetings or for lectures which take place in the evening. (Campus02, 2020) The number of students who only wanted distance learning in the future was very small. (AktionsGemeinschaft, 2020; ÖH JKU, 2020b; Kremer et al., 2021; Dorfer et al., 2021) For example, a survey by the University of Graz shows that only 3% of students would like to see pure online teaching in the future. (Dorfer et al., 2021) Exams should only take place directly at the university. Only oral exams can be conducted well online. Nervousness and the fear of technical problems were too high for written online exams. (Campus02, 2020) But there were also some students who would still like to have exams online. (Bork-Hüffer et al., 2021)

In many studies, students indicated that they would like to see more digital teaching in the future, in addition to face-to-face teaching. (Fachschaft::Architektur, 2020; AktionsGemeinschaft, 2020; Staab, 2021; Campus02, 2020; ÖH JKU, 2020b; Kremer et al., 2021; ÖH JKU, 2020a; Stabsstelle Qualitätsmanagement der BOKU, 2020; Verein Pilotprojekt, 2021; ÖH Uni Wien, 2020; Dorfer et al., 2021) This could be well implemented through blended learning or flipped classrooms. (Dorfer et al., 2021) Blended learning is preferred by many students to purely online teaching. (Kremer et al., 2021; Rührnößl, 2022) Many students would like to see more investment in digital teaching. Especially live streams, recorded videos and online teaching materials were desired in the future. (ÖH JKU, 2020b, 2020a; Bork-Hüffer et al., 2021; Dorfer et al., 2021) At the University of Innsbruck, 93% of the students want online access to all teaching materials. In addition, half of the students would like to be able to study remotely. (Bork-Hüffer



et al., 2021) The majority of lecturers would also like to hold more synchronous online lectures in the future, as they also saw many advantages for the students and had good personal experiences. (Campus02, 2020; Kremer et al., 2021; Dorfer et al., 2021) Even a survey conducted before the COVID-19 pandemic showed that students were open to new digital offerings and wanted more lecture recordings and digital offerings. The majority rejected online-only teaching. (Malacek, 2020)

Teachers are of the opinion that pure on-site teaching will not be the future. Often resources such as lecture halls are scarce, so additional online teaching would be very helpful in the future. (Campus02, 2020)

In the future, it will be almost impossible to teach without digital teaching, and students will increasingly demand it. For students, neither pure online teaching nor face-to-face teaching is conceivable. A good mix of both, such as blended learning, will be the future of teaching and learning. Asynchronous methods such as online learning materials and recorded videos will be particularly important in universities. This has implications not only for students, but also for lecturers. It will be increasingly important for them to adapt their courses and continuously improve their digital skills.

## **2.10 Summary and Lessons Learned**

The COVID-19 pandemic had a significant impact on universities, and distance learning permanently changed the way we study. The way courses are delivered and exams are taken has changed significantly and opens the door to new teaching methods for the future. Extensive changes for teachers and learners led to many uncertainties and challenges, but there were also some benefits.

The switch to distance learning was especially easy for students at universities of applied sciences. Many students were satisfied with the switch to online learning. After comparing many different studies, it is clear that the quality of distance learning depended very much on the university and the teacher. Some managed the rapid change very well and tried to implement the teaching well, others did not adapt the courses to the new situation. These courses were not well received by students. Many studies showed that self-study of lecture notes and pure self-education were not sufficient for good teaching. Live streams, lecture recordings, Q&A sessions and online meetings were well received and will be increasingly requested in the future. In particular, students found it useful to be able to watch and re-watch videos to better understand the content. It would be useful to keep these recordings for the future, as they can help students in their learning. Blended or hybrid learning approaches would be appropriate. Pure online teaching was not desired by many students, a good combination with face-to-face teaching would be useful.

The use of helpful tools such as learning management systems and video conferenc-

ing tools were well received by students and they would like to see this continue. In particular, tools that students were already familiar with, were helpful in coping with distance learning during the pandemic. Further digitization of universities will be essential in the future, especially the digitization of libraries is long overdue. The closure of libraries and study areas hit students hard. Above all, students missed meeting other fellow students, learning together and social contact. As a result, the transition was very difficult for them and their motivation to study alone at home was low. Some teachers and students lacked the technical know-how to use different tools and not all of them had the necessary software and hardware at their disposal. Distance learning required a good internet connection and sufficient data volume. For exams it was necessary to have a stable internet connection, cameras, microphones and a suitable working place. Some students had difficulties, because they could not work undisturbed at home. This depended very much on their living situation. Fear of technical problems was a major challenge, especially during exams. These fears were mostly unfounded, but often led to stress and nervousness. Some examination formats were well received by the students, but they would like to see face-to-face examinations in the future. This again shows that online teaching is useful as a complement, but not in itself.

In addition to the challenges, there were also some advantages for the students. The resulting flexibility in terms of time and place was seen as very positive by many students. The time saved by not having to travel was also frequently mentioned as a benefit. The organization of the study day was sometimes seen as an advantage and sometimes as a disadvantage. Furthermore, some students reported that their studies progressed more quickly as a result of the flexibility and many reported that their studies progressed slower. These results again show that satisfaction is highly dependent on the university and the teachers.

From the available results, it can be concluded that for students, good distance learning consists mainly of the following points:

- **Communication & Information:** Sufficient information about the organizational and performance requirements at the beginning of the semester is essential. Lecturers should also be available to answer questions, for example through Q&A sessions, regular online meetings or a Q&A forum. It is important for students to be able to contact their teachers if they have any problems or questions.
- **Adequate Workload of Lectures:** The workload should be appropriate for online teaching and should not be higher than for face-to-face teaching. Too much workload leads to stress and a lack of motivation.
- **Use of Tools and Video Recordings:** Scripts alone for self-study are not enough, live streams with interaction or recorded videos are very useful. Videos can be replayed over and over again, helping students to learn the content of the lecture. The availability of video recordings also gives students a lot of flexibility.

- **Exams:** Sufficient examination dates, exam seats and time to complete assignments are essential. Examination modalities need to be communicated well in advance.

Online teaching will permanently change the future and bring many advantages for students and teachers.

### 3 Situation in Schools During Distance Learning in Austria

This chapter discusses surveys on the experiences of school principals, teachers, pupils and their parents with distance learning at schools in Austria. 68 surveys from different schools and school types are compared and the main results are presented.

As mentioned above, the surveys were conducted in a variety of schools of different types. The majority of the studies discussed were carried out in different schools. As shown in figure 3.1, 65% of the surveys were conducted at more than one type of school, followed by 16% where only people from middle schools (lower secondary schools) were questioned. These schools are attended by pupils from school level five to eight, aged between ten and 14. (Bundesministerium Bildung, 2023b) 7% of the surveys were conducted with people from the lower and upper secondary schools (AHS), where the pupils are between ten and 18 years old and in the fourth to twelve school level. There were also surveys in primary schools (first to fourth school level, ages six to ten) and in vocational high schools (after compulsory education). There were no surveys from other secondary schools (e.g. BHS).

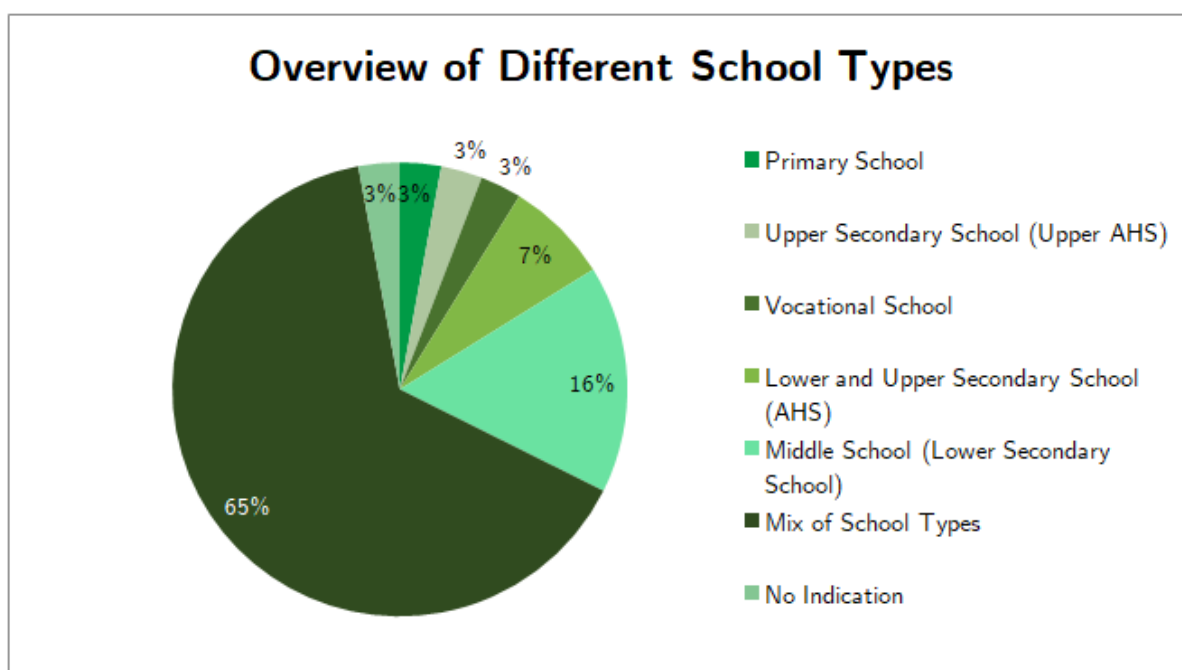


Figure 3.1: Overview of Different School Types (n=68)

In the schools, not only pupils were asked about their experiences with distance learning. As shown in figure 3.2, very often parents and teachers explained their views and opinions on home schooling. Pupils were interviewed in 29% of the cases. Parents were interviewed in 36% of the surveys and teachers in 31%. There were also a few surveys that focused on school principals.

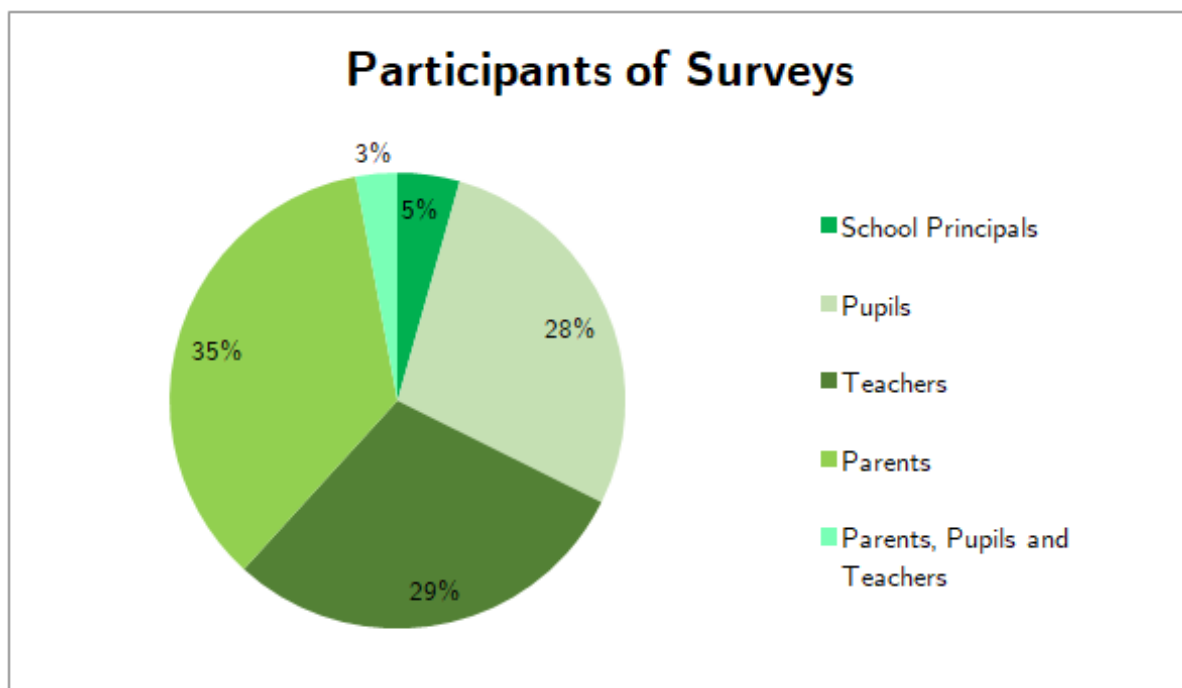


Figure 3.2: Overview of Participants (n=68)

As figure 3.3 shows, 25% of the surveys had less than 100 respondents. The same number of surveys had between 100 and 500 participants. This is closely followed by surveys with 500 to 1000 participants. More than 3000 people took part in 12% of all surveys. For 7% no information was given on the number of participants.

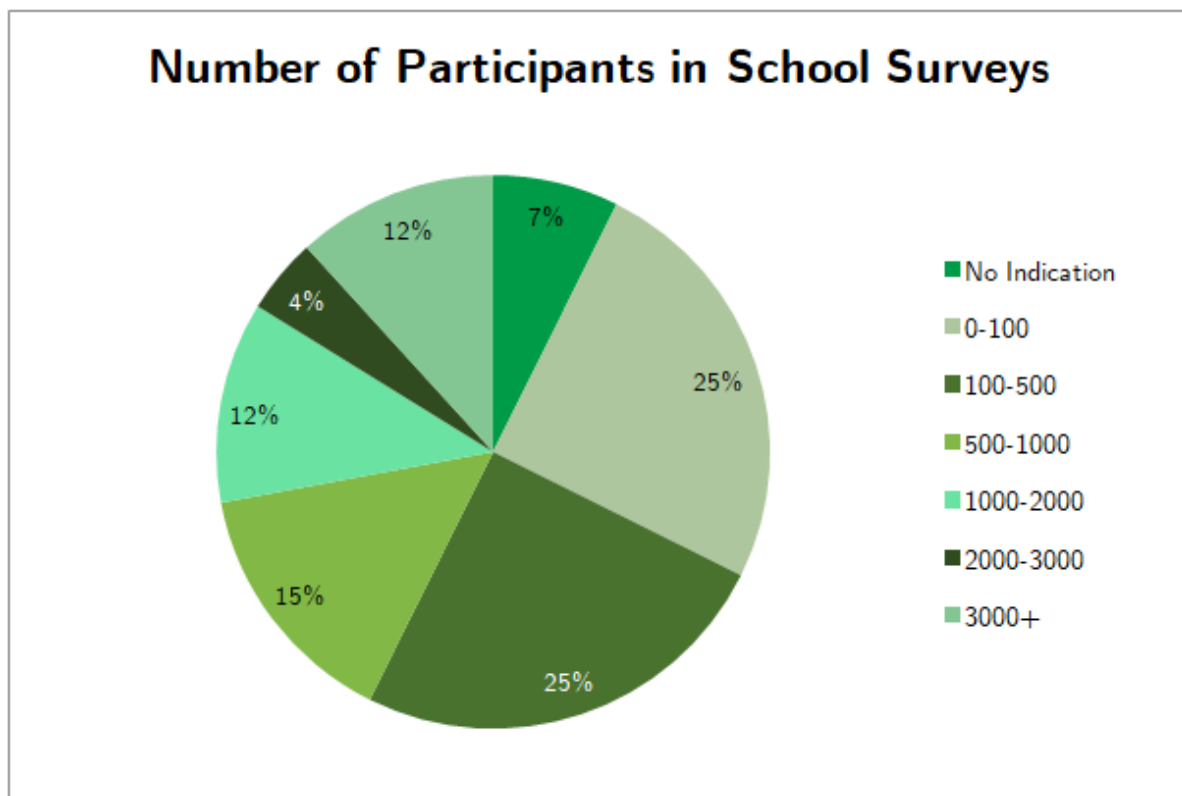


Figure 3.3: Overview of the Number of Participants (n=68)

The main topics of the school surveys are listed in table 3.1. Most often the surveys contain questions about the general situation during the COVID-19 pandemic. The equipment, workload, communication were also often discussed topics.

Main Topic	Number of Surveys
General Situation	37
Equipment	26
Workload	22
Communication	22
Future	20
Tools	20
Psychological Impact	17
Disadvantages	17
Support by Parents	15
Teachers	12
Advantages	12
Methods	12
Disadvantaged Children	11
Assignments	11
Learning Loss	8

Digital Skills	8
Strains Family	6
Working Place	5
Digital Skills Teachers	5
Performance Assessment	4
Childcare	2

Table 3.1: Overview of Main Topics in School Surveys (n=68)

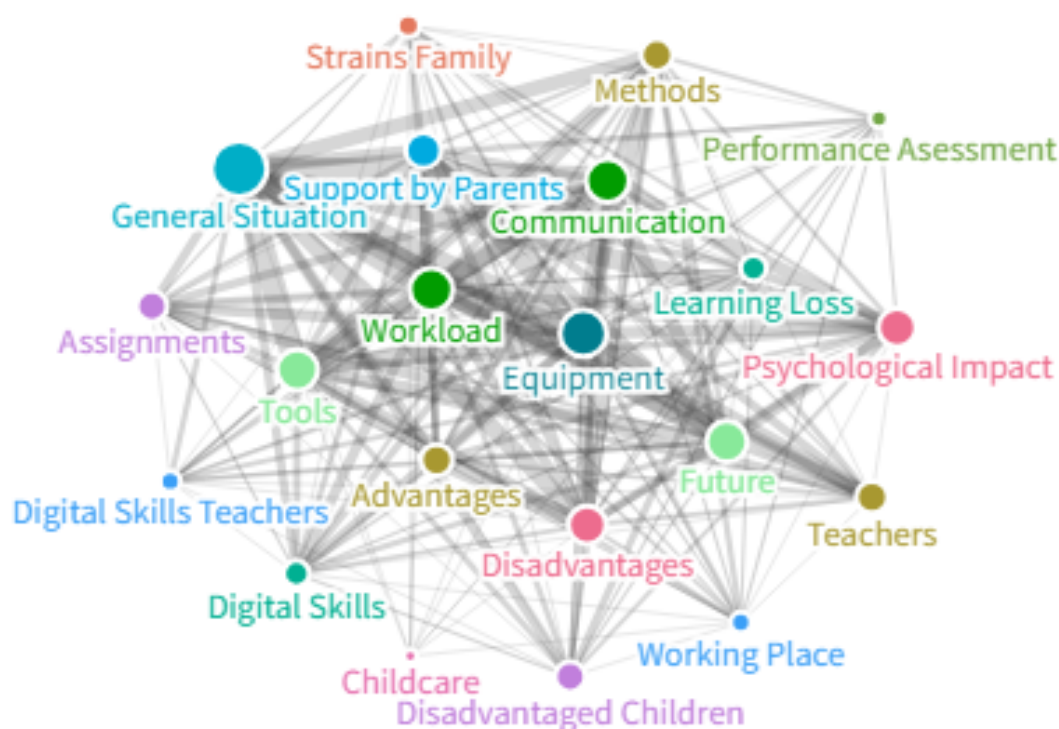


Figure 3.4: Different Topics of School Surveys Displayed as Network Graphic (n=68)

Figure 3.5 shows a timeline of all the surveys conducted in the schools. It can be seen that most of the surveys were conducted after the first and the second lockdown. In figure 3.6 it can be seen that 43 surveys were made in the first year of the pandemic in 2020. There are also 14 surveys from 2021 and three surveys from 2022. For eight surveys there was no indication of when the survey was conducted. Most surveys were done in May 2020, November 2020, and December 2020. For 12% there was no information on when the survey data were collected.

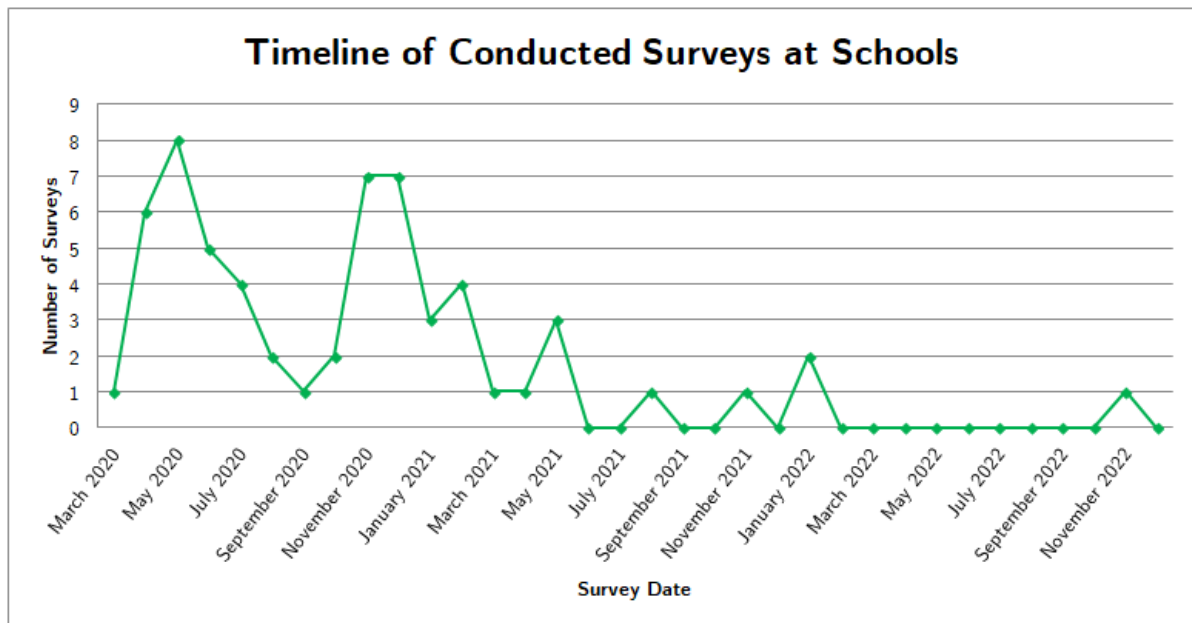


Figure 3.5: Timeline of the Different Studies (n=60)

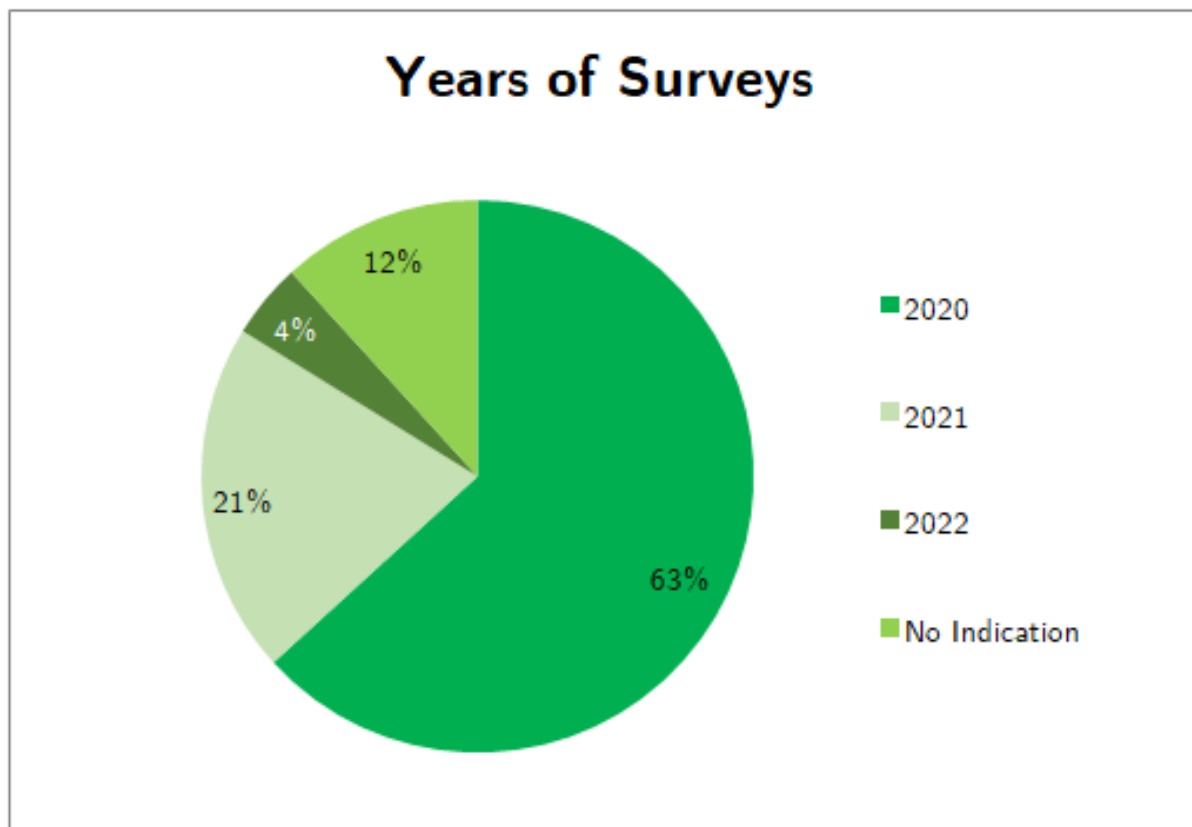


Figure 3.6: Overview of the Years of Surveys (n=68)



As figure 3.7 shows, almost all the surveys were quantitative online surveys, there were only six interview surveys. One survey did not specify how the survey was conducted.

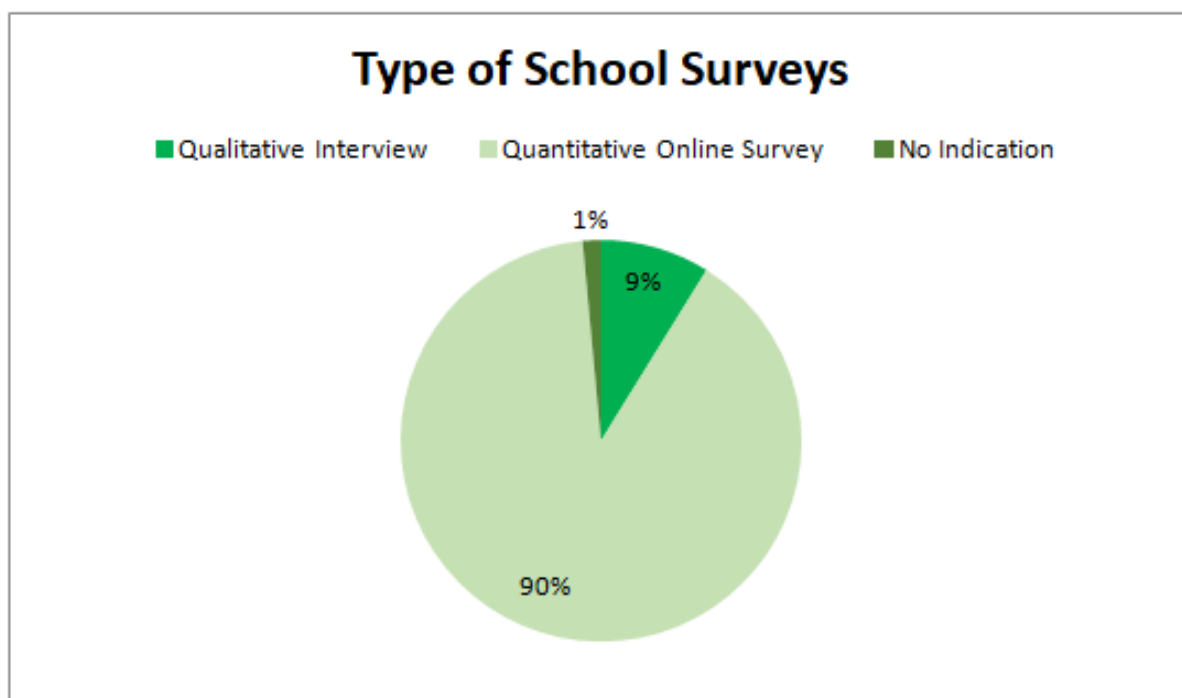


Figure 3.7: Overview of the Different Types of School Surveys (n=68)

### 3.1 General Situation and Experiences During the Switch to Distance Learning

The first chapter explains the satisfaction with home learning, the general situation and how pupils, parents and teachers perceived the change to distance learning.

Overall, many respondents rated the distance learning well and most of them were at least partially satisfied. (Anderl and Larcher, 2020; Gymnasium Feldkirch, 2020; MS Breitenbach, 2020; NMS Tux, n.d. LVEV, 2020; Tengler et al., 2021; Klema, 2020; Saurer, 2020; Schreiner et al., 2020; Schwantler, 2021) Students reported that the online learning worked better in the second lockdown than in the first. (MS Breitenbach, 2020) Figure 3.8 shows how many people rated the distance learning well or partly well (school grades one and two). The results show an average satisfaction of 66%. Many people were satisfied with the format, but there were also three surveys where satisfaction was not good (<50%). The survey by Tech for Austria, 2020, shows poor results. This is a survey done with teachers of schools for pupils with social and learning difficulties, who had many problems with distance learning. In the survey by MKV, 2021, which also interviewed teachers, the transition was rarely rated as very good and often as good or average. The worst result came from the survey by MKV, 2021. In this survey, too,

distance learning was mostly rated as mediocre (grade 3). Reasons for the poor rating were the lack of preparation, the lack of technical equipment for teachers and pupils, and the lack of technical know-how on both sides. (Schwantler, 2021)

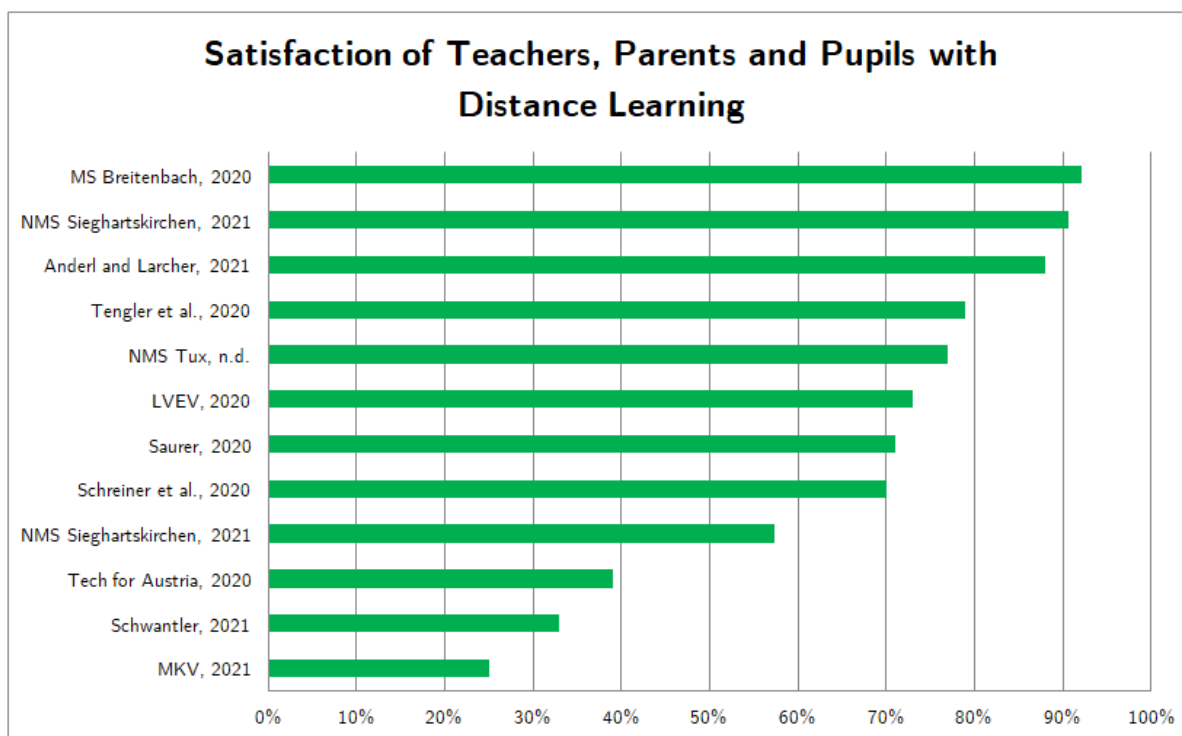


Figure 3.8: Overview of People who Rated the Distance Learning Well or Partly Well (n=12)

Most of the pupils wanted return to school quickly (Schreiner et al., 2020), because they coped better with face-to-face teaching than with distance learning and they understand the assignments better (Kröll, 2022). In addition, for many pupils, learning at home was much more difficult than the normal school lessons. (Sieberer, 2021) Many parents stated that they believed their children would have learning difficulties when the schools reopen. This opinion became stronger the longer the pandemic lasted. (Schnell and Larcher, 2021)

The quality of online teaching was often rated as poor to mediocre. In the survey by Helm and Postlbauer, 2021, almost one of three parents stated that they were not satisfied with the online teaching. 39% evaluated it as medium and 37% were not satisfied with the activities of the school. In the survey of Holtgrewe et al., 2020a 55% of pupils said they liked home schooling, but a third felt overwhelmed. The older the pupils, the less they missed the school. These results confirm that distance learning was particularly difficult for younger children.

Despite the sudden change to home teaching, most teachers coped well with the new

teaching format. (LVEV, 2020; Saurer, 2020) Many teachers learned more about digital media through self-study and online tutorials. They also made use of online training opportunities. (Tengler et al., 2021; Kämpf and Winetzhammer, 2020; Jungmeier, 2020) This was confirmed by the survey of school principals, many teachers had trained themselves in media and how to plan their classes, but they also received information material from the school. (Jesacher-Rößler and Klein, 2020) Nevertheless, further training in online teaching and data protection for teachers will be needed in the future. (LVEV, 2020) Especially in the area of standard tools, software, programs and digital teaching methods, further training for the teachers will be needed. (OGM, 2021)

In addition to teachers, pupils and parents, school principals were also questioned about distance learning. They stated that they did everything possible to ensure that pupils completed the school in the usual way and that their performance did not deteriorate. They also said that disadvantaged pupils were given support to ensure that they did not fall behind in their learning. (Jesacher-Rößler and Klein, 2020) The opinion of teachers in other surveys showed that this plan did not work very well, which will be discussed in detail in chapter 4.3.

Overall, satisfaction with distance learning was relatively high and the transition was manageable for many pupils, teachers and parents, but there were many challenges. This will be discussed in the next chapter.

## **3.2 Advantages and Disadvantages of Distance Learning in Schools**

This chapter is about the positive and negative aspects of distance learning. There were many challenges for students, teachers and parents but there were also some advantages. In contrast to the results of the university students, the pupils and parents found more negative aspects. University students are much more used to independent learning than pupils, so self-organized learning was easier for them.

The teachers' commitment and efforts were mentioned very positively. (Gymnasium Feldkirch, 2020; Saurer, 2020; Sieberer, 2021; OGM, 2021; Schwab et al., 2020a) Parents indicated that most teachers tried to respond quickly to pupils despite the difficult situation. (Schnell and Larcher, 2020) Accessibility and communication with teachers was mostly rated as good. They were available to answer questions and gave regular feedback to the pupils. (Gymnasium Feldkirch, 2020; MS Breitenbach, 2020; NMS Tux, n.d. Helm and Postlbauer, 2021) Nevertheless, this communication was a challenge for many pupils as it was often not possible to ask questions directly. (Schober et al., 2020b) However, there were exceptions. In Schnell and Larcher, 2020, 22% felt that the teachers did not make an effort, especially teachers in the upper classes. Some parents stated that they did not feel well supported or only partially supported. In the survey by LVEV,

2020, the lack of supervision and feedback was the biggest challenge for the children.

Another challenge, as for the university students, was the lack of personal social contact with other children. (Gymnasium Feldkirch, 2020; Tengler et al., 2021; Saurer, 2020; MKV, 2021; Kröll, 2022; Sieberer, 2021; Helm and Postlbauer, 2021; Holtgrewe et al., 2020a; Kämpf and Winetzhammer, 2020; OGM, 2021; Schwab et al., 2020a; MS Schwanenstadt, 2021; Schober et al., 2020d, 2020f, 2021a; Trültzsch-Wijnen and Sturm, 2021; Ziegler, 2020) They missed contact with friends and learning with others. (Holtgrewe et al., 2020a) Children often used some digital tools such as WhatsApp to communicate frequently with classmates or other children, but this could not replace face-to-face contact. (Kämpf and Winetzhammer, 2020) They also missed spending time away from their family. (Holtgrewe et al., 2020a) Despite the many challenges, some say that the family has grown closer during this time. (Schober et al., 2021a)

There were some students who did not have the necessary technical equipment and a sufficient internet connection to participate properly in distance learning. (Schwantler, 2021; Tech for Austria, 2020; MKV, 2021; Sieberer, 2021; Kämpf and Winetzhammer, 2020; Jesacher-Rößler and Klein, 2020; Schwab et al., 2020a; Schober et al., 2021a; Trültzsch-Wijnen and Sturm, 2021; Ziegler, 2020; NMS Sieghartskirchen, 2021a, 2021b; Elternverein Paulinum, 2020; Steiner et al., 2021; Jekel et al., 2020) Single platforms were mentioned positively and tools such as MS Teams worked well. (Gymnasium Feldkirch, 2020) The use of many different platforms at one school was often mentioned negatively. (LVEV, 2020; Schwab et al., 2020a; Schober et al., 2020b; Jekel et al., 2020) Children's digital skills improved through distance learning. (Tengler et al., 2021; Schwantler, 2021; MKV, 2021; Kämpf and Winetzhammer, 2020; Jungmeier, 2020; OGM, 2021; Schober et al., 2020b; MS Schwanenstadt, 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020; Spiel and Holzer, 2020; Schwab and Lindner, 2020; Burtscher-Mathis and Häferle, 2022) The improvement of digital competences will be very helpful for children in the future. (OGM, 2021; Schober et al., 2020b)

Positive aspects of online learning were that children gained more autonomy, self-determination and self-regulation. They also became better at organizing their school activities. (Tengler et al., 2021; Schwantler, 2021; MKV, 2021; Kämpf and Winetzhammer, 2020; Jungmeier, 2020; OGM, 2021; Schwab et al., 2020a; Schober et al., 2020b; MS Schwanenstadt, 2021; Ziegler, 2020; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020; Spiel and Holzer, 2020; Schwab and Lindner, 2020; Burtscher-Mathis and Häferle, 2022; MKV, 2020) A few times the pupils also mentioned positively that they could sleep longer (Kämpf and Winetzhammer, 2020; Schwab et al., 2020a; MS Schwanenstadt, 2021; Schober et al., 2020d; Ziegler, 2020), that they saved time by not having to travel to school (OGM, 2021; Schwab et al., 2020a) and that they could manage their own time (Tengler et al., 2021; OGM, 2021; MS Schwanenstadt, 2021; Ziegler, 2020; Burtscher-Mathis and Häferle, 2022). The free time allowed each child to learn and work at their own pace. (Tengler et al., 2021; OGM, 2021; Schwab et al., 2020a; Schober et al., 2020d; Ziegler, 2020; Holtgrewe et al., 2020b) In addition, the parents were able to gain a deeper insight

into the children's learning, assignments and learning material during their shared study time. (Tengler et al., 2021; Kämpf and Winetzhammer, 2020; Schwab et al., 2020a)

Pure self-study was also viewed negatively by pupils, as it was by university students. If the lessons were not adapted to the online mode, this was rated very negatively. More live teaching was therefore desired. (Gymnasium Feldkirch, 2020) Another disadvantage was the large amount of time spent on the assignments. The respondents of ten surveys reported that the workload was often very high (Gymnasium Feldkirch, 2020; LVEV, 2020; Tengler et al., 2021; Kröll, 2022; Holtgrewe et al., 2020a; MS Schwanenstadt, 2021; Schober et al., 2020f; NMS Sieghartskirchen, 2021a; Elternverein EBG Hollabrunn, 2021; Hinterberger and Matic, 2020) and often higher than before (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020). Parents would therefore like to see a better coordination between teachers. (Gymnasium Feldkirch, 2020; LVEV, 2020; Schwab et al., 2020a) Teachers indicated that they communicated a lot with colleagues and were often in contact through virtual meetings. (Trültzsch-Wijnen and Sturm, 2021)

Teachers reported that they noticed a decline in pupils' performance. They also observed that pupils and parents were overwhelmed, parents often more than children. (Anderl and Larcher, 2020) Distance learning required parents and pupils to reorganize their daily routines. Although self-organization was often seen as positive, many children and parents found it difficult to organize the school day themselves. (Tengler et al., 2021; Schreiner et al., 2020; Helm and Postlbauer, 2021; Jesacher-Rößler and Klein, 2020; Schwab et al., 2020a; Schober et al., 2020b, 2021a; Elternverein Paulinum, 2020; Steiner et al., 2021; Burtscher-Mathis and Häferle, 2022) In addition, planning and organizing tasks took a lot of time. (Tengler et al., 2021) Time management was also a challenge for some pupils. (Gymnasium Feldkirch, 2020) Teachers reported that it was difficult for children and parents to keep an overview of assignments. (Trültzsch-Wijnen and Sturm, 2021) As a result, many children were overwhelmed. (Saurer, 2020; Tech for Austria, 2020; MKV, 2021; Kröll, 2022; Helm and Postlbauer, 2021; Holtgrewe et al., 2020a; Schwab et al., 2020a; Holtgrewe et al., 2020b) After the first opening of the schools, the joy of learning returned. (Holtgrewe et al., 2020b)

Children's mental health also worsened because of nervousness, irritability, anxiety and loneliness. (Anderl and Larcher, 2020; Schober et al., 2021a) Every fourth child was more irritable or anxious because of the pandemic. (Anderl and Larcher, 2020) Many pupils feared that online lessons would be too difficult for them and were nervous about participating in online activities. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) Some pupils were afraid of not being able to meet the requirements and therefore feared high pressure to perform which resulted in them being overwhelmed. (Schober et al., 2020f; Schwab and Lindner, 2020; Schwab et al., 2021) There was often a lack of motivation (Tengler et al., 2021; Jesacher-Rößler and Klein, 2020; Schwab et al., 2020a; MS Schwanenstadt, 2021; Schober et al., 2021a; Trültzsch-Wijnen and Sturm, 2021; Steiner et al., 2021) and concentration to study at home (Schober et al., 2021a), especially among the secondary pupils (Schober et al., 2020f). As a result, the psychological strain on the stu-

dents continued to increase significantly one year after the start of the distance learning. High school students, in particular, studied at home for a very long time, so they lacked social contacts and often felt lonely. This led to listlessness and exhaustion. In general, tiredness, low mood, and sleep problems were health issues for children. Compared to the first lockdown, these problems increased dramatically during the second lockdown. (Schnell and Larcher, 2021) The situation was a great psychological burden for the school children. (Helm and Postlbauer, 2021; Schwab et al., 2020a) Emotional support during this difficult time came mainly from the family, especially from the mothers. (Holtgrewe et al., 2020a; Burtscher-Mathis and Häferle, 2022) Psychological support from school psychologists or support from school workers was hardly more available during distance learning than during normal schooling. (Jesacher-Rößler and Klein, 2020) In addition to mental stress, there was also physical stress due to the long hours spent in front of the computer and the lack of movement. (Schober et al., 2021a; Hinterberger and Matic, 2020) Online activities and the use of digital media increased significantly. (Burtscher-Mathis and Häferle, 2022) The children lacked free time activities and hobbies during the pandemic. (Schreiner et al., 2020; Schober et al., 2021a)

The lack of planning was a major problem for many parents and pupils. Not knowing when the schools open was very stressful for them. (Schnell and Larcher, 2021; Schober et al., 2020f, 2020c) Uncertainty about grades, tests and the completion of school subjects was high. (Schober et al., 2020d, 2020f, 2020c) Uncertainty about the future and what will happen with distance learning was also a burden for many of those involved. (Schreiner et al., 2020; Schnell and Larcher, 2021; Schober et al., 2020f, 2020c) Many felt that the government's decision to close schools was not the right one. (Schnell and Larcher, 2021; Helm and Postlbauer, 2021) In addition to the burden on the pupils, the situation also put a strain on the parents, especially in terms of time and stress. (Gymnasium Feldkirch, 2020; Kröll, 2022; Schnell and Larcher, 2020) Parents often helped their children with the assignments and digital technologies. (Saurer, 2020; Holtgrewe et al., 2020a; MS Schwanenstadt, 2021; Burtscher-Mathis and Häferle, 2022) Almost half of the pupils often needed help from their family. (Saurer, 2020) Combining work and caring responsibilities were very difficult for many parents. (Anderl and Larcher, 2020; Kämpf and Winetzhammer, 2020; Schober et al., 2021a) This often led to overwhelming demands. (Tengler et al., 2021; Schober et al., 2021a) Parents complained that when they had to take on the role of teacher at home, the material was not absorbed as well by the pupils as it was in school. (Tengler et al., 2021; Kämpf and Winetzhammer, 2020)

*"We are not teachers, we are "only" the parents. Everything that teachers teach is better accepted."* (Tengler et al., 2020, p. 8)

In a survey conducted by Anderl and Larcher, 2020, 42% of the parents said that they would not be able to ensure the care of their children in the case of further school closures. (Anderl and Larcher, 2020) The stress of caring for children during school closures was very high. The fact that this stress increased sharply, during the COVID-19 pandemic, can be seen clearly. Before the COVID-19 pandemic, about 9% of parents were

stressed and during the school closures this number increased to 66%. In the months that followed, the percentage dropped sharply and in the second lockdown at the end of 2020, this number increased again to the same level as in the first lockdown. So, especially during the school closures the parents had great difficulties. (Anderl and Larcher, 2020; Schnell and Larcher, 2021) Some had to organize external childcare in order to manage home learning. (Helm and Postlbauer, 2021) Many parents also stated that the school closures led to less time for themselves. (Helm and Postlbauer, 2021)

Often the situation was stressful for the whole family and there was more arguing at home, but most families managed the home education quite well. (Helm and Postlbauer, 2021) Although they often had stress, they grew closer. (Kämpf and Winetzhammer, 2020; Schwab et al., 2020a; Schober et al., 2021a; Burtscher-Mathis and Häferle, 2022) In the survey of Helm and Postlbauer, 2021 almost one in two parents said that the school closures were a great psychological strain for them and that they were at their limit. (Helm and Postlbauer, 2021) From the parents' point of view, it was also difficult to motivate the children, to guide them and to explain the study material. (Tengler et al., 2021; Helm and Postlbauer, 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) They often lacked time and motivation during this difficult time. (Helm and Postlbauer, 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) Another problem was that not all parents had the necessary knowledge about all school subjects and digital tools. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) As a result, some parents, pupils and teachers felt that those pupils whose parents did not have the necessary skills fell behind their peers. (OGM, 2021)

The challenges were also reflected in the children's grades. One in four parents stated that their child's grades in recent tests and schoolwork were at least a little worse than before. 39% would have lower marks in their final school reports than before. (Schnell and Larcher, 2021) Some parents indicated that the situation had been taken into account in marking. (Helm and Postlbauer, 2021) In the survey of Trültzsch-Wijnen and Trültzsch-Wijnen, 2020 more than half of the children and parents were concerned that distance learning will have a negative effect on the pupils. Parents were slightly more concerned about this than the children. Furthermore, 47% were concerned that online learning would have a negative effect on their grades. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020)

Figure 3.9 shows an overview of the benefits of home schooling. The two main advantages of distance learning were that students became much more independent and organized and that they could improve their digital skills. As mentioned above, improved digital competences can be very helpful for a child's future and their further education. Being able to learn at their own pace and manage their own time was also seen as a benefit by the pupils.

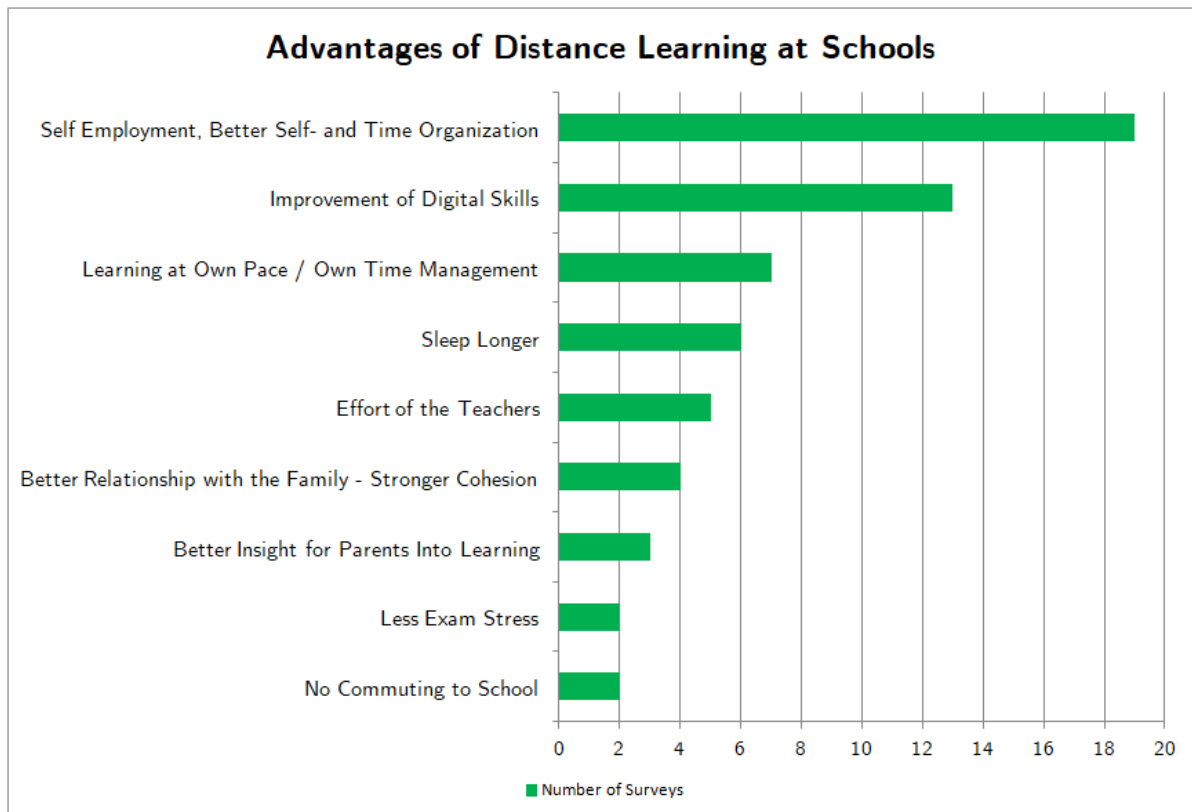


Figure 3.9: Overview of Advantages of Distance Learning Observed by School Children (n=24)

The disadvantages, mentioned by the children and their parents are illustrated in figure 3.10. The main disadvantage was the same as for the university students in the previous chapter. The pupils lacked social contacts the most. This was followed by overload, high stress, high demands, and the heavy burden of distance learning. There were also many pupils who did not have the necessary technical equipment or a good internet connection. Lack of motivation was also a negative aspect of home schooling. As well as the many disadvantages for pupils, there were also challenges for parents such as childcare, stress and problems with learning support. One disadvantage that was often mentioned by teachers was that socially disadvantaged children or children with learning difficulties are even more disadvantaged by distance learning. More on this topic are discussed in the next chapter.



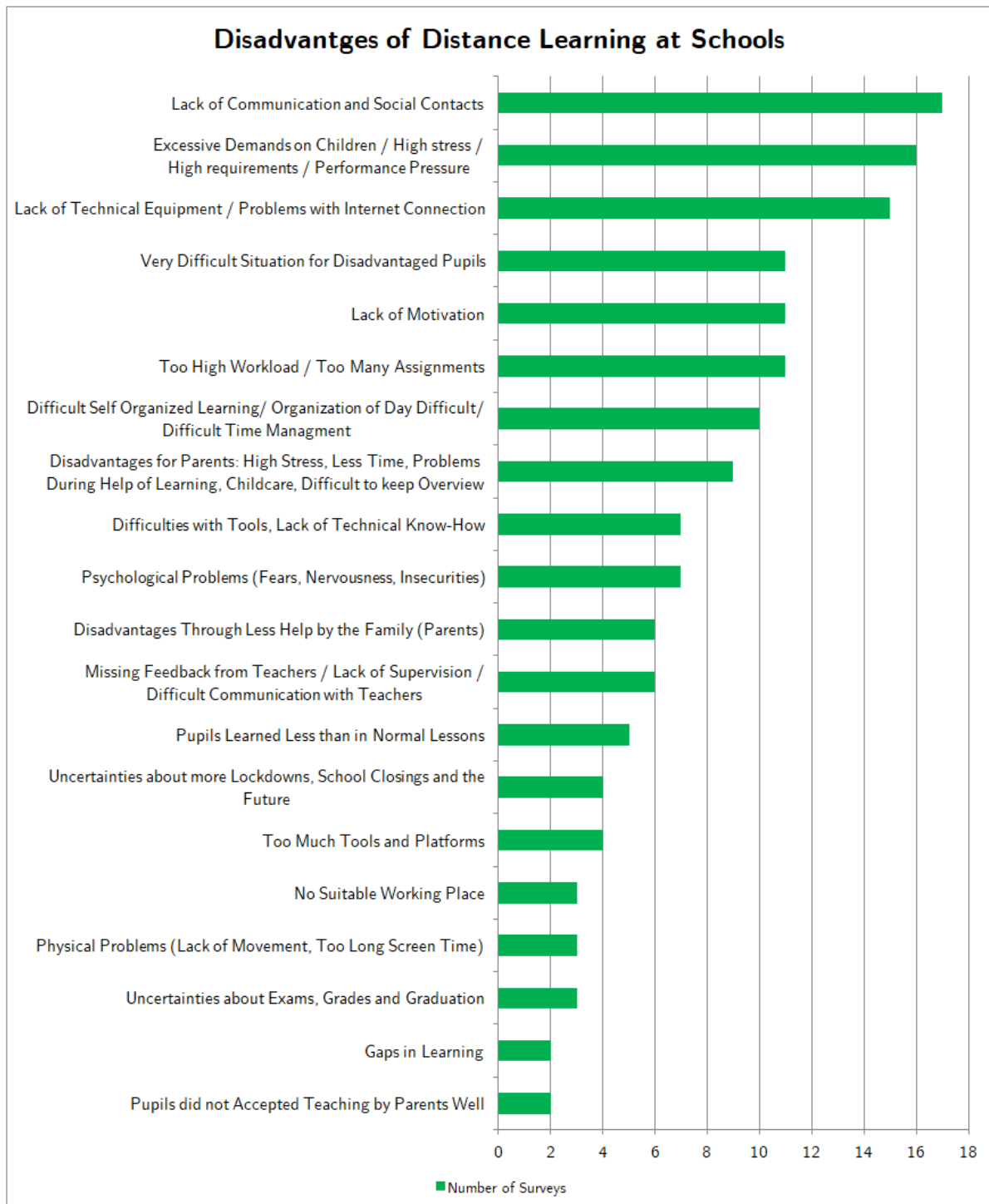


Figure 3.10: Overview of Challenges during Distance Learning reported by Pupils (n=42)

Some of these challenges are described in more detail in the following chapters.

### 3.3 Learning Deficits and Disadvantages of Children with Social and Learning Difficulties

After the pandemic, some teachers' resume was not very positive. The survey of Schwab et al., 2022 showed that 40% of teachers observed that pupils' performance deteriorated. In addition, almost 22% felt that it was difficult for all children to develop a common knowledge base. As a result, many teachers reported that the school closures during the COVID-19 pandemic increased educational inequalities between children. (Schwab et al., 2022) Furthermore, the students learned less in distance learning than in regular classes (Schreiner et al., 2020; MKV, 2021; Helm and Postlbauer, 2021; OGM, 2021; Vollmer, 2020), especially lower-performing children were affected (Helm and Postlbauer, 2021). This problem was already apparent at the beginning of the pandemic and was still a widespread problem more than a year later. That children learned less than in normal face-to-face teaching was mentioned in several surveys from 2020 and 2021. (Schreiner et al., 2020; MKV, 2021; Helm and Postlbauer, 2021; OGM, 2021; Vollmer, 2020)

Overall, eleven surveys showed that disadvantaged children often had problems with distance learning. (Schreiner et al., 2020; Tech for Austria, 2020; MKV, 2021; Ziegler, 2020; Steiner et al., 2021; Jekel et al., 2020; Spiel and Holzer, 2020; Schwab and Lindner, 2020; Hinterberger and Matic, 2020; Schwab et al., 2021, 2022) Most of these surveys were conducted in a mix of school types, but this was observed in both, middle and upper secondary schools. (Schreiner et al., 2020; Hinterberger and Matic, 2020) This shows that the problem occurred in all types of schools. Children were disadvantaged by various reasons, such as a lack of technical equipment (Tech for Austria, 2020; MKV, 2021; Schwab et al., 2020a; Ziegler, 2020; Jekel et al., 2020; Spiel and Holzer, 2020), lack of help from parents (Tech for Austria, 2020; Schwab et al., 2020a; Ziegler, 2020; Spiel and Holzer, 2020), low education of parents or low-performing children (Helm and Postlbauer, 2021). The motivation of disadvantaged children was often low and self-organization was a challenge. (Tech for Austria, 2020) Lack of hardware meant that pupils were often unavailable to teachers. (Tech for Austria, 2020; Steiner et al., 2021; Jekel et al., 2020; Schwab and Lindner, 2020) For example, in the survey of Tech for Austria, 2020, teachers reported that 20% of the children were unavailable to them. Compared to all pupils, the parents of disadvantaged children were about 30% less accessible. Pupils were also less likely to contact teachers when they had questions and were more difficult to reach by computer and telephone. Furthermore, disadvantaged children overall are more stressed than the total of all other children. (Steiner et al., 2021)

It was difficult for teachers to assess how well pupils were doing at home and to support them. This could exacerbate the problems of disadvantaged children and pupils with learning difficulties. Therefore, teachers were not very confident that they could teach the pupils with these problems well (Ziegler, 2020; Spiel and Holzer, 2020) and they were worried about them (Hinterberger and Matic, 2020). Often the disadvantaged children

performed much worse. For example, in the survey of Anderl and Larcher, 2020, teachers reported loss of competence and excessive demands on parents and children. More than twice as many of the disadvantaged pupils were overwhelmed as compared to the normal pupils. (Anderl and Larcher, 2020) The study by Schreiner et al., 2020 confirmed that pupils with lower grades had more difficulties with distance learning. They were often unable to complete the tasks on their own and found it more difficult to study alone at home. The survey by MKV, 2021, also emphasizes that whole populations fall behind in learning because of these disadvantages. The survey by Tech for Austria, 2020, looks into schools with high or very high levels of social stress and shows that these problems are very common there and, therefore, this survey clearly confirms that disadvantaged children are further disadvantaged by distance learning. (Tech for Austria, 2020) Teachers also believe that inequality of opportunity and educational injustice increased by home learning. (Schwab and Lindner, 2020; Schwab et al., 2021) As a result, students often failed in their learning and their skills deteriorated. (Steiner et al., 2021) The teachers' assessment of the educational development of the socio-economically disadvantaged pupils after the pandemic was not very positive. 78% of the teachers thought that it got worse. (Schwab et al., 2022)

In a survey conducted after the last COVID-19 lockdown, when pupils could decide whether to go to school or stay at home for distance learning, the children reported that teachers made negative comments about staying at home. Furthermore, absence was seen as negative cooperation. As a result, the children were put under more pressure to perform and were, therefore, overwhelmed. (LSV Kärnten, 2022) Although this survey cannot be compared with the others, the division into a present and absent group also created social inequalities and many disadvantages for pupils.

In summary, low-achieving and socially disadvantaged children had a very difficult time during the pandemic. Inequalities became more pronounced and they were more disadvantaged. It will be difficult for these pupils to catch up on their learning. In general, it will be a challenge for all involved to bring all pupils back to the same level of knowledge.

### **3.4 Teaching Methods in Time of COVID-19 and Used Tools in Schools**

Teachers implemented e-learning in very different ways. Some used only live lessons, some used a mixture of live lessons and work assignments and some did not use online lessons. Teaching with digital presence was implemented through live teaching, videoconferencing and individual question sessions. (Steiner et al., 2021) In some schools, digital presence times for questions and videoconferencing were mandated by the school and teachers had to have weekly meetings with students to exchange information about the current situation. (Weber et al., 2021)

In the survey by Aigner et al., 2021 the teachers used live and asynchronous teaching most. They also used a lot of video material. In the survey by Trültzsch-Wijnen and Trültzsch-Wijnen, 2020 almost 54% of the children reported that distance learning was implemented with online lessons and additional learning materials. 23% had only online lessons and 20% had no online lessons and no digital tools were used, they learned in different way. 2% reported they had no digital teaching at all. This means that they had neither online classes nor any other kind of education. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) The survey by Trültzsch-Wijnen and Sturm, 2021, where teachers were questioned, gave almost identical results. The different teaching methods were probably due to different levels of knowledge about digital media among teachers. It was noted that older teachers in particular did not have the necessary knowledge and technical equipment to teach online. (Elternverein Paulinum, 2020) The better the technical equipment and knowledge of the teachers was, the better they were able to cope with teaching. (Spiel and Holzer, 2020) The surveys showed that most teachers were able to use the tools relatively well. (Jungmeier, 2020) In many schools there was some online training for teachers to use the tools properly, but about 20% had no further training for teachers. (Weber et al., 2021)

Many parents felt that there was not enough live online teaching (MS Breitenbach, 2020; NMS Tux, n.d. Schnell and Larcher, 2020) although it would be very helpful for the pupils (NMS Tux, n.d.). Many pupils were of the opinion that the online lessons were good. (MS Perg, 2021) Most teachers reported that they used synchronous online lessons one to several times a week. 26% reported that they never used synchronous online teaching. (Trültzsch-Wijnen and Sturm, 2021) The results of the study by Helm and Postlbauer, 2021 on the frequency of online lessons showed that in 22% of the cases there was no live teaching. In 20% of the cases it was almost once a week and only for 29% of the students it was daily. In most cases, students were given tasks to complete. Often there were also educational videos to watch or texts to read. Learning platforms and software were used in most cases. (Helm and Postlbauer, 2021)

Distance learning brought more digital learning platforms, learning apps, WhatsApp groups and online meeting tools into use. (OGM, 2021) Before the pandemic, not many pupils used digital media and were, therefore, not very familiar with the handling. According to the teachers, this was due to the lack of digital equipment in the classrooms. (Kämpf and Winetzhammer, 2020) Students were not trained enough in school to use computers for learning. (Schwantler, 2021) About half of the students were already working with computers before the crisis. (Saurer, 2020) Teachers also had little experience with online teaching before the pandemic, some made learning materials available online, (Saurer, 2020; Schwantler, 2021) used LMS and e-mails. (Saurer, 2020) School principals also confirmed that there was no intensive use of digital technologies and learning activities before the COVID-19 disease. (Weber et al., 2021)

After the start of e-learning, most of the materials were provided through online learning platforms and e-mails were often used for communication. (Tengler et al., 2021;

Saurer, 2020; Helm and Postlbauer, 2021; Schwab et al., 2020a; Schober et al., 2020f; Trültzsch-Wijnen and Sturm, 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020; Weber et al., 2021) The LMS Moodle has been established in many schools. (Saurer, 2020; Jungmeier, 2020; Schwab et al., 2020a) Digital systems such as SchoolFox, WebUntis (Tengler et al., 2021), EduPage (Kröll, 2022) and Skooly were used (Saurer, 2020). Books and exercise sheets were still often used despite online learning. (Tengler et al., 2021; Kämpf and Winetzhammer, 2020; Trültzsch-Wijnen and Sturm, 2021; Steiner et al., 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020; Weber et al., 2021) Some materials had to be collected at schools in paper form. (Helm and Postlbauer, 2021; Steiner et al., 2021) Video conferencing tools such as MS Teams, Skype and Zoom were used for the online lessons (Tengler et al., 2021; Saurer, 2020; Schwantler, 2021; Kämpf and Winetzhammer, 2020; Jungmeier, 2020; Schwab et al., 2020a; Trültzsch-Wijnen and Sturm, 2021; Steiner et al., 2021; Weber et al., 2021) and some teachers provided videos for the children (Schwantler, 2021; Steiner et al., 2021). Learning applications such as Anton (Kämpf and Winetzhammer, 2020; Ziegler, 2020) or Antolin were also used more frequently to motivate the children (Kämpf and Winetzhammer, 2020). For communication, teachers mainly used e-mail, messenger services, telephone and video conferencing tools. (Saurer, 2020; Schwab et al., 2020a; Weber et al., 2021) This result was confirmed by the survey of Weber et al., 2021, online learning platforms were used most often to communicate with pupils, closely followed by e-mail. Video conferencing was the third most used. The same two tools were most commonly used to provide learning materials, followed by paper printouts. For communicating with parents, e-mails were the most used tool, followed by SchoolFox. (Weber et al., 2021) Thus, it can be seen that both digital and analogue media were used in home schooling. (Tengler et al., 2021) Table 3.2 gives an overview of the used tools in schools. The table represents only those tools and platforms that do not yet appear in the university students' tools overview in table 2.3:

Tool Name	Tool Type	Description
EduPage	Learning Management System	Cloud based school management system that combines many features such as messaging between teachers and parents, assigning homework, schedule, grading, curriculum, pupil attendance tracking, room booking, class register and e-learning. This system also provides parents with an overview of the lessons, e.g. through automated messages in case of new grades or absence of students. (edupage.org, 2023)
SchoolFox	Communication	Application to communicate with the parents and for the school organization. The app also offers a video conferencing system and storage in the cloud. (foxeducation.com, 2023)

Skooly	Learning Management System	Skooly is a platform available online or through an app. It is a tool to provide homework to students with integrated chat function. It can also be used as a communication notebook. (Bundesministerium für Bildung, 2023)
Webuntis	Learning Management System	School management system which can be used for lesson planning, attendance tracking, grading, statistics, digital class register and communication. The whole communication between teachers, students and their parents can take place via this tool. (Untis, 2023)
Anton	Learning App	Free learning app for smartphone, tablet or computer. Tasks, exercises and explanations in many school subjects like mathematics, history, biology, german, english or other languages. Teachers can create classes and check the learning progress of individual students. (anton.app.de, 2023)
Antolin	Learning App	Paid smartphone app where students in grades one to four can practice reading. (antolin.westermann.de, 2023)

Table 3.2: Overview of Different Tools used by Schools

In general, the use of most digital tools worked well. (Saurer, 2020; Holtgrewe et al., 2020a; OGM, 2021; Elternverein Paulinum, 2020) Teachers reported that the systems were sometimes overloaded. (Saurer, 2020) In the survey of Trültzsch-Wijnen and Trültzsch-Wijnen, 2020, e-mail, books and worksheets were used by almost every child. The school-provided platform was used by three quarters of the children and platforms not provided by the school by almost 41%. Almost 75% used video chat or video conferencing tools. Almost 70% used messenger applications and 40% used SMS. Telephone calls were used by every fourth child. Teachers at Middle School Sieghartskirchen used Microsoft Teams for distance learning. About 30% of the first school class pupils still had problems with the application. (NMS Sieghartskirchen, 2021a) In the second, third and fourth grades children had fewer problems with Microsoft Teams. (NMS Sieghartskirchen, 2021b) This result confirms again that distance learning was more difficult for younger children.

For most children the handling with the digital technologies was manageable, but some pupils had difficulties. (Schreiner et al., 2020; Holtgrewe et al., 2020a; Ziegler, 2020; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) In this case, the parents had to help them, but using the tools was often a challenge for them too. (Holtgrewe et al., 2020a; Ziegler,

2020; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) The children’s digital skills became much better after the start of online learning, during the first lockdown. (Sieberer, 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) As a result, the pupils were more familiar with the computer during the later school closures. (Sieberer, 2021) For example, in the survey of Trültzsch-Wijnen and Trültzsch-Wijnen, 2020 73% of the children said that their ability to work with videoconferencing tools had improved. 81% of parents felt that their children’s use of digital technologies had improved. They learned to manage files on the computer, print and upload documents, participate in video conferences and work with learning applications. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) Pupils and teachers often found it difficult to know whether information on the internet was correct or not. (Trültzsch-Wijnen and Sturm, 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) Pupils’ awareness of the dangers of the internet was often still seen as problematic by teachers. (Steiner et al., 2021) Furthermore, there were some specific tools that could be used well in the classroom, e.g. a specific geography tool, but pupils and often teachers lacked the technical know-how to use them correctly. (Jekel et al., 2020)

The coordination between the teachers was sometimes mentioned as negative. (LVEV, 2020) The reason for this was that there was no time for coordination at the beginning of the pandemic because of the sudden change to distance learning. (Steiner et al., 2021) Teachers used many different approaches to interpret distance learning. Therefore they used many different tools and platforms. (LVEV, 2020; Kröll, 2022; Schwab et al., 2020a; Schober et al., 2020b) This variety of tools made communication difficult for parents and their children. (LVEV, 2020; Schober et al., 2020b) Furthermore, it often led to coordination difficulties and it was hard to keep an overview. In the survey of OGM, 2021, half of the pupils stated that there was one communication tool in use. 35% used two or three different tools. (OGM, 2021) In the second lockdown the number of applications used decreased. (Schober et al., 2020f) The survey of Schober et al., 2020f showed that 80% of teachers used a maximum of two different platforms. The wide range of tools made it difficult for teachers to find the right tool. (Jekel et al., 2020) Respondents would like to see a single tool for the whole school. (LVEV, 2020) The reason for the variety of tools was that not all schools made specifications about the use of tools and platforms. Therefore, many teachers searched for suitable applications themselves. (Schwantler, 2021; Trültzsch-Wijnen and Sturm, 2021) The survey of Jesacher-Rößler and Klein, 2020, confirmed that there were many schools without general guidelines. 30% of the school principals surveyed did not specify how teachers should communicate with parents and over 35% did not specify a standard form of communication with pupils. 31% did not specify any learning platforms and tools. New middle schools were the most prescriptive and therefore had the least individualized approach by teachers. (Jesacher-Rößler and Klein, 2020) This was also confirmed by the survey Weber et al., 2021, in which only principals of new middle schools were interviewed. Almost half of the schools had an overall concept, but 46% of the teachers had coordinated with other teachers. About 75% of the teachers prepared learning materials together with the team. Only 5% had no plan and no coordination at all. (Weber et al., 2021)

In summary, teachers had many different approaches to implementing distance learning and it brought many new tools such as learning applications. At the beginning of the COVID-19 pandemic, many different tools were used but it became more consistent over time. The usage of tools worked relatively well but there were problems especially with younger pupils. Parents often helped them with the use of different tools. A big advantage is that children learned to use digital media better. The next chapter looks at the digital equipment used by the pupils during distance learning.

### 3.5 Technical Equipment and Learning Space of Pupils

The third biggest challenge of home schooling was the IT infrastructure of the pupils. Some parents and pupils faced the problem of not having the appropriate technical equipment for distance learning. (Saurer, 2020; MKV, 2021; Schnell and Larcher, 2021; Schwab et al., 2020a; Schober et al., 2020b, 2021a; Trültzsch-Wijnen and Sturm, 2021; Ziegler, 2020; Steiner et al., 2021; Vollmer, 2020) Especially at the beginning of home teaching this was a problem. (Saurer, 2020; Schnell and Larcher, 2021) For example, in the study of Schnell and Larcher, 2021 16% of parents stated that their children did not have a suitable device. By the beginning of 2021, this situation had improved considerably, with only 2% of pupils lacking the necessary equipment. Teachers and school principals were particularly committed to ensuring that all pupils were adequately equipped. Some parents had to buy technical equipment to enable their children to participate in online learning. (Elternverein Paulinum, 2020) On average, parents spent €300 on home learning equipment. (Schnell and Larcher, 2021) 12% of school principals reported that they had received digital devices for children. (Jesacher-Rößler and Klein, 2020) More than 70% of school leaders surveyed in Weber et al., 2021 said they had invested more than €25000 in digital equipment in the last 10 years.

Most of the kids had access to a fast internet connection, a printer and a laptop at their disposal. Some had to share these with others in the household. (Schnell and Larcher, 2020; Elternverein Paulinum, 2020) Most of the children used a laptop or PC for online learning. (NMS Sieghartskirchen, 2021a, 2021b) At the middle school Sieghartskirchen the internet connection of the students was often not sufficient to participate in the Microsoft Teams sessions. About 30% had problems with the internet. (NMS Sieghartskirchen, 2021a, 2021b)

At the lower and upper secondary school (AHS) Hollabrunn almost all pupils had access to a computer or laptop. Three or four different communication channels are usually used to communicate the tasks. For most parents, the channels and the digital platforms worked well. In March/April 2020, more pupils had problems with the learning platforms than almost a year later in February 2021. (Elternverein EBG Hollabrunn, 2021) In a survey by Helm and Postlbauer, 2021, three quarters of parents rated the technical equipment and the workspace as good or very good. For 4%, however, the equipment



was inadequate. 39% of these parents reported problems with the environment in distance learning. At the lower and upper secondary school (AHS) Feldkirch, almost all pupils had sufficient technical possibilities to cope with distance learning. (Gymnasium Feldkirch, 2020)

Some children had to share the digital devices with other children or the parents in the same household. (Holtgrewe et al., 2020a; MS Schwanenstadt, 2021) This led to problems when more than one child was in home schooling or when more than one person in the house needed the technical equipment at the same time. (Gymnasium Feldkirch, 2020; Holtgrewe et al., 2020a; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) Overlapping online hours for several children in the same household was therefore sometimes a problem. (Gymnasium Feldkirch, 2020) An example of this was the survey from Trültzsch-Wijnen and Trültzsch-Wijnen, 2020: 25% agreed and 18% partly agreed with the statement *"I do not have digital devices for everyone in the household to do online/distance learning and teleworking when needed."* (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020 p. 15) At the middle school Schwanenstadt approximately 60% had their own device and almost 30% had to share it with others. Some only used the mobile phone for online activities. (MS Schwanenstadt, 2021)

Most of the children coped quite well with the technical conditions. (MS Breitenbach, 2020; NMS Tux, n.d. Kröll, 2022; Holtgrewe et al., 2020a; Kämpf and Winetzhammer, 2020; OGM, 2021; Schnell and Larcher, 2020; Schober et al., 2020f; Burtscher-Mathis and Häferle, 2022; MKV, 2020; Elternverein EBG Hollabrunn, 2021) As shown in figure 3.11, in eight surveys, between 91% and 100% said they had enough computers, laptops or PCs. In the other eight surveys, the proportion of people who felt that they had enough equipment was lower. One survey showed that only between 51% and 60% were well equipped.

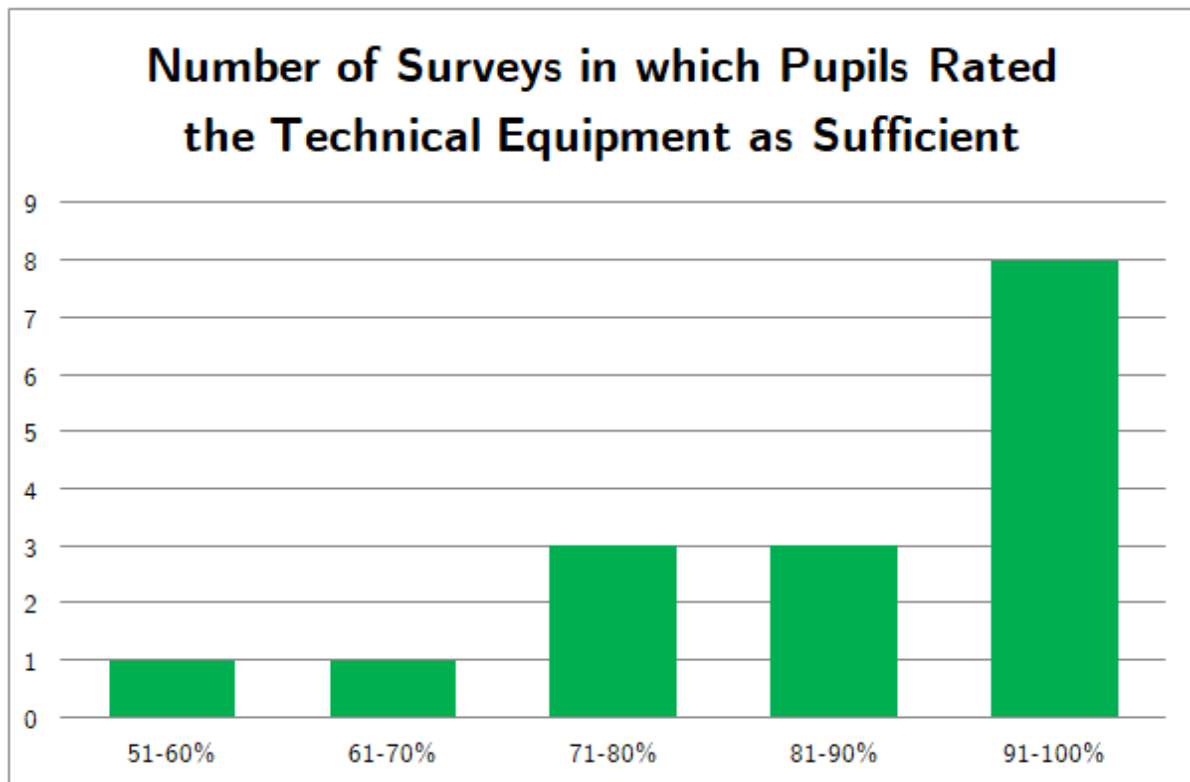


Figure 3.11: Overview of the Number of Surveys where Students said they are Well or Partly Well Equipped with PCs, Computers and Laptops (n=16)

Most of the children had a notebook or PC to work online, but not every household had a printer to print homework and assignments. (Saurer, 2020; Kröll, 2022; Kämpf and Winetzhammer, 2020; Steiner et al., 2021) Some parents reported problems with the supply of printers, so it was difficult for many to obtain the necessary equipment. (Kämpf and Winetzhammer, 2020) The question of whether sufficient printers were available was not asked very often, but as shown in figure 3.12, the results show that in none of the surveys the availability of printers was rated at more than 91%. In one survey only 70% and in one 77% rated the availability of printers well or partly well.

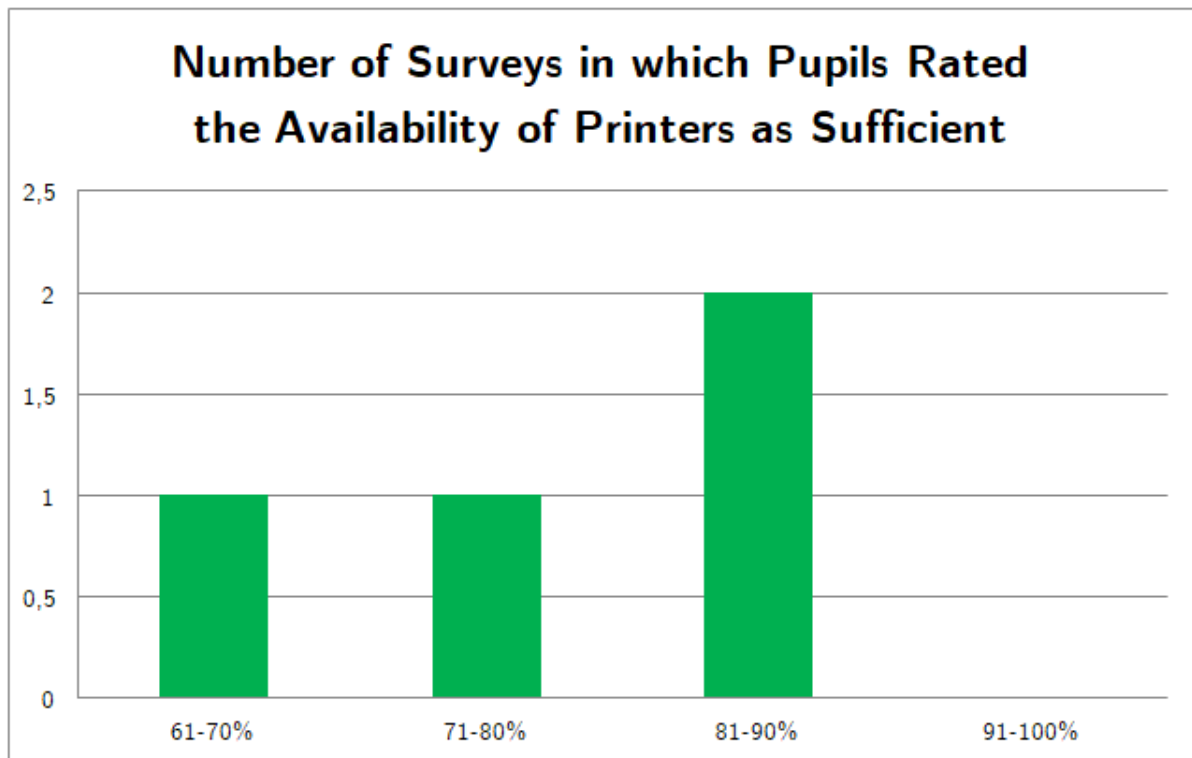


Figure 3.12: Overview of the Number of Surveys where Students said they are Well or Partly Well Equipped with Printers (n=4)

Five surveys showed that pupils often did not have a fast internet connection. (NMS Tux, n.d. NMS Sieghartskirchen, 2021a, 2021b; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020; ImmoScout24, 2021) Almost all students had an internet connection at home, but as shown in figure 3.13 it was often not fast enough for distance learning. Two surveys even showed that only between 61% and 70% had a sufficient internet connection.

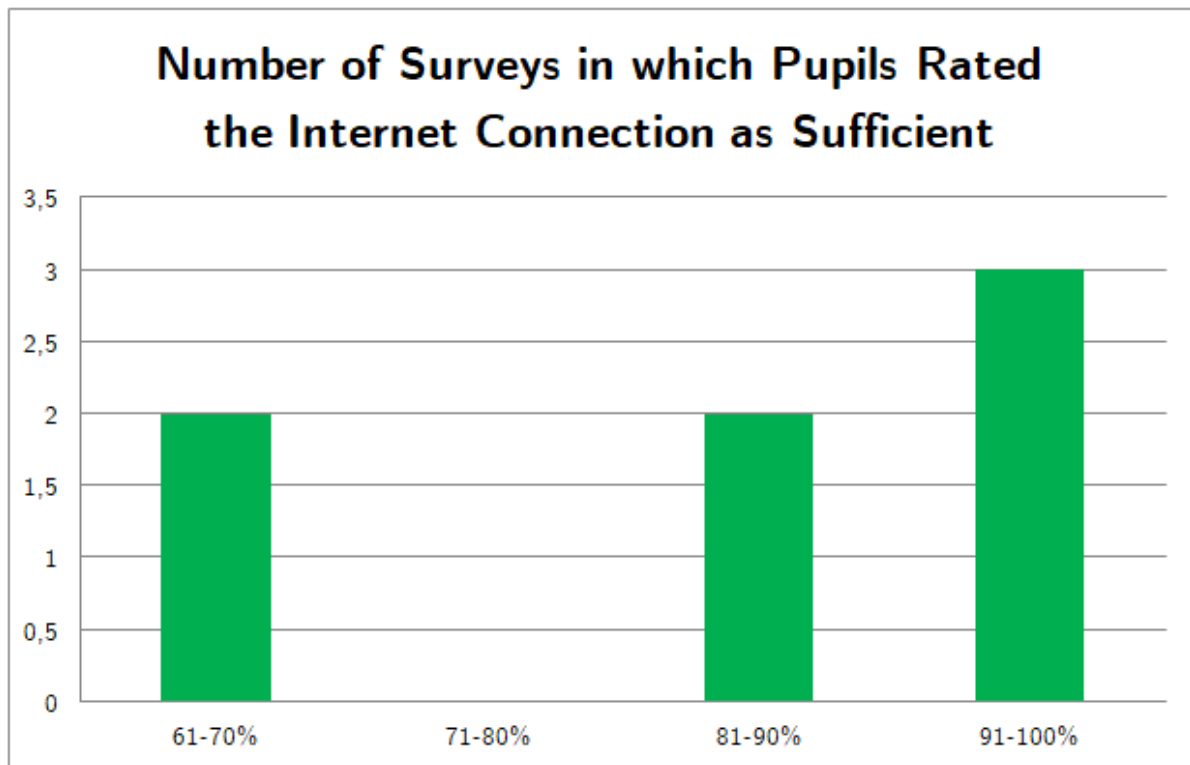


Figure 3.13: Overview of the Number of Surveys Where Pupils said they had a Sufficient Internet Connection (n=7)

More than 20% reported that technical barriers made distance learning at least partially impossible. (Trültzsch-Wijnen and Sturm, 2021) Primary school pupils in particular had problems with digital infrastructure and digital literacy. (Jesacher-Rößler and Klein, 2020) At the middle school Tux, the workplace and the technical equipment were rated very well, only the internet connection was rated slightly lower. (NMS Tux, n.d.) Many other surveys also show that the most common technical problem was the internet connection. Although the majority of respondents had a sufficiently fast internet connection and sufficient data volume, some repeatedly stated that they did not. Although this proportion was not very high, this problem could lead to inequalities. After all, the internet is a basic requirement for participation in e-learning. Problems with internet connection could lead to difficulties in uploading and downloading learning materials or work assignments, or in attending in online lessons. (Elternverein Paulinum, 2020; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020)

In addition to the technical equipment, it was also important for the pupils to have a suitable and quiet place to work and learn. Most of the children had this, but it depended very much on their living situation. (Holtgrewe et al., 2020a) But there were also some children who did not have a suitable place to study. In addition, there were sometimes disruptive factors such as noise during online lessons. (Schwab et al., 2020a; Steiner et al., 2021; ImmoScout24, 2021) School principals also indicated that there were

pupils who did not have the appropriate living conditions to learn. (Jesacher-Rößler and Klein, 2020)

In addition to the pupils, good technical equipment was also important for the teachers. Most of the teachers were well equipped with digital devices. The internet was also adequate for most, but teachers often had problems with the speed. (Jungmeier, 2020; Trültzsch-Wijnen and Sturm, 2021)

When the studies were summarized, the pupils were mostly well equipped but not every child had a suitable working place to learn at home. The internet connection and availability of printers often caused problems for some children. The number of pupils who did not have a computer was small, but any child who did not have a suitable device for distance learning was disadvantaged.

## **3.6 Social Life and Communication During the COVID-19 Disease**

As the university student surveys already showed, social connection and contact with teachers is one of the biggest issues in distance learning. The social contacts during the pandemic were also very much missed by the pupils. 15 studies reported about this disadvantage. (Gymnasium Feldkirch, 2020; Saurer, 2020; Schreiner et al., 2020; Sieberer, 2021; Helm and Postlbauer, 2021; Holtgrewe et al., 2020a; Kämpf and Winetzhammer, 2020; OGM, 2021; Schwab et al., 2020a; MS Schwanenstadt, 2021; Schober et al., 2020d, 2020f, 2021a; Trültzsch-Wijnen and Sturm, 2021; Ziegler, 2020) For example in the survey of Helm and Postlbauer, 2021, 80% agreed that children missed social contact with their peers. The majority of pupils studied alone at home and only a few exchanged ideas with their classmates. (MS Schwanenstadt, 2021) To encourage contact between class members, study groups and more online activities would have been helpful. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) In the survey of Schreiner et al., 2020, many pupils were able to maintain good contact with their friends despite the pandemic, but they lacked time with their classmates.

In most schools, children and parents felt well informed by the school and teachers (Kröll, 2022; Schober et al., 2020d; Elternverein EBG Hollabrunn, 2021), but there was some uncertainty about the opening of schools and tests (Schober et al., 2020d). There were questions, particularly about the grades and performance assessment. (Schober et al., 2020d) School administrators often obtained information about the impact of their actions through contact with parents (e-mails) and teachers. (Jesacher-Rößler and Klein, 2020)

In many schools, the accessibility of the teachers was rated as good. (Gymnasium Feldkirch, 2020; MS Breitenbach, 2020; NMS Tux, n.d. Saurer, 2020; Schreiner et al., 2020;

MS Schwanenstadt, 2021; Elternverein Paulinum, 2020; Elternverein EBG Hollabrunn, 2021) In addition, many reported that teachers usually responded quickly to questions. (MS Breitenbach, 2020; NMS Tux, n.d.) In most cases, teachers communicated with parents and children using digital tools such as learning management systems, e-mail and video conferencing tools. (Saurer, 2020; Schwantler, 2021; Steiner et al., 2021) Teachers also reported good online communication (Saurer, 2020; Jungmeier, 2020; Schwab et al., 2020a; Trültzsch-Wijnen and Sturm, 2021) but missed the personal contact with children. (Jungmeier, 2020; Trültzsch-Wijnen and Sturm, 2021) Cooperation between teachers and pupils also worked well most of the time. (Jesacher-Rößler and Klein, 2020) At the AHS Feldkirch, for example, parents were generally satisfied with the accessibility of teachers and children received sufficient feedback on their work. (Gymnasium Feldkirch, 2020) In a survey of parents from all over Austria, the results were similar. Teachers also gave regular feedback to children. 57% of parents reported that teachers' expectations were clearly communicated, while 21% said this was not the case. (Helm and Postlbauer, 2021) In other surveys the contact with teachers was often rated as mediocre. In some subjects pupils had frequent contact, in others less. Again, it depended on the teacher. (LVEV, 2020; Ziegler, 2020) In the survey from Trültzsch-Wijnen and Trültzsch-Wijnen, 2020 41% of the children had daily contact with the teachers, 53% weekly contact and 6% no contact. One parent even reported that a teacher did not contact them for seven weeks. (LVEV, 2020)

Distance learning was also very time-consuming for teachers. Especially the individual supervision of children took a lot of time. Often, one teacher had to support 40-50 or more children, which meant that teachers often spent ten hours a day in front of the screen. Because of this time-consuming individual supervision, it was difficult for teachers to always answer all questions quickly. (MS Schwanenstadt, 2021)

After the first schools opened, the government of Austria ordered classes to be split into a regular group, taught at the school and a distance learning group. The groups rotated so that only half the pupils were in the class at any time. The pupils were happy to be back and to see their classmates. Learning was easier for them because they could get quick feedback from teachers and could ask questions directly. The smaller number of pupils in the classroom also meant that teachers had more time to spend with each individual. Many pupils commented positively on the fact that they were able to receive personal explanations of tasks and learning. (Schober et al., 2020c)

In summary, the lack of communication and social contact were the main challenges for children. The lack of personal contact meant that pupils had to find new ways to keep in touch with friends and classmates. They often used digital media such as WhatsApp to stay in contact with their friends. The amount of contact with teachers was highly dependent on the teacher. For good distance learning, good teacher accessibility and constant contact are essential.

### 3.7 Learning and the Associated Workload During the COVID-19 Pandemic

As at universities, the students reported often that the workload at many schools was higher than before COVID-19. (Gymnasium Feldkirch, 2020; Kröll, 2022; Holtgrewe et al., 2020a; MS Schwanenstadt, 2021; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020; Elternverein EBG Hollabrunn, 2021; Hinterberger and Matic, 2020) Many students reported that the amount of homework was too high. (MS Perg, 2021) Reasons for the high amount of work were more assignments, concentration difficulties, a lack of variety, additional time spent working on learning platforms and the sole elaboration of tasks. (Holtgrewe et al., 2020a)

Older children (16-19 years) perceived distance learning as more time consuming. (Schober et al., 2020f; Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) Some surveys showed that the amount of work was mostly appropriate. (MS Breitenbach, 2020; NMS Tux, n.d. MS Schwanenstadt, 2021) The average time spent on school activities is shown in 3.14. It shows that most children spent about four to five hours a day on school activities. One survey stands out with an average of more than seven hours. This was the survey mentioned above, in which the upper school pupils reported a particularly high workload in the second lockdown.

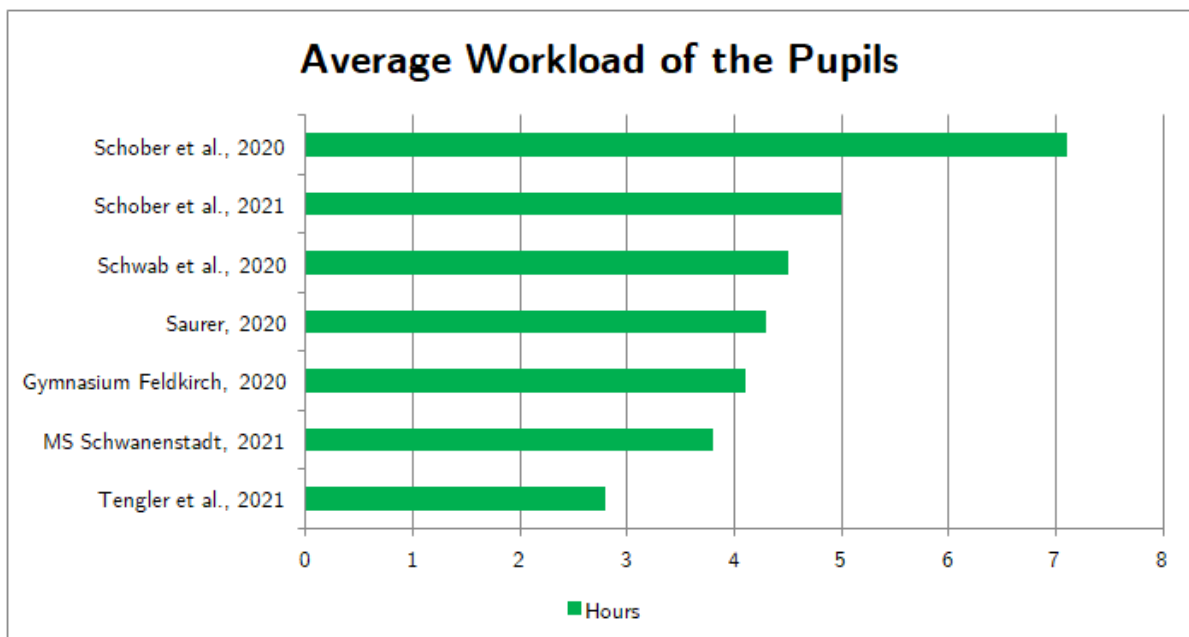


Figure 3.14: Comparison of Average Hours Spent by Students on School Activities (n=7)

In addition to the often reported high workload, parents had to help their children a lot with their homework, assignments and time management. (MS Breitenbach, 2020; Tengler et al., 2021; Helm and Postlbauer, 2021; Holtgrewe et al., 2020a; Schnell and

Larcher, 2020; MS Schwanenstadt, 2021; NMS Sieghartskirchen, 2021a, 2021b; Elternverein Paulinum, 2020) Often the parents did not know how to help their children (Holtgrewe et al., 2020a) and some students received little or no help from their families when they needed it (Jesacher-Rößler and Klein, 2020; Schwab et al., 2020a; Schober et al., 2020b, 2020f, 2021a; Steiner et al., 2021). The reasons for this were often a lack of knowledge or the lack of time of the parents. (Steiner et al., 2021) Pupils received the most support during distance learning from their mothers. (Schwab et al., 2020a; Schober et al., 2020b, 2020f, 2021a) The younger children in particular needed help with organizing their work and the computer and internet. The kids were not accustomed to organizing so much themselves. (Elternverein Paulinum, 2020)

Younger children often needed more support from their parents. The percentage of pupils who could do their work independently is much higher in the higher classes. Pupils spent the most time on mathematics. (NMS Sieghartskirchen, 2021a, 2021b To help them learn, the parents often used offline materials such as books, free online learning materials or free online courses. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020) Compared to the time before the pandemic, the number of parents who had difficulties to help their children increased. (Schnell and Larcher, 2020) Without this help, some tasks would not be possible for the children. (Gymnasium Feldkirch, 2020) The children often needed support to understand and work on the tasks. (NMS Tux, n.d. Holtgrewe et al., 2020a) This view of the children was also reflected in the teacher surveys. Almost 60% agreed at least partly that the distance learning was too demanding for the pupils. (Trültzsch-Wijnen and Sturm, 2021) The assignments were understandable to most of the children and if not it was not a problem for the pupils to ask the teachers for help. (MS Schwanenstadt, 2021) In the survey of Holtgrewe et al., 2020a, 22% of the pupils had difficulties with the assignments. For most parents, the tasks correspond to the children's knowledge, but some children were overwhelmed by the tasks. (Elternverein EBG Hollabrunn, 2021)

Despite the drastic changes brought about by distance learning, learning objectives and assessment were not adapted, or were adapted too little. This created additional stress and pressure for the pupils. (Schnell and Larcher, 2021) Through home learning, students often learned less than they would have in a regular school setting. (Schwantler, 2021; MKV, 2021; Helm and Postlbauer, 2021; OGM, 2021; Vollmer, 2020) In addition, the quality of teaching suffered. (Schwantler, 2021) Teachers indicated that they conducted approximately 60-70% of their regular classes online during the school closures. (Vollmer, 2020) In the survey of Schwantler, 2021, some teachers also stated that not all of the planned content could be taught. This clearly confirms parents' impressions that pupils learned less.

Many pupils found it necessary to make a daily or weekly plan for their assignments and school work. (Schober et al., 2020b) This and fixed learning times helped them to organize the day or the week well. (Schober et al., 2020b) The difficulty of the tasks was rated as average, again there were some students for whom everything was easy and



some for whom it was very difficult. (Elternverein Paulinum, 2020) This could again be due to the different implementation of distance learning by the teachers.

In addition to the high workload for the pupils, online teaching also resulted in a high workload for teachers. They needed more time to plan and create learning materials than before the COVID-19 pandemic. (Tengler et al., 2021; Schwantler, 2021; Schwab et al., 2020a; Schober et al., 2021a; Trültzsch-Wijnen and Sturm, 2021; Ziegler, 2020; Steiner et al., 2021; Schwab and Lindner, 2020; MKV, 2020; Holtgrewe et al., 2020b; Hinterberger and Matic, 2020; Schwab et al., 2021; Aigner et al., 2021) Furthermore, many written e-mails, written instead of verbal contact and the lack of preparation time were the main reasons for that. (Klema, 2020)

After a few months of distance learning, the teachers stated that almost all pupils had gaps in their learning and that their language skills had suffered. (Schober et al., 2021a) Many teachers were concerned that not all students could keep up. (Trültzsch-Wijnen and Sturm, 2021) This feeling was shared by the students, many of whom were worried about missing too many lessons at home. (Schreiner et al., 2020) In addition, teachers found it difficult to assess whether students understood the material well or whether they were copying from the internet. (Schwab et al., 2020a; Jekel et al., 2020)

After the initial reopening of schools, there was still a lack of clarity about grades. In addition, there was often pressure to perform as teachers tried to catch up on missed learning material. (Schober et al., 2020c) With the reopening of the schools, the well-being of the pupils had also improved significantly. (Schober et al., 2020c) The students were able to do their work better and the organization was easier for them. (Schober et al., 2020c) After these openings, the second lockdown followed and the children were back in distance learning mode. Compared to the first hard lockdown, the pupils did better or at least as well in the second one. They also felt better and the contacts improved. (Schober et al., 2020f) It was also noticeable that the pupils in the upper school continued to have a very high workload and that some of them enjoyed learning less than before. (Schober et al., 2020f)

In contrast to the university surveys, there were hardly any questions about how the grades were achieved in schools. In the survey of Steiner et al., 2021, teachers said that the collaboration in distance learning was part of the grade. In many cases the previous performance was sufficient for a grade, especially in the first lockdown. There were hardly any tests during distance learning. (Steiner et al., 2021)

In summary, the workload during distance learning was very high for both, students and teachers. Good organization and weekly timetables were essential to cope with this. Especially for the first and second year pupils, the workload was higher and they needed more help from their parents. There were many uncertainties about how grades would be awarded. Coordination between the teachers regarding the quantity of assignments and submission times would be desirable.

### 3.8 Distance Learning in the Future

The wishes and suggestions for the future reflect the challenges and benefits. More contact between teachers and students would be important in distance learning. Faster and more information about the assessment, planned school openings, grades etc. would be helpful. (Schnell and Larcher, 2020; Holtgrewe et al., 2020b) Many would like teachers to respond to pupils more individually (Holtgrewe et al., 2020b) and give feedback more quickly. (LVEV, 2020; Schober et al., 2020b) In addition, more work materials and online office hours would be helpful. For the future, they would like to see standardized solutions in all subjects and standardized, functioning platforms. Furthermore, they would like to see less work and lower expectations from teachers. In general, parents would like teachers to take more in consideration that parents have jobs. In order to achieve this, online schooling would be desirable to reduce the burden on parents. (Schnell and Larcher, 2020) At many schools, the children would like to have more online sessions and fewer and simpler tasks, so that they can solve them themselves and do not need their parents' help so often. (MS Breitenbach, 2020; MS Schwanenstadt, 2021) Furthermore, they wished for a weekly learning plan instead of daily assignments and more time for the homework. (MS Schwanenstadt, 2021) As the coordination between teachers was often criticized, a better coordination between teachers regarding tasks, platforms and handing in times would be desirable.

For the future, the parents wished for the schools to take into account the impact of the crisis by lowering the criteria for advancement to the next school level. (Helm and Postlbauer, 2021) In principle, the parents can well imagine that an optimized distance learning could improve the education system in the future. (LVEV, 2020) Learning at their own pace has been a great advantage for many children, and therefore they would like to keep this advantage in the future. (Holtgrewe et al., 2020b)

A common platform for submitting assignments would be desirable in order to get a better overview of the children's homework in the future. (LVEV, 2020; Schwab et al., 2020a; Schober et al., 2020b) Teachers would also like to see a uniform specification of the tools in the school. (Schwantler, 2021; Schwab et al., 2020a) Parents would like to see more digital education lessons in school so that pupils learn more about digital systems and are prepared for more distance learning in the future. (LVEV, 2020) Well prepared learning materials and a reasonable amount of time to work on the tasks would be desirable. (LVEV, 2020) It would be helpful if there were more online activities for the children to exchange and learn together. Guidelines for parents on how to support children with distance education activities and homework were desired. (Trültzsch-Wijnen and Trültzsch-Wijnen, 2020)

When pupils were asked whether they prefer regular classes at school or online classes, the result was clear, they preferred classes at school. (MS Schwanenstadt, 2021) The reasons for this were the personal contact with the teachers and classmates, better understanding of the tasks, the possibility to ask questions directly, no distractions and

more motivation. (MS Schwanenstadt, 2021) The use of digital technologies should also be used more in face-to-face teaching. (Tengler et al., 2021; OGM, 2021; MKV, 2020) Many teachers will use online tools to extend their teaching in the future (Tengler et al., 2021; Saurer, 2020; Trültzsch-Wijnen and Sturm, 2021; Spiel and Holzer, 2020), but online teaching cannot completely replace classroom teaching (Saurer, 2020; Sieberer, 2021; OGM, 2021). Social contact and the personal interaction are very important for the learning process of the children. (Kämpf and Winetzhammer, 2020) Digital media should support the normal teaching to add variety to the school day. (Kämpf and Winetzhammer, 2020) Blended learning is advocated by many pupils, teachers and parents, but some reject it completely. (OGM, 2021) Many pupils would like to have smaller learning groups and the opportunity to continue learning more independently. (Holtgrewe et al., 2020b) Teachers plan to continue to use digital teaching platforms such as Moodle. They also want to continue to provide digital resources to further enhance learning and encourage independence. (Trültzsch-Wijnen and Sturm, 2021; Spiel and Holzer, 2020) Teachers would also like to keep the possibility of submitting homework online. (Saurer, 2020)

There is still a lot of potential for the future in terms of access to literature and learning aid, a better overview of learning objectives and tasks and an adaptation of the lessons to the performance level of the individual students. Further training of teachers and upgrading of hardware are essential to realize this potential. Digital competences such as the use of digital tools (e.g. translators), media skills, data and text processing should be covered more in the schools. The challenges of digitization for schools are the technical infrastructure and support, the qualification and motivation of teachers and the creation of digital concepts. (OGM, 2021) For a better implementation of online teaching, further education of teachers would be helpful. (Schwantler, 2021; Jungmeier, 2020; Steiner et al., 2021; Holtgrewe et al., 2020b) Many teachers would also like to see more digital training within the school. (Trültzsch-Wijnen and Sturm, 2021) Furthermore, it would be important for the school to be better equipped digitally. (Trültzsch-Wijnen and Sturm, 2021; MKV, 2020) Schools often lack Wi-Fi access and sufficient power sockets. (MKV, 2020) It should be possible for every pupil in the class to use a laptop. (MKV, 2021)

It can be deduced from the wishes of the respondents that digital media will continue to play a very important role in schools in the future. This result is also confirmed by the survey of Krizek, 2020, where 63% of school principals clearly believe that digital media will be important in the future. The students prefer regular school classes but there is a lot of potential in the digitization of the school. The use of digital platforms and tools in addition to the regular teaching classes will be important in the future.

### 3.9 Summary and Lessons Learned

In conclusion, distance learning during the COVID-19 pandemic will have a major impact on the future of teaching in Austria and will change the teaching in schools. The results show how important digital skills and competences are for the teachers as well as for the pupils. Teachers, pupils and parents were mostly positive about home schooling, but have also encountered many different challenges.

Younger and disadvantaged pupils were particularly affected. They were often disadvantaged by a lack of technical equipment and help at home. After the schools reopened, it was especially difficult for the teachers that all pupils had the same level of knowledge. Learning problems were often caused by a lack of communication with teachers and excessive demands. Excessive workloads and lack of coordination between teachers often left pupils unmotivated and exposed to high levels of stress. The self-organization and time management was a challenge for many pupils. Often they got help from their parents, but they were often overwhelmed by the situation. Fixed daily or weekly schedules would be helpful to make the process easier for them. The usage of tools was often rated as positive but too many different tools made it difficult to keep an overview. In order to achieve this, overall concepts of the schools would be helpful.

Despite the many disadvantages, there were also benefits. Digital and self-organization skills had improved significantly. These skills can have a very positive impact on the pupils' futures. The efforts of the teachers were also often mentioned positively.

Pure online teaching in the future was rejected by almost all involved people but many teachers plan to continue using digital media as a support of normal teaching. Many want to keep the submission of exercises via online platforms such as Moodle.

From the available results it can be concluded that there are a number of aspects that are important for good distance learning:

- **Communication:** Sufficient communication with the students is an important aspect of distance learning. The right choice of tools is essential to facilitate communication and encourage collaboration. Sufficiently quick feedback from teachers and availability for questions are particularly important for the pupils' learning success.
- **IT Infrastructure:** Adequate technical equipment for children and teachers is the basic prerequisite for the implementation of distance learning. Every student and teacher should have a device with sufficient internet connection. It is also important to choose the right technologies, platforms and tools. The number of different tools in a school should be kept to a minimum so that students have a better overview of the tasks.
- **Digital Skills:** Teachers should have a good knowledge of available tools and, if

necessary, train themselves accordingly. For pupils, the acquisition of digital skills is essential from primary school onwards. The new compulsory subject (from school year 22/23) digital basic education (Bundesministerium Bildung, 2023a) in schools is a good start to bring digital skills closer to the children.

- **Appropriate Teaching Materials and Tasks:** When creating the tasks, teachers must ensure that the tasks are clearly formulated, as it is not possible to ask questions directly. It is also important that the assignments are well structured and that there is enough time to complete them. Good coordination between teachers would be important for this, so that not all tasks have to be done at the same time.

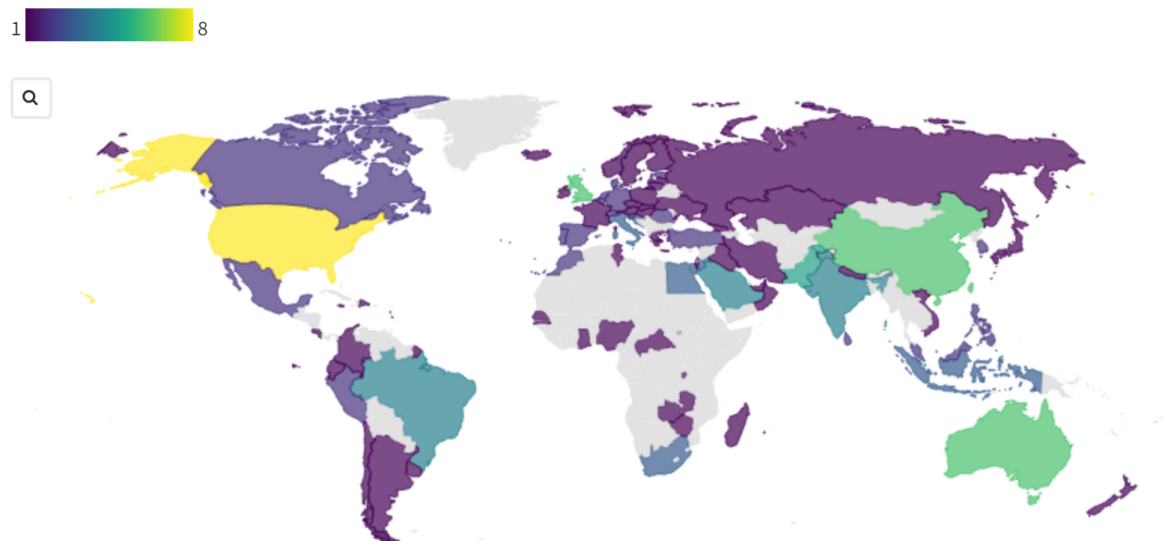
Distance learning can be successful if the above points are taken into account. The results of the study show that distance learning has already worked better in subsequent closures. It can therefore be concluded that students and teachers are already prepared for further school closures due to the many experiences in recent years.

## 4 Digital Learning in Austria Compared with Other Countries

Now that the results of the students in Austria are available, they will be compared with studies from other countries. The aim is to find out whether students in other countries experienced the time of distance learning in the same way or differently. This chapter shows the comparison of the results of this paper study and different other meta analyses and systematic literature reviews. In summary 15 papers from different countries worldwide were identified and selected for the comparison.

The compared papers were made with literature from different geographical locations worldwide. Figure 4.1 shows which countries were analyzed in the compared papers. Four papers did not contain a list of analyzed countries.

### Countries in Analyses



Source: World Bank Official Boundaries

Figure 4.1: Overview of Geographical Locations (n=11)

The publication years of the compared analyses were between 2020 and 2023. As shown

in figure 4.2, most of the analyses were published in 2020 and 2021. Figure 4.3 shows an exact timeline of the compared analyses and literature reviews.

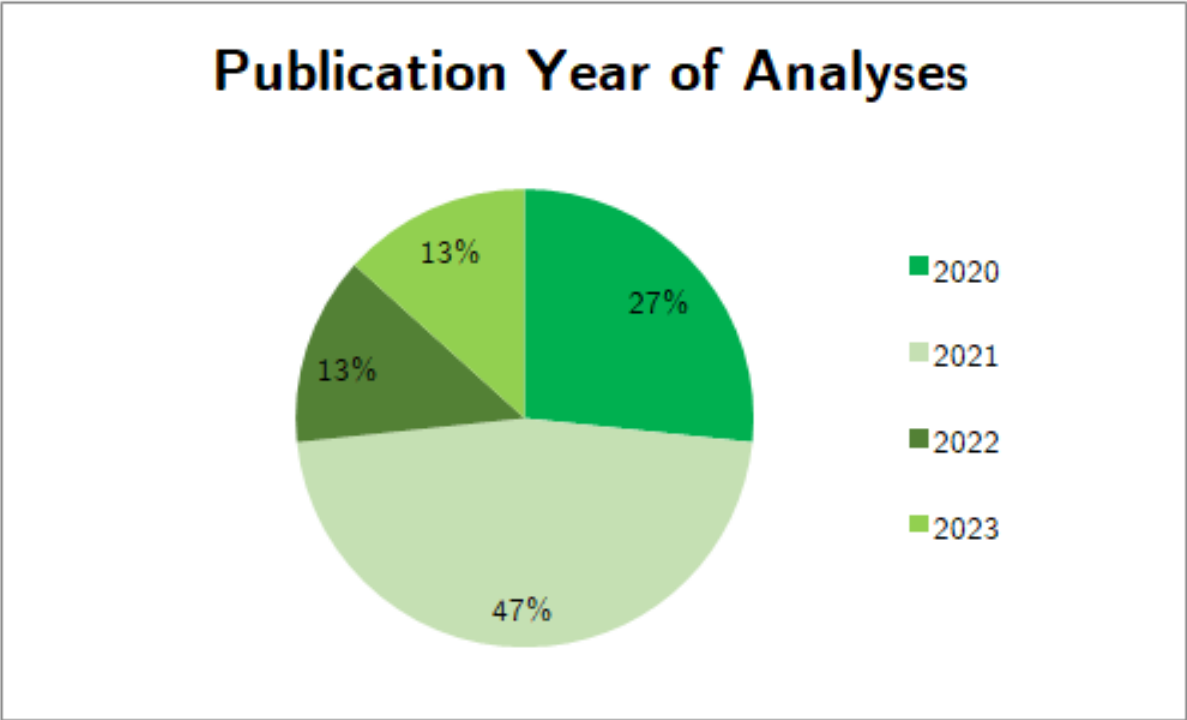


Figure 4.2: Overview of Publication Years of the Analyses (n=15)

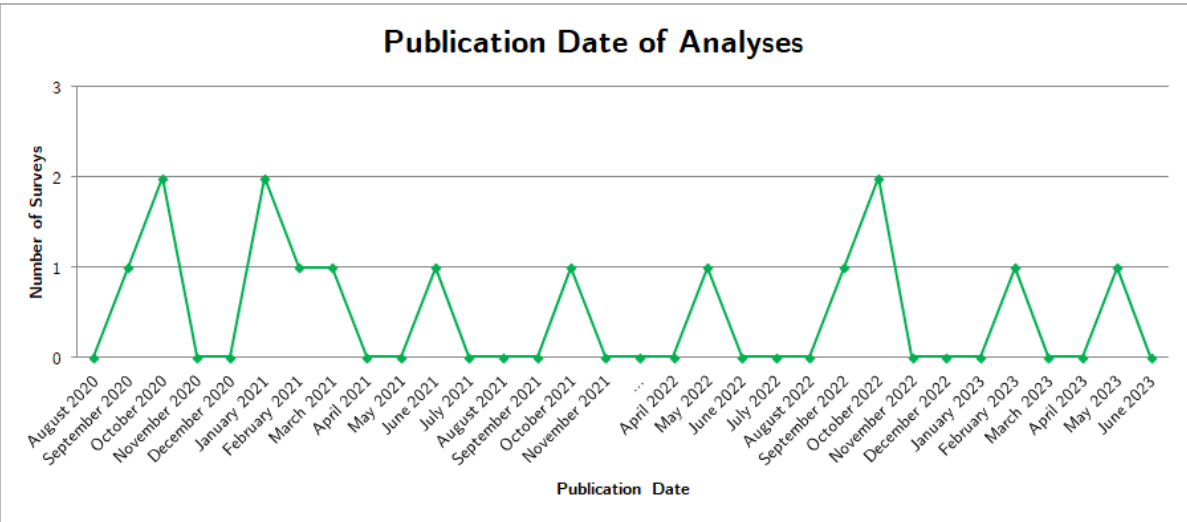


Figure 4.3: Timeline of Analyses Publication (n=15)

As shown in figure 4.4, most of the analyses focused on higher education students but there were also many analyses which were about students from a mix of institutions

such as schools and universities. 13% of analyses and reviews concentrated on children at schools and 33% were about students at higher education institutes. 33% were a mix of both. Because many analyses made no difference between university and school students, this chapter does not differentiate explicitly between education types.

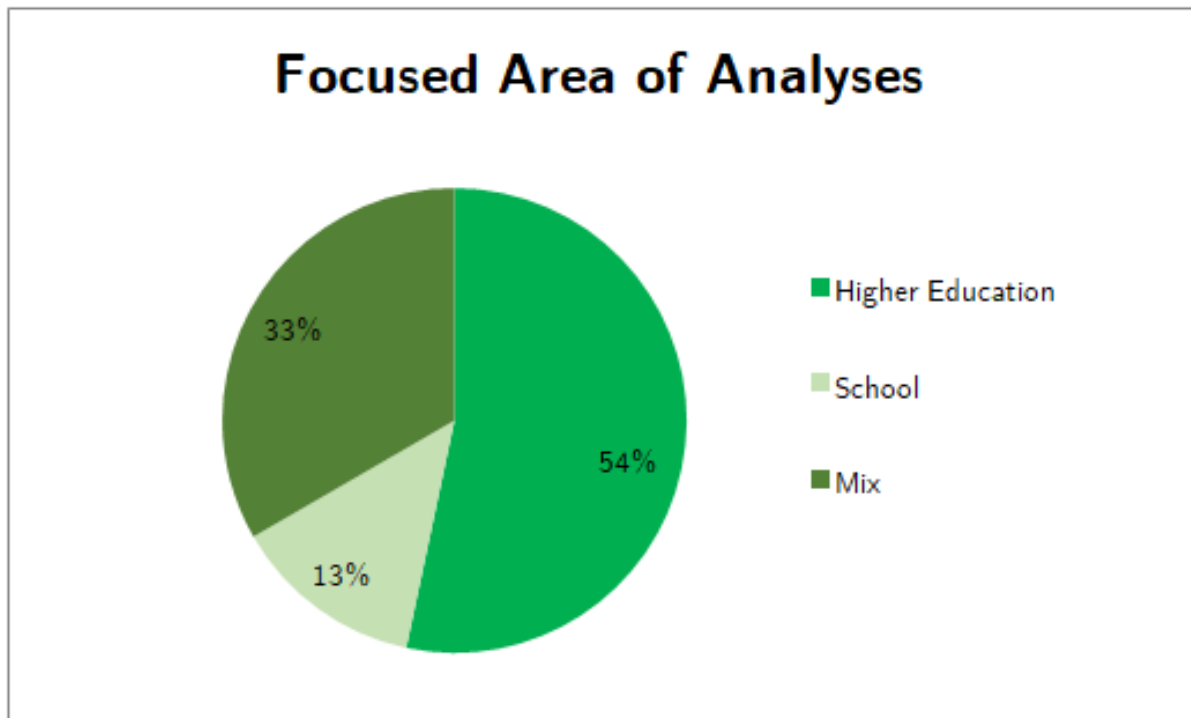


Figure 4.4: Overview of Focused Area of Meta Analyses (n=15)

The compared meta analyses and literature reviews had a different number of analyzed surveys. In one analysis, there was no indication of the number of papers. As shown in figure 4.5 most of the analyses compared less than 50 different surveys. Only two used more than 50.



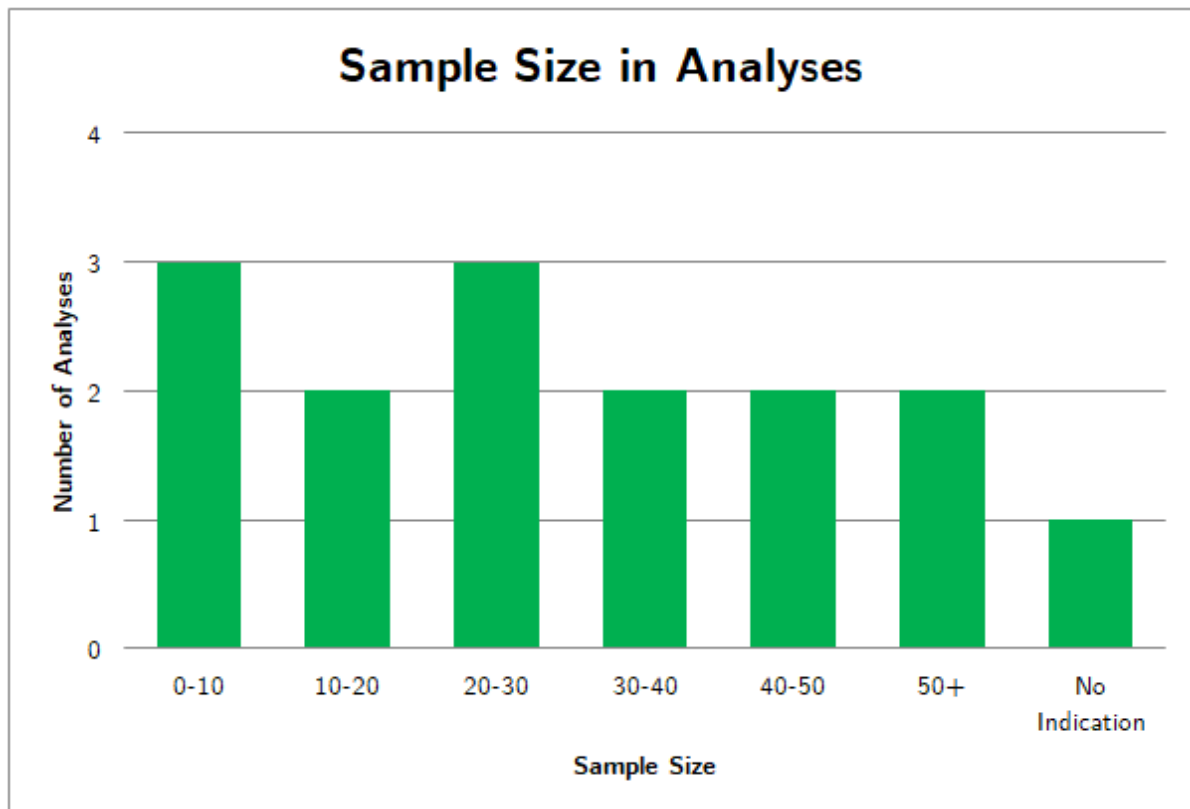


Figure 4.5: Overview of Sample Size of the Compared Analyses (n=15)

## 4.1 Results

The school closures due to the COVID-19 pandemic affected more than 1.5 billion students worldwide. (UNESCO.org, 2021) As in Austria, most other countries closed the universities and schools, canceled physical class lectures and switched to distance learning. Thus, the approach to managing university and school operations during the COVID-19 outbreak was in many countries very similar compared to Austria. (Mseleku, 2020) Due to school and university closures and the associated distance learning, difficulties and challenges arose in many countries. (Muhaimin et al., 2023; Liu et al., 2022; García-Morales et al., 2021a) These were largely similar to the challenges faced by Austrian students.

### 4.1.1 General Satisfaction with Digital Learning

As shown in figure 4.6, the analysis of students in Austria found that two thirds were satisfied with the switch to distance learning and the teaching itself. It resulted in an average satisfaction of 65% (University students 64% and school children 66%). The meta analysis of Xu and Xue, 2023 showed an average satisfaction of online education of almost 60%, so the results were very similar. There was no other meta analysis where

the satisfaction was content.

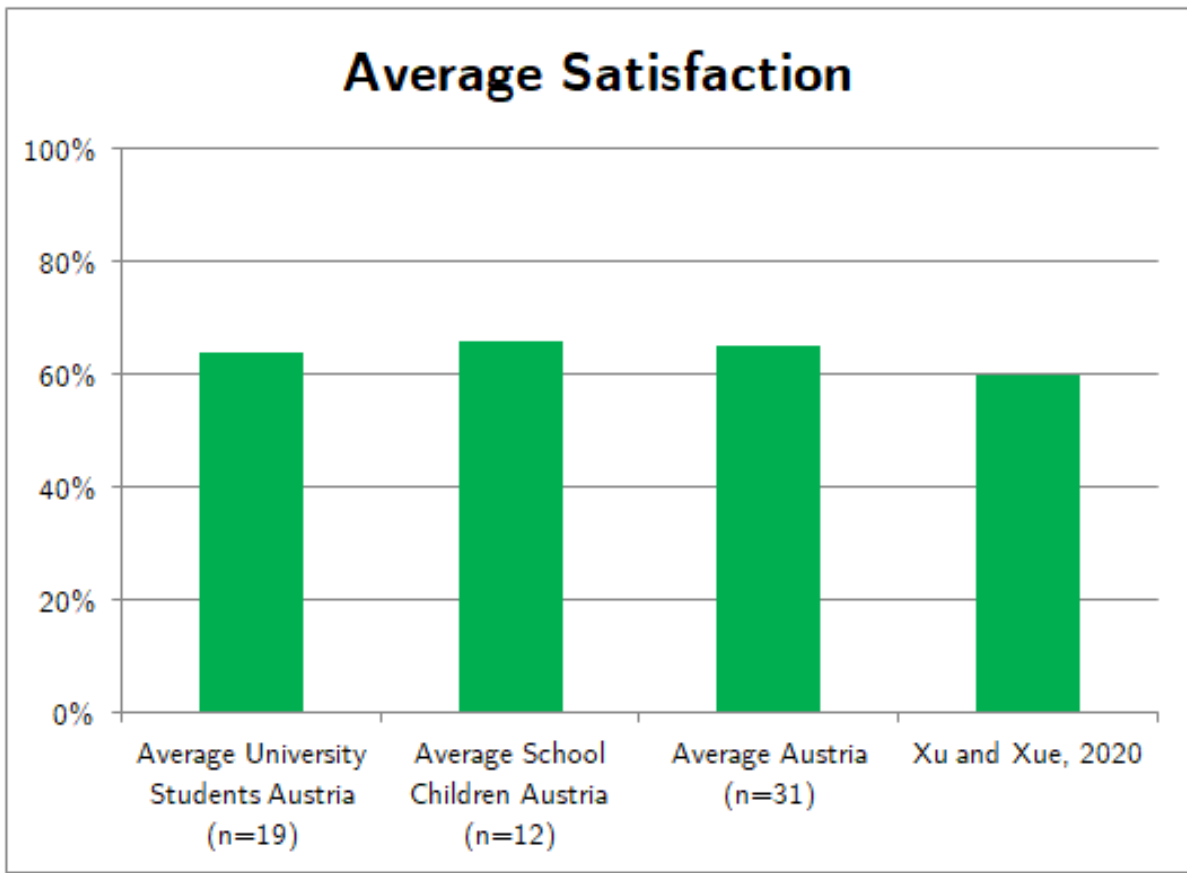


Figure 4.6: Average Satisfaction

As already seen in the analysis in Austria, some students saw distance learning as very beneficial and some less so. (García-Morales et al., 2021b) Many disadvantages and also some advantages were reported. These aspects will be discussed in the next chapters.

#### 4.1.2 Used Tools and Implementation of Online Learning

The analysis by Prestiadi, 2020, showed that the utilization of useful tools and platforms was very important to perform the distance learning well. Furthermore, the method how teachers implement the online teaching was necessary for effective learning.

Different learning management systems and video conferencing tools were used to perform online teaching. (Bond, 2021) The meta studies by Naciri et al., 2021, Turnbull et al., 2021, Bond, 2021 and Camargo et al., 2020, showed that Zoom was the most used tool for distance learning. Additionally Moodle (Prestiadi, 2020; Naciri et al., 2021; Turnbull et al., 2021), Blackboard (Naciri et al., 2021; Turnbull et al., 2021), YouTube (Turnbull et al., 2021), WebEx, Google Classroom (Bond, 2021; Naciri et al., 2021), Google Meet (Camargo et al., 2020), Facebook (Turnbull et al., 2021; Camargo et al.,

2020) other free conference call software (Naciri et al., 2021) were in use. Android applications helped the children to understand the learning content better. (Prestiadi, 2020) This shows a similarity compared to the used tools in Austria where especially Moodle and Zoom were very often in use. A too high number of different platforms and tools was often challenging for students. (Aini et al., 2020) The analysis of students in Austria led to the same result.

Regarding the used teaching methods, the analysis by Camargo et al., 2020 and Xu and Xue, 2023, showed that asynchronous and synchronous methods were used. This was evident to the surveys in Austria, where both were used in equal part. Often pre-recorded videos were provided by the teachers. (Camargo et al., 2020) The students in the analysis of Camargo et al., 2020, as well as the students in Austria preferred recorded videos over live lessons because of the given time flexibility. Recorded videos were very popular among students. (Bond, 2021) In the analysis by Bond, 2021, it was even mentioned that students were given the task of creating videos for other students. This reduced the preparation time for the teachers considerably. This is a method which was never mentioned in surveys in Austria.

Many courses could be taught well via live teaching or videos, but it was more difficult with practical courses such as labs. The meta analysis and literature review of Muhaimin et al., 2023, identified learning and teaching problems in these courses. This was also a result of the study with Austrian students, labs could not be held in the same way as before the COVID-19 pandemic and, therefore, the students could not learn the same content as before. Especially for practical study programs such as pharmacy/chemistry this was often a problem. (Muhaimin et al., 2023) The studies by Mseleku, 2020 and Talib et al., 2021 came to the same conclusion. In the analysis of Talib et al., 2021 they reported that this was a problem especially in the field of health care sciences.

Thus, the topic of tools and platforms also shows many similarities between Austrian students and students from other countries. For the most part, the same tools were used and teaching was also synchronous and asynchronous.

### **4.1.3 Communication During the COVID-19 Pandemic**

Lack of communication was identified as a major challenge in five analyses Muhaimin et al., 2023; Liu et al., 2022; García-Morales et al., 2021b; Bond, 2021; Talib et al., 2021. In addition, communication with classmates was often ineffective. (Aini et al., 2020) Too little communication with the teachers was a common problem for the students. (García-Morales et al., 2021b; Talib et al., 2021) Often the students needed more support from teachers. (Bond, 2021) In addition, some students felt bored and isolated. (García-Morales et al., 2021a; Bond, 2021; Talib et al., 2021) These findings are very similar to those of the students in Austria in this paper, where failing to communicate was the biggest problem faced by students. It is at the top of the list of challenges.

In Bond, 2021, it is reported that some parents blocked the phone number of the school because of too much phone calls. Such a case was not described in the surveys conducted in Austria, rather the opposite was the case. Parents and pupils mostly wanted more communication with teachers.

Some analyses showed that communication could also be an advantage of distance learning. Communication was more convenient and modern and students had the opportunity to ask questions in chats and there was no need for a face-to-face meeting. Some students felt uncomfortable speaking live with people and found it more comfortable to speak in an online environment. Furthermore, parents got a better insight into their children's learning and learning content. (Talib et al., 2021) Cooperation and better insights into what is happening at school was also a frequently cited benefit of Austrian parents and students.

#### **4.1.4 Technical Equipment and Working Environment of the Students at Home**

Technical issues (Mseleku, 2020; Muhaimin et al., 2023; García-Morales et al., 2021a, 2021b; Bond, 2021; Naciri et al., 2021; Aini et al., 2020; Talib et al., 2021; Pokhrel and Chhetri, 2021) and a non sufficient internet connection (Mseleku, 2020; Muhaimin et al., 2023; García-Morales et al., 2021b; Bond, 2021; Naciri et al., 2021; Turnbull et al., 2021; Aini et al., 2020; Talib et al., 2021; Pokhrel and Chhetri, 2021) often posed challenges for the students. In many countries the technical infrastructure and internet bandwidth was not sufficient for online learning. (Bond, 2021; Aini et al., 2020; Pokhrel and Chhetri, 2021) Many families did not have enough internet data for the whole family. (Bond, 2021) In addition, technical devices (Bond, 2021) and a powerful internet were too expensive for a lot of families. (Pokhrel and Chhetri, 2021) A lack of hardware and software often led to problems during online learning. (Mseleku, 2020) It was also mentioned that the problems e.g. technical resources occurred especially directly after the changeover and got better over time. (Liu et al., 2022) This is also in line with the results from this work, the availability of technical equipment improved over time.

In the analysis by Prestiadi, 2020, the students had difficulties to communicate with the teachers due to network problems. The analysis of Naciri et al., 2021 contains a survey from India where only 18% of the students had their own laptop/PC. Most of students worked with their smartphone or tablet. (Naciri et al., 2021) The analysis of Mseleku, 2020, also showed a similar result in India. Almost 30% did not participate in online learning due to a lack of devices. (Mseleku, 2020) This was a big difference to the students in Austria, because there almost all students had their own PC or laptop. In some countries and deep rural areas, where the infrastructure is not so good as in Austria, the students had network problems or electricity problems. (Mseleku, 2020) Since the infrastructure in Austria is quite good, such problems did not occur here. It can be observed that the technical problems and lack of equipment had affected many

more students in other countries than in Austria.

Many students in Austria reported about problems with the learning environment at home. Often they were disturbed or they had no suitable room to learn. The surveys of Bond, 2021 and Mseleku, 2020, identified the same problem in other countries. However, it is noticeable that the proportion of students who did not have a suitable working place is higher than in Austria. (Mseleku, 2020)

#### **4.1.5 Educational Inequalities and Learning Loss**

Several analyses indicated that students were confronted with a learning loss. They learned less and were confronted with learning gaps due to home learning. (Mseleku, 2020; Liu et al., 2022; García-Morales et al., 2021b; Pokhrel and Chhetri, 2021) This is a common aspect in comparison to students in Austria where five school surveys reported that pupils learned less than in normal lessons. Furthermore, this was also observed at Austrian universities.

As shown in chapter 3.3 the pupils at Austrian schools were often confronted by an increase of educational inequalities. The meta analysis and literature review of Betthäuser et al., 2022 showed similar results. Particularly for pupils from low socio-economic backgrounds the pandemic had a significant negative effect. It was also reported that especially among children who got little support at home and have little access to digital technologies were disadvantaged. The study also discovered that the technical infrastructure and digital literacy had an impact on the effectiveness of distance learning. These problems occurred in all school levels. (Betthäuser et al., 2022) The study from Liu et al., 2022, also concluded that economically disadvantaged students and pupils performed worse and were thus disadvantaged by online teaching. The analysis of Mseleku, 2020, came to the same result, inequalities increased especially in low-income countries. Furthermore, the gap between advantaged and disadvantaged children increased. (Mseleku, 2020) Other analyses also confirmed these results. (García-Morales et al., 2021a, 2021b; Talib et al., 2021; Pokhrel and Chhetri, 2021)

To sum up, students in Austria as well as in other countries were confronted with inequalities. The analyses showed that especially low-income countries were affected. As the pupils in Austria were mostly quite well equipped technically and the majority of parents had a good education, some pupils were disadvantaged but not in the quantity as in other countries. Some analyses reported a large number of students for whom it was not possible to join on online lessons. As already mentioned in the last chapter, especially in India many students were not able to participate in distance learning due to a lack of technological devices.

### **4.1.6 Influence on Students**

Many students in Austria were affected by psychological problems such as stress, uncertainty and pressure. This was also observed in several analyses in other countries, the students were more anxious and had more stress. (Mseleku, 2020; Muhaimin et al., 2023; García-Morales et al., 2021b; Bond, 2021) Students worried a lot and this had an impact on their mental health and performance. (Talib et al., 2021) The work-life balance suffers from distance learning, as the boundaries between school and leisure time become blurred. (Talib et al., 2021) Some students reported that they had less stress, and therefore less anxiety, because there was less school related stress. (Bond, 2021)

The students spent a lot of time in front of the screen (Muhaimin et al., 2023; García-Morales et al., 2021b; Talib et al., 2021; Pokhrel and Chhetri, 2021) and there was a lack of movement among the children (García-Morales et al., 2021b; Bond, 2021). The Austrian pupils had the same problems. Often the screen time was too long and exhausting for the children's eyes.

The reviews by Muhaimin et al., 2023, Aini et al., 2020 and Talib et al., 2021 showed that a lack of motivation was often a disadvantage of distance learning. In comparison, the study by Naciri et al., 2021 found that most of the students were more or similarly motivated to participate in online courses than in face-to-face courses. (Naciri et al., 2021) Lack of motivation was often a problem for both Austrian university students and school pupils. None of the Austrian surveys showed that students were more motivated than before the pandemic.

A major challenge for many students was the self-organization of their day due to a lack of self-organization skills. (García-Morales et al., 2021a) In Austria, self-organisation was seen as both a disadvantage and an advantage. Some students found it easy, while others had problems. For some, it brought a lot of flexibility, but other students would find a regular schedule easier.

Evident to students in Austria, privacy was also an issue in other countries. Many students were concerned about their privacy and the security of their data. (Bond, 2021; Turnbull et al., 2021; Talib et al., 2021) The study by Pokhrel and Chhetri, 2021 reports that due to the high amount of time spent on the computer, the risk of cyberbullying and dangerous content on the internet increased. Children often lack the knowledge and skills to protect themselves against this.

### **4.1.7 Collaboration Between Teachers, Students and Parents**

Many analyses came to the result that the sudden switch to distance learning led to difficulties for the lecturers. (Mseleku, 2020; Muhaimin et al., 2023; García-Morales et al., 2021a; Bond, 2021; Aini et al., 2020; Talib et al., 2021) Often the necessary technical knowledge was missing and therefore it was difficult to adjust the lectures properly.

(Mseleku, 2020; Muhaimin et al., 2023; García-Morales et al., 2021a; Bond, 2021; Talib et al., 2021) It was also often difficult for the teachers to use the tools in a pedagogically correct way. (Bond, 2021) Beside the digital skills, there was also often a lack of technical devices and internet for distance learning. (Talib et al., 2021) The sudden and unprepared switch to distance learning was a major challenge and very stressful for the teachers and professors. (García-Morales et al., 2021a) At universities the students did not report about a lack of knowledge of the professors, but often the students mentioned no or less adaption of the courses. These different methods used by the teachers and professors were related to their knowledge. At Austrian schools it was reported that especially older teachers had not always the necessary knowledge and technical equipment. Many teachers had training about online teaching and many educated themselves.

As already identified in this analysis, parents often had not enough knowledge or time to help their children with learning. They are often not qualified to teach their children at home. The same result shows the analysis by García-Morales et al., 2021b and Pokhrel and Chhetri, 2021.

Austrian students reported that the relationship between them and their parents got stronger due to the collaborative work. The review of Bond, 2021 showed the same result. The analyses by García-Morales et al., 2021b and Pokhrel and Chhetri, 2021 showed a better relationship between teachers, parents and children. A better communication and work between learners and teachers could not be observed in the surveys in Austria.

#### **4.1.8 Workload and Study Delay During the Pandemic**

Austrian university students as well as school children often reported that their workload was too high or higher than before the COVID-19 pandemic. This was the second most important challenge at the universities. The analyses by Naciri et al., 2021 and Talib et al., 2021 confirmed these results. The study by Bond, 2021 showed that not all students reported a high amount of work, some worked less than two hours a day for the school.

In addition to the high workload for the students, the amount of work for the teachers also increased significantly, both in Austria and in other countries. (Bond, 2021; Aini et al., 2020) As reported in many Austrian surveys, teachers had to prepare a lot of material for the courses, which led to an increased workload for them. (Aini et al., 2020)

Study delays were also a major challenge for Austrian university students. This issue did not appear in any of the comparative analyses.

### **4.1.9 Performance Assessment of Students**

The topic of performance assessment was also addressed by Muhaimin et al., 2023 and Talib et al., 2021, but in a different context than this master thesis. They wrote about a problem for teachers to evaluate the performance of students. (Muhaimin et al., 2023) In Austria the problem was more on the side of the students. They reported about difficult exams and too little time for exams. This is also observed in the literature review by Pokhrel and Chhetri, 2021. Student assessment caused many uncertainties and confusion. Furthermore, teachers used many different examination approaches and often found it difficult to check for plagiarism. (Pokhrel and Chhetri, 2021) The analysis made by Turnbull et al., 2021 confirmed the problems with plagiarism. Difficulties with cheating were also mentioned in the analysis of Bond, 2021.

### **4.1.10 Advantages Provided by Online Teaching**

In this paper and in five other analyses, the flexibility of distance learning was a major advantage for students. (Muhaimin et al., 2023; Prestiadi, 2020; Bond, 2021; Naciri et al., 2021; Talib et al., 2021) It allows students to learn independent of time and place. (Prestiadi, 2020; Bond, 2021; Talib et al., 2021) They liked working from home, watching the videos and lectures at home, and studying and organizing their learning at their own pace. (Muhaimin et al., 2023) In another review, parents complained that distance learning led to a lack of flexibility. (García-Morales et al., 2021b) This could be because the new learning format provided flexibility for students but inflexibility for parents due to increasing childcare responsibilities. Thus, flexibility was the main advantage for Austrian students as well as for children from other countries.

Some meta-analyses showed that students lacked digital literacy skills and, therefore, had difficulties using the different online tools and platforms. (Bond, 2021; Turnbull et al., 2021; Aini et al., 2020) Especially young students did not have enough skills to use the digital tools and platforms on their own. (Bond, 2021) The digital skills of students and pupils increased during the pandemic. This effect can be seen among students in Austria and has been observed in several other analyses. (García-Morales et al., 2021b; Talib et al., 2021) Students learned more about platforms and tools. This can also be helpful in future education. (Pokhrel and Chhetri, 2021)

### **4.1.11 Distance Learning in the Future**

Many Austrian surveys showed that learning in the future will be influenced by digital teaching. Talib et al., 2021 saw it as the impetus for the digital transformation of teaching. It will bring new possibilities to the future of education. (Pokhrel and Chhetri, 2021) The meta-analysis of Mseleku, 2020 showed, that they preferred face-to-face teaching over online teaching. The reason for this was better communication with friends and teachers. (Mseleku, 2020) On the other side, the analysis of Talib et al., 2021, showed that many students preferred online classes to traditional classes because



of the flexibility and convenience. The study by Bond, 2021, showed that further teacher training will be very important in the future. This is the same result as in Austria.

The analysis of Muhaimin et al., 2023, also came to the conclusion that new technologies bring new teaching formats for the future and that distance learning methods can be used as a supplement to regular teaching. The analysis by Liu et al., 2022, showed the same result, the COVID-19 pandemic brought new innovative solutions and opportunities in the topic of tools and teaching methods for the future. Furthermore, the universities are planning to extend traditional teaching with parts of digital teaching. (García-Morales et al., 2021a) In conclusion, distance learning has changed the way how the children learn in many countries and it will be part of the future teaching all over the world, after the crisis.

#### **4.1.12 Summary of the Comparison**

To summarize the comparison of Austrian students with other countries, it showed many similarities. Especially the analysis of Talib et al., 2021, led to a very similar result as the study of this master thesis. On the whole, the advantages and disadvantages were very similar. The technical infrastructure in Austria was much better than in many other countries. There were some IT problems in Austria and it was a challenge for many, but they were much bigger in other countries like India. In addition, many families did not have the money to buy the necessary equipment. Therefore, many students found it difficult to participate in distance learning at all. Flexibility was identified by all students as the greatest advantage. It was also evident that many more disadvantages than advantages were identified. In most analyses, only disadvantages were discussed.

Many other analyses also showed that distance learning will continue to be very important in the future. It will be used frequently, especially as a supplement to normal classroom teaching.

## 5 Summary and Conclusion

The COVID-19 pandemic had a major impact on almost all people around the world. It brought significant changes in education and different challenges for children, students, parents and teachers. The sudden shift to distance learning led to many disadvantages, but also some advantages could be identified by the students. Above all, it brought a turnaround for the future of education in Austria as well as in other countries. In this paper 127 different surveys from schools and universities in Austria were compared and similarities and differences were identified. It showed how distance learning was experienced by students during the COVID-19 pandemic.

This study showed that everyone involved was unprepared for this new situation, and it was therefore a great challenge for the teachers to adapt the courses. In addition, learning at home without any personal contact was a new and unknown situation for the students. The university students and the school children observed similar challenges, but there were some differences. The overall satisfaction with the distance learning and the change was rated as moderate by both parties. It was noticeable that the satisfaction of school children and university students was almost the same. Furthermore, the satisfaction at universities of applied sciences was much better than at universities. Problems with exams often led to low satisfaction for the university students. The result of another study of other countries showed a similar number.

For the school children, the sudden change to home schooling led to a lack of social contacts, a lack of motivation, many uncertainties, psychological problems, strain and stress. Parents of young children in particular had problems with teaching and caring for their children. In addition, younger children needed more parental support than older students. It was also reported that the students did not accepted the teaching by parents very well. Particularly challenging were the self-organized learning, a lack of technical equipment, a lack of digital skills and a high workload. Especially children who lacked the necessary technical equipment, had too little help from their parents, or children who already had learning difficulties before the COVID-19 pandemic were disadvantaged by home learning. It can be said that distance learning reinforced inequalities among children. Especially school children were affected, but sometimes university students were also affected. Many studies from other countries confirmed this. Especially the IT infrastructure was a common problem. Compared to other countries such as India, the infrastructure in Austria was quite good.

Schools often used helpful tools and platforms, but there were often too many different tools. This made it difficult for parents and students to keep track. The reason for that

was often a lack of an overall distance learning concept at the schools. Children also saw positive aspects of distance learning. They improved their digital skills and learned to manage their own time. They also became more independent. These benefits will serve the children well in the future. Digital literacy and self-organization will be important skills for their future lives. In addition, the relationship between the students and their families was strengthened. For the future education in schools, there is a high potential in digital teaching. Digital media will play an important role in future education.

University students in Austria often reported similar problems as school children, such as a lack of social contacts, a lack of IT equipment, poor internet connection, increased workload and a lack of motivation and concentration. Communication with peers and lectures was often problematic. It can be observed that communication worked better at universities of applied sciences than at universities. As the number of students is much smaller than at universities, it was easier to maintain contact.

In addition, exams were often mentioned as problematic because they were too hard and the time was too short. These problems often had an impact on their study progress and many students reported about delays in their studies. The comparison between the studies showed that at the beginning of the first semester of distance learning, students often reported that they would experience a delay in their studies. On closer inspection, it became clear that this was often a fear of most students, because the number of students who later reported an actual delay in their studies was much lower. Especially at the beginning of the pandemic, students were very uncertain and thought that the pandemic would have a major impact on their studies. These fears again show that stress and psychological strain were very high.

The flexibility brought by home learning was a great advantage for many students. They were able to organize their day and learning on their own. But this flexibility was not only seen as an advantage. For some students the organization was a major challenge. Thus, it can be observed that some advantages can also be seen as disadvantages, depending on the competencies of the students.

The lecturers at universities used synchronous and asynchronous teaching methods. Often a mix of the two was well received by the students. Learning management systems and video conference tools such as Moodle, BigBlueButton or Zoom were used, but this work showed that the success of distance learning was highly dependent on the teacher. Some examples were given where no digital tools or digital teaching methods were used and the students had to study all the content on their own. These courses were not well received by the students.

In order to participate in online learning, good internet connection and technical equipment were required. Internet speed in particular was often a problem for students. In the future, students would like to see a mix of online and face-to-face teaching. Especially recorded videos and the use of digital tools would be helpful in addition to classroom

teaching in the future.

To summarize this work, there were many advantages and disadvantages in online learning. There were also many similarities but also some differences. The analyses of other countries also led to similar results as in Austria. Digital learning will play a very important role in the future and it will be indispensable in the future education.

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