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Do Higher Education Students Have the Means to Learn During the COVID-19 Pandemic? Student Demands for Distance Learning in a Suddenly Digital Landscape

Abstract

Across the globe, 2020 terms began under conditions incited by the corona pandemic. Within a relatively short amount of time, universities started to develop and implement online courses for distance learning. The current study is about an online survey at a German university investigating the unique circumstances under which students began the digital 2020 summer term. Of approximate-

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ly 38 500 students, N = 5563 students from across all institutional faculties took part in the survey. Results indicate how well students are equipped with devices for digital learning, what kind of experiences they have already made with online learning, and how competent they reported feeling regarding digital learning. The study provides important insights into digital higher education during the exceptional pandemic situation. The results are intended to feed into student counselling systems via support by way of access to devices or courses regarding digital skills, or through counselling for students with special social burdens.

Keywords
higher education, e-learning, digital readiness, COVID-19 pandemic

Verfügen Studierende über die Mittel und Wege, um während der Coronaviruspandemie zu lernen? Bedarfe für Online-Lehre in einer plötzlich digitalisierten Landschaft

Zusammenfassung
Weltweit begann das Jahr 2020 unter dem Einfluss der Coronapandemie. Innerhalb sehr kurzer Zeit begannen Universitäten, Online-Kurse für den Fernunterricht zu entwickeln und implementieren. Die vorliegende Studie untersuchte anhand einer Online-Umfrage an einer deutschen Universität die besonderen Umstände, unter denen Studierende das digitale Sommersemester 2020 begannen. Von etwa 38 500 Studierenden nahmen N = 5563 Studierende aller Fakultäten an der Umfrage teil. Die Ergebnisse zeigen, wie gut die Studierenden mit Geräten für das digitale Lernen ausgestattet sind, welche Erfahrungen sie zuvor bereits mit dem Online-Lernen gemacht hatten und wie kompetent sie sich in Bezug auf das digitale Lernen fühlen. Die Studie liefert wichtige Einblicke in die digitale Hochschulbildung während der außergewöhnlichen Pandemiesituation. Die Ergebnisse können in studentische Beratungssysteme einfließen, sei es durch Unterstützung beim Zugang zu Geräten, durch Kurse zu digitalen Schlüsselkompetenzen oder durch Beratung von Studierenden mit besonderen sozialen Belastungen.

Schlagworte
Hochschulbildung, E-Learning, Digital Readiness, Coronapandemie

1. Introduction

The corona pandemic led to an ad hoc changeover at universities across the globe from predominantly face-to-face teaching to exclusively digitally supported teaching formats ("emergency remote teaching"; Bond et al., 2021; Hodges et al., 2020). Studies on remote learning provide important insights into student equipment and

engagement. However, those studies do not transfer to the current situation of distance learning in a suddenly digital landscape. Hence, the current study investigates student technical equipment, experiences, digital skills, and further possible individual and contextual challenges at a German university.

Studies on technical equipment and media use by students suggest that higher education students have a range of digital devices at their disposal (e.g., Dolch & Zawacki-Richter, 2018; Sailer et al., 2018) – although inter-individual differences are to be expected. For example, the media-use study by Zawacki-Richter et al. (2016) revealed that female students use social networks more often during their studies than did male students. Differences are furthermore to be expected between traditional and non-traditional students (e.g., those with children; see Paulsen & McCormick, 2020) as well as due to study subject. For example, the study by Weber et al. (2019) found information-seeking behavior relative to study subject: students of the humanities or social sciences more often consult libraries but less often use online resources for information seeking.

In emergency remote teaching, students' digital readiness might contribute to how students cope with the change to online formats. Inter alia, skills regarding the use of digital tools as well as information seeking or information sharing behavior seem to be important (Hong & Kim, 2018; Rubach & Lazarides, 2019; Weber et al., 2019). For example, students with high self-confidence in the use of digital technologies seem to have significantly fewer barriers in social interaction or motivation (Muilenburg & Berge, 2005).

Accordingly, the success of the switch to digital teaching in the pandemic situation may depend on access to digital devices, previous experience in media use, as well as students' digital skills. In contrast to students purposefully enrolling in a course of study at a distance teaching university (cf. Stöter et al., 2014), students during the corona pandemic did not voluntarily choose to participate in a digital semester themselves but had to adopt a quick and pragmatic approach in the wake of the pandemic (Kerres, 2020). Due to contact restrictions, students were more dependent than usual on their personal equipment because access to computer rooms could no longer be provided at universities. Furthermore, students were less able to receive technical assistance through personal contact. Finally, subgroups of students with children might have faced further challenges due to a lack of childcare (daycare and school closures).

2. Aims of the Study

The aim of the study is to assess how students are equipped for the first pandemic online semester by way of equipment with digital devices, e-learning experiences, and digital skills. The study aims to identify groups of students with digital learning accessibility difficulties. In line with previous study results, gender- and subject-specific differences can be assumed. Furthermore, differences among study

experience and domestic condition are considered. We investigate two research questions (RQ):

RQ 1: How well are higher education students prepared for a complete shift to digital distance learning?

RQ2: What are the specific preconditions of higher education students with respect to their expected degree, study subject, gender, or domestic conditions?

3. Method

The study reports the first measurement of an online survey study during the summer semester 2020 (Bedenlier et al., 2021; Händel et al., 2020), to which all students at a full university were invited. The current report refers to data of the week before the start of the official lecture period, where all students enrolled at the university were invited via email to take part in a survey on the general conditions of digital teaching.

3.1 Instruments

Students were asked about their workplace equipment (quiet workplace, internet access) as well as PC devices (desktop, tablet, notebook, min = 0, max = 3). Furthermore, experiences with nine e-learning offerings (see Table 2; Froebus & Bender, 2019) at the university were recorded: For each of the nine university e-learning offerings, students indicated whether they had used them before (min = 0, max = 9).

Finally, two four-item subscales (Digital Tool Application – DTA, and Information-Sharing Behavior – ISB) from the Digital Readiness for Academic Engagement Questionnaire (DRAE; Hong & Kim, 2018) were used to assess students' self-assessed digital skills. The items had to be answered on a 6-point Likert scale (1 = *not at all correct* to 6 = *completely correct*); DTA: α = .76, for example, "I can use software or apps on a computer or mobile device"; and ISB: α = .83, for example, "I can interact with fellow students using real-time communication media, e.g., video conferencing tools or messenger services."

3.2 Sample

In total, 5563 students (which corresponds to 15% of all students) took part in the survey; 62% of the respondents were female, 38% male, 0.3% non-binary; 14% did not provide any information on gender. The participating students were on average 23.2 years old (*SD* = 4.5) and were enrolled in their 4.5 semester (*SD* = 2.8). Less than 5% of the respondents had at least one child to look after in the house-

hold, which corresponds to the distribution of students in Germany (Middendorff et al., 2017). Table 1 shows the relative frequencies in the surveyed sample. Students across all five faculties participated in the survey and the participation distribution corresponds well with the distribution within the university.

Table 1: Sample Separately Reported by Faculty and Expected Degree

	Students [%]
Faculty	
Faculty of Humanities, Social Sciences, and Theology	27.6
Faculty of Sciences	12.8
Faculty of Business, Economics, and Law	20.7
Faculty of Engineering	23.7
Faculty of Medicine	15.2
Expected degree	
Bachelor	37.2
Master	24.3
State exam	35.4
Doctoral exam	1.8
Others	1.4

3.3 Data Analysis

Descriptive statistics are reported to illustrate the current pandemic situation in higher education with regard to student digital equipment, relevant experience, and skills. Digital skills was correlated with (a) equipment and (b) e-learning experience. Finally, multivariate (co-)variance analyses were calculated to investigate possible group differences between subject cultures (operationalized via the respective faculty), gender, and required child care.

4. Results

4.1 Descriptive Statistics

Table 2 illustrates the availability of each workstation element and whether students had already used available e-learning features.

Table 2:   Availability of Technical Devices and Use of Previous E-Learning Offerings

Equipment	M	SD
Work area	.91	.29
Internet access	1.00	.07
Desktop-PC	.31	.46
Notebook	.91	.29
Tablet-PC	.48	.50
Sum score PC devices	1.70	0.71
E-learning offering		
Downloadable lecture notes/literature	.92	.27
Lecture recordings	.67	.47
Live streams of lectures	.06	.24
Live media in courses	.49	.50
Online learning modules	.52	.50
Online communication and collaboration	.63	.48
Other online-supported learning opportunities	.35	.48
E-tests	.43	.50
Online self-tests for self-control	.53	.50
Sum score e-learning experiences	4.57	2.09

Note. 0 = no; 1 = yes.

Less than 1% had neither a notebook, nor a desktop/tablet PC available. About half of the e-learning offerings had already been used by students, with a maximum for downloadable scripts and a minimum for live streams.

With regard to the assessed skills, the students considered themselves to be rather competent in the use of digital tools (DTA; $M = 4.64$, $SD = 0.91$) and in the sharing of digital information (ISB; $M = 5.03$, $SD = 0.94$).

Bivariate correlations indicate significant but weak correlations between equipment and previous e-learning experiences with self-assessed skills ($.16 \leq r \leq .20$, $ps < .001$).

4.2 Interindividual Differences in Equipment, Experience, and Self-Assessed Digital Skills

4.2.1 Differences Relative to Desired Degree

First, this study explored whether the desired degree – Bachelor's (BA) vs. Master's (MA) degree – had an influence on the handling of e-learning offers or digital skills. As expected, MA students reported a higher experience with universi-

ty e-learning offerings (M = 4.83, SD = 1.84) than did BA students (M = 4.33, SD = 2.16), $F(1, 3350)$ = 50.76, p < .001, η^2 = .02. Although both groups of students considered themselves relatively competent, the values among MA students were significantly higher (DTA: M = 5.00, SD = 0.80; ISB: M = 5.30, SD = 0.86) than among BA students (DTA: M = 4.67, SD = 0.89; ISB: M = 5.03, SD = 0.92), $F(1, 3350)$ = 116.26, p < .001, η^2 = .03, and $F(1, 3350)$ = 72.14, p < .001, η^2 = .02. No significant differences were found with respect to computer equipment, $F(1, 3350)$ = 1.72, p = .19.

4.2.2 Gender Differences

Male and female students significantly differed with regard to computer equipment, $F(1, 4707)$ = 71.40, p < .001, η^2 = .02. Male students were slightly better equipped with digital devices (M = 1.81 devices, SD = 0.73) than were female students (M = 1.63 devices, SD = 0.68). There were no significant gender differences in the experience of university e-learning offerings, $F(1, 4707)$ = 1.97, p = .16. However, differences were found with regard to self-assessed computer skills. Male students rated their digital information sharing skills higher (M = 5.26, SD = 0.88) than did female students (M = 4.92, SD = 0.95), $F(1, 4707)$ = 146.25, p < .001, η^2 = .03. A strong effect was shown with regard to the use of digital tools in favor of male students (M = 5.14, SD = 0.76) when compared to female students (M = 4.38, SD = 0.84), $F(1, 4707)$ = 957.25, p < .001, η^2 = .17.

4.2.3 Differences Relative to Subject Groups

Significant subject differences of small effect size were found, DTA: $F(4, 5481)$ = 136.14, p < .001, η^2 = .09; ISB: $F(4, 5481)$ = 40.12, p < .001, η^2 = .03; experience with university e-learning offerings: $F(4, 5481)$ = 25.40, p < .001, η^2 = .02; computer equipment: $F(4, 5481)$ = 9.92, p < .001, η^2 = .01) (see Table 3 for descriptive values). Tukey post hoc tests indicate that for DTA and ISB, students from the Faculty of Engineering have higher scores than all other students. Students from the Faculty of Humanities, Social Sciences, and Theology as well as from the Faculty of Medicine have lower scores than do other students (ps < .01). Students from the Faculty of Sciences and of Business, Economics, and Law have similar self-assessed skills.

Similarly, students of the Faculty of Engineering are best equipped, and significantly better than those of the Faculty of Humanities, Social Sciences, and Theology and the Faculty of Business, Economics, and Law (ps < .05). Finally, students of the Faculty of Humanities, Social Sciences, and Theology are worse equipped than those of the Faculty of Medicine (p < .001).

Deviating from this pattern, results concerning experiences with university e-learning offerings are highest in the Faculty of Business, Economics, and Law

(ps < .001) and lower in the Faculty of Sciences than in all other faculties (ps < .01) – with the exception of the Faculty of Humanities, Social Sciences, and Theology, where students similarly reported less experience with e-learning.

All effects remained significant when controlling for gender, although the effect sizes were smaller.

Table 3: Descriptive Values of Digital Skills, Previous E-Learning Experience, and Technical Equipment, Separately for the Students of Each Faculty

	DTA		ISB		E-Learning		Equipment	
Faculty	M	SD	M	SD	M	SD	M	SD
Faculty of Humanities, Social Sciences, and Theology	4.43	0.90	4.88	0.97	4.38	2.11	1.62	0.70
Faculty of Sciences	4.68	0.90	5.03	0.93	4.25	1.87	1.69	0.70
Faculty of Business, Economics, and Law	4.61	0.86	5.08	0.92	5.10	1.97	1.69	0.72
Faculty of Engineering	5.09	0.80	5.28	0.88	4.67	1.98	1.77	0.71
Faculty of Medicine	4.34	0.91	4.86	0.93	4.63	2.47	1.77	0.67
Total	4.64	0.91	5.03	0.94	4.62	2.10	1.70	0.70

Note. DTA = digital tool application; ISB = information-sharing behavior.

4.2.4 Domestic Conditions

Students with children may face particular challenges due to corona-related school and daycare closures. Significant differences were found with regard to the workplace. While 92% of the students without children had a quiet workplace, this was true for only 64% of the students with children, $F(1, 5500) = 217.46$, $p < .001$, $\eta^2 = .04$. No significant differences were found in PC equipment, $F(1, 5500) < 1$, or in experience with university e-learning offerings, $F(1, 5500) = 2.29$, $p = .13$. However, students with children considered themselves less digitally skilled (DTA: $M = 4.64$, $SD = 0.91$; ISB: $M = 5.05$, $SD = 0.93$) than students without children (DTA: $M = 4.49$, $SD = 0.96$; ISB: $M = 4.69$, $SD = 1.18$), $F(1, 5500) = 7.32$, $p = .01$, $\eta^2 = .00$, and $F(1, 5500) = 33.10$, $p < .001$, $\eta^2 = .01$, for DTA and ISB respectively.

5. Discussion

The present study arose in the context of the radical switch to digital teaching exacerbated by the corona pandemic (cf. Kerres, 2020). An important feature of the survey is that, to obtain an inventory that was as unbiased as possible, the study was carried out before the onset of digital classes in the 2020 summer semester.

Consistent with previous surveys (e.g., Sailer et al., 2018; Zawacki-Richter et al., 2016), almost all students appear to have access to a desktop PC, notebook or tablet PC. This is a promising precondition for the start of a digital semester (RQ1). Still, universities should not leave any student behind, and take account of students without access to technology for participating in an ad hoc digital semester. Individual digital skills were rated as rather high, with the ability to share digital information more pronounced than the ability to use different programs (Rubach & Lazarides, 2019).

The correlative analyses indicate an interrelation between equipment features and previous e-learning experiences with self-assessed skills. Although both constructs were surveyed simultaneously and thus, no causal conclusions can be drawn, this can still be interpreted as a possible indication that both the use of technical equipment and the experience gained lead to higher competences (Senkbeil et al., 2019).

Finally, group comparisons were made based on existing subject groups, study experience, gender, and domestic conditions to identify which groups of students start the digital semester well prepared (RQ2). Regarding technical equipment, differences were found in line with expectations. Overall effect sizes can be regarded as small. Still, due to differences with regard to gender, degree (BA vs. MA), and subjects, university management and deans of the faculties need to be aware that some groups of students might need support in order to achieve equity in digital distance learning. While no significant computer equipment differences were found for students with or without children, students with children were less likely to have an available and quiet workplace, that is, these students face more difficult study conditions not exclusively attributable to digital teaching (because this is precisely where digital teaching formats could also have advantages for students with children; see Zawacki-Richter et al., 2016), but rather due to a lack of childcare facilities.

Furthermore, significant differences in self-assessed digital skills were found that are in line with the pattern of results of *actual* measured competencies (Senkbeil et al., 2019). Hence, assuming that self-reported skills correlate with actual competencies, students enrolled in specific faculties might need training to achieve ICT literacy. Particularly with regard to the use of digital applications, considerable and large gender differences were found to the disadvantage of female students, which is in agreement with results regarding computer self-concept (Lim, 2001).

5.1 Limitations and Implications

A first limitation relates to the sample, which might be a selective sample – either due to personal interest in the survey, or due to lacking internet access. Second, the results refer to only one university and do not provide detailed information on individual courses of study, socioeconomic status, or migration background. Third, digital skills were not recorded on the basis of a detailed competence test (cf. Senk-

beil et al., 2019) or behavioral data, but rather on two selected scales of self-assessed digital skills.

Still, the study is of relevance because it underscores the circumstances imposed upon students at the beginning of the 2020 summer semester. The survey provides important observations of student groups that need special support, in particular – either through courses on the use of digital media or through the consideration of their individual study situation, like one in which supplemental childcare is lacking or altogether absent. Of course, digital teaching formats that were developed within a few weeks cannot be compared with established digital or blended learning formats that have been planned by expert committees for the long term (cf. Hetzner & Schmidt, 2018; Kerres, 2020; Moskal et al., 2013). Nonetheless, the distance learning experiences brought about by the corona pandemic might contribute to a stronger and more equitable foundation for digital learning services in the long term. In addition to this stocktaking, a continuous and process-oriented investigation of the study conditions in this exceptional semester is required. That is, what (additional) resources are used by students during the semester; how do students develop computer skills; and what are the consequences of (sudden) digitalization in terms of student engagement (Bond et al., 2020) or student achievement.

Acknowledgements

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