



## Online Student Surveys

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The report is based on analyses of six online student surveys conducted between January 2022 and January 2023. The surveys were conducted in both English and German, the questionnaires being equivalent. There were two repeated full surveys at the University of Oldenburg, Germany, and LCC International University, Lithuania, as well as two additional surveys at the University of Vienna and the University of Warwick. Table 1 provides an overview. A total of 2,125 students participated in the surveys. The surveys were part of digiUR's intellectual output no. 4 ("Research Study: Digital UR").

This report reviews key variables related to UR and the pandemic, namely, first, digital competence; second, research experience and research competence; and third, factors that should be examined in light of current research on UR, such as self-efficacy. The fourth and final part addresses the impact of the pandemic on UR. The annex contains the survey questions in two languages, English and German as well as some data.

### 1. Digital Competence

The digiUR project followed the priority "Innovative practices in a digital age" in the field of higher education. Therefore, digital literacy played a key role. For our study, we referred to the European project DigCom2.1 (Carretero et al. 2017) to measure digital competences. For our surveys, we used questions from the DigCompSat study (Clifford et al. 2020), hereafter referred to as Digital Competence<sup>1</sup>.

In our data, Digital Competence depends on gender, age, and subject of studies, as expected. In general,

- Female students show less Digital Competence than male students
- Students of STEM show more, students of humanities less Digital Competence

As to the data from Oldenburg, students of the age 25 to 30 show the highest level of Digital Competence, students of age 36 and older the lowest level.

In our analyses, Digital Competence is an integrated scale of ten items, from which five are drawn from the DigCompSat study and five are new constructions according to the five competence areas of DigComp2.1.

Some details. The analysis of the items on digital competencies revealed (here data from Oldenburg 2022, the results are similar for all surveys):

- The responses to the specific questions on information, communication, and content correlate

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<sup>1</sup> By capitalizing "Digital Competence" we refer to the artificially formed variable for digital competence. The same applies to the other variables.

very strongly with each other.

- The most influential general item is the one on problem solving.

- However, the ten questions on digital competence form a useful overall scale. We just need to add up the values for all questions! The statistical details are:

-- Cronbach alpha = .874

-- no single item can be left out

-- highest contribution by the item on problem solving (item with an overall assessment)

-- high correlation with self-assessed digital competence:  $r=.662$

-- high correlations with Critical Thinking, Self-Efficacy etc.

Table 1: Online Student Surveys, main results

		UOL 1	UOL 2	Vienna	LCC 1	LCC 2	Warwick
Sample	N (all cases)	1100	510	177	235	46	57
	N' (corrected) <sup>a</sup>	1027	384		172	33	
	return rate	11%	5%		35%	7%	
When		Jan 2022	Jan 2023	April 2022	Jan 2022	Jan 2023	Oct 2022- Jan 2023
Language		German	German	German	English	English	English
Gender	Women	68%	68%	70%	67%	76%	65%
Age	under 18	0%	0%	0%	7%	3%	3%
	18-20	21%	13%	31%	48%	45%	
	21-25	59%	62%	52%	42%	52%	18-24: 97 %
	26-30	12%	13%	7%	2%	-	
	31-35	4%	5%	2%	1%	-	
	36 and over median	4% 21-25	6% 21-25	7% 21-25	1% 18-20	- 21-25	
Years of Study	median	3 years	3 years	3 years	3 years	2 years	not asked
Study Focus	STEM	35%	38%	-	-	-	16%
	Teacher education	48%	36%	36%			2%
DigComp 2.1 (short)	mean (range 1-4)	2.8	2.8	3.0	3.0	2.9	2.8
	standard deviation	.54	.54	.55	.50	.55	.58
Research Experience <sup>b</sup>	None	25%	20%	32%	11%	9%	9%
	Preparation	41%	39%	49%	31%	24%	41%
	Participation	15%	21%	11%	49%	64%	41%
	Assistance	6%	10%	6%	4%	15%	not asked
	Own project inside	14%	20%	15%	20%	27%	27%
	Own project outside university	2%	2%	6%	11%	9%	9%
UR Impact of Pan-demics (Grineski et al. 2020)	UR in pandemics <sup>c</sup>	26%	24%	51%	34%	30%	32%
	Mentoring (90%)	54%	48%	51%	47%	60%	33%
	Motivation (68%)	54%	56%	59%	35%	70%	50%
	Research steps (64%)	47%	70%	44%	45%	40%	44%
	Equipment (57%)	31%	26%	38%	25%	20%	11%
	Time (56%)	26%	24%	35%	18%	20%	0%
	Conferences (45%)	8%	12%	14%	8%	20%	0%
	Scientific career (42%)	18%	17%	18%	3%	20%	0%
Internet (42%)	42%	41%	47%	25%	30%	11%	
Inclusion <sup>d</sup> (see also Table 3)	Fewer opportunities	no change	no change	no change	no change	no change	no change
	Foreign language	somewhat worsened	no change	no change	no change	no change	no change

<sup>a</sup> due to unclear status as undergraduate or too few data

<sup>b</sup> Many students stopped answering after ticking *None* or *Methods* only. This is particularly noticeable in the heavily corrected data sets (UOL2, LCC, lower values for *None* and *Methods*).

<sup>c</sup> *Did you participate in any kind of (student) research since the start of the pandemic? If yes: What had been challenging for you when conducting research during the pandemic*

<sup>d</sup> *Has your study situation changed as a result of studying online during the pandemic? Fewer opportunities=students with fewer opportunities. Foreign language=studying in a foreign language.*

## 2. Research Experience, Research Competence

In order to assess UR, we need to consider on the one hand what is offered by universities, e.g., methods courses or research seminars, and on the other hand the research competence that students acquire in this way. To capture what is offered, we formed the variable Research Experience. Research Experience is surveyed in the categories:

- *No research experience*
- *Preparation (introduced into methods)*
- *Participation (in course-based research)*
- *Assistance (for university researchers)*
- *Own project inside university*
- *Own project outside university*

We capture as Research Competence the students' self-assessment with reference to the peer group, a procedure that has proven successful in expertise research (cf. Mieg 2009). The question is:

*If your fellow students approached you to give advice on practical research problems (from research design to analysis), how confident would you be to do so?*

The main results are (similar for all universities):

1) What counts is own independent research: Students' research competence is most enhanced by students' own independent research in their context of study. This is a strong argument for UR!

Statistical evidence: Typically, Research Competence correlates most strongly with "Own project within university" (e.g., UOL1:  $r=.349$ ,  $p<.001$ ; LCC1:  $r=.248$ ,  $p<.001$ ). No other variable correlates as strongly with forms of research experience (not even Self-Efficacy or self-assessed digital competence). Also, in regression analyses with Research Competence as the dependent variable, the most important predictor is "Own project within the university" (in second place comes mostly Self-Efficacy).

2) Preparation does not suffice: There is a clear, negative correlation of "Preparation (introduced into methods)" with Research Competence. That is, a (mere) introduction to research methods probably reduces self-assessed research competence. This again is a strong argument for UR.

Statistical evidence: typically negative correlations of Research Competence with "Preparation (introduced into methods)" (e.g., UOL1:  $r=-.138$ ,  $p<.001$ ; LCC1:  $r=-.255$ ,  $p<.001$ ). The correlation changes only slightly if we correlate Research Competence with "Preparation\_only", i.e., restrict it to methods introduction only, no other research experience (UOL1,  $r=-.146$ ,  $p<.001$ ; LCC1:  $r=-.252$ ,  $p<.001$ ).

## 3. Current Research on UR

Which factors that influence UR do we know from current research? Studies show positive effects of self-efficacy (e.g., Sadler & McKinney 2010) and uncertainty tolerance (Wessels et al. 2021). In addition, the possible relationship with critical thinking is often used as a rationale for UR (cf. Petrella & Jung 2008). For our surveys, we formed three short scales (2 questions each): Self-Efficacy and Uncertainty Tolerance (both in Wessels et al. 2021), and Critical Thinking (Sosu 2013). Our findings were:

1) Strong influence of Self-Efficacy. Self-Efficacy, i.e. the expectation that one can personally make a difference, shows a strong influence in our surveys and represents an important factor influencing Research Competence.

Statistical note: Since Self-Efficacy seems to be very similar to the variable Research Competence, high correlations are to be expected. However, even if we form a residual variable of Self-Efficacy from Research Competence, it still shows strong influence, e.g., when it is negatively correlated with loss of motivation in the pandemic (Oldenburg 2022 data).

2) Uncertainty Tolerance, an important but difficult variable. At the University of Oldenburg, student teachers are characterized by a low Uncertainty Tolerance (different in Vienna, which is related to the teaching profession). However, the variable Uncertainty Tolerance does not make sense in English (probably because of the many negations) and had to be replaced by the similar concept of ambiguity tolerance (e.g., Furnham & Marks 2013). Uncertainty Tolerance / Ambiguity Tolerance does not play as important a role as Self-Efficacy. The analyses will be continued in a scientific article.

3) Critical thinking as compensation for research? Critical Thinking is also related to Research Competence, but - similar to Uncertainty Tolerance / Ambiguity Tolerance - it takes a back seat to Self-Efficacy. Our data suggest that critical thinking can give students lacking research experience a "sense" of research competence. Indeed, although the relationship between critical thinking and UR is not yet clear, there is clear evidence that critical thinking can be fostered by university teaching (Abrami et al. 2015). Our analyses will be continued in a scientific article.

#### 4. Effects of the COVID-19 Pandemic

1) Challenges for UR due to the pandemic. Students report similar problems when they perform UR under pandemic conditions, as outlined in the US study by Grineski et al. (2020). As Table 1 shows, there are two exceptions: They complain less about lack of mentoring as well as lack conference experiences. One explanation could be: Our students do not expect mentoring or the chance to present their research at conferences.

2) Hybrid UR? Looking at the data from the University of Oldenburg (a large sample), the type of previous research - whether online, in person, or hybrid - has a major impact on Research Competence. The hybrid learning situation shows the highest Research Competence, while the online-only learning situation shows the lowest (Table 2), especially in online group work (Oldenburg 2023 data). This is also true for maintaining motivation (i.e., no loss of motivation). However, as the comparison with LCC shows (unfortunately only a few cases), we have to be careful with the conclusions; there online learning is familiar to students and effective in UR as well (Table 2).

Table 2: Research Competence as a function of the type of previous research experience.

<i>Overall, in what form have you gained your research experience so far?</i>	University of Oldenburg 2023	#	LCC 2023	#
I had not yet	2.0	160	1.6	5
almost always online	2.9	55	3.9	7
almost always in person	3.1	100	2.6	11
mostly hybrid	3.3	64	2.8	10
	2.6	379	2.8	33

The values for Research Competence range from 1 (very low) to 5 (very high).

3) No effects of the pandemic on inclusion: Neither students with fewer opportunities nor those who must study in a foreign language say the pandemic has worsened study conditions. Table 3 shows the total of all surveys. The median value for students with

fewer opportunities (second column) and for students in a foreign language is "neither". Overall, however, the opinion that the study situation has worsened slightly prevails (for students with fewer opportunities, "somewhat worsened" is the most frequent answer). Note on the assessment of inclusion: Addressing individuals in need of inclusion (via disabilities, special challenges, fewer opportunities...) is a delicate matter and is handled differently at each university. This variety of regulations and addresses may be one reason why students with fewer opportunities distribute their responses almost evenly (as many as 30% see improvement).

Table 3: Effects of the pandemic on inclusion (total of all surveys)

	<i>Do you have any <u>special challenges</u> to overcome in your studies (e.g. studying with a child, physical or mental impairments, caregiving responsibilities)? Has your study situation changed as a result of studying online during the pandemic?</i>	<i>Are you <u>studying in a foreign language</u>? Did your study situation improve by studying online during the pandemic?</i>
	N=468	N=447
strongly worsened	20 %	12 %
somewhat worsened	26 %	25 %
neither	24 %	36 %
somewhat improved	15 %	17 %
strongly improved	15 %	9 %

4) Digital benefits from the pandemic? Please find in the annex the answers to the two open questions on the digital benefits of the pandemic (LCC International University and University of Oldenburg):

*During the pandemic, you may have been introduced to (new) digital tools or programs. Which of these is the most important for you?*

*During the pandemic, much of the research took place online, even when you were conducting your own research as a student. This had many disadvantages, but also advantages. In your view, what can be the most important advantage of online-based research for students that we should preserve in the long term?*

We will document our findings on the impact of the pandemic on undergraduate research in a scientific article.

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