

# The Corona transition and student learning

Student evaluations of exams, student well-being & engagement and their relationships with the learning environment

*Third Express Report - March 2021*

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[Deliverable 3A: Long-term effect of transition, Q2 data]



## Introduction

Already more than a year ago, on March 12, 2020, Eindhoven University of Technology decided to change learning and teaching drastically, as a response to the Corona pandemic. Since then, almost all teaching has been conducted online, with only short phases of limited face-to-face teaching after the summer break in September. Since the start of this transition, we have been surveying Bachelor and Master students from the department of Industrial Engineering and Innovation Sciences (IE&IS) to obtain insights into their experiences with online learning. For each student, we focus on one specific course that they have attended. Furthermore, and independent of any course, we examine various dimensions of students' well-being, including feelings of loneliness, worrying, depression, and concentration problems.

In the previous two reports, we described students' experiences and well-being during the transition (2019-2020, Q3) and the first quartiles of online learning (2019-2020, Q4 and 2020-2021, Q1). While all reports cover well-being issues and their relationships with the learning environment, each report also includes its specific perspective. In this report, we describe a follow-up analysis on students' experiences and well-being over Q2 of this academic year. We briefly sketch how students' well-being changed when compared to the (earlier) Q1 quarter. After that, we examine how different well-being indicators relate to characteristics of the learning environment, including the home situation of the student, but also to aspects of the course design and the teacher's behavior. Finally, we examine how students perceive and evaluate their (often online) exams during the Corona period in Q2. We focus on students' test anxiety, their exam-coping skills, how doable they think the course-specific exam was, and whether they felt more or less nervous than in a comparable pre-Corona exam context. We examine whether proctored and non-proctored exams differ regarding these exam perceptions.

Specifically, the following questions are answered in this report:

1. *What is the situation in Q2 regarding the well-being of IE&IS students and to what extent, if at all, does students' well-being differ when compared to Q1?*
2. *How is students' well-being related to characteristics of their learning environment (home environment, course design, teacher's behavior)?*
3. *What are students' perceptions of (online) exams, including test anxiety, and do these differ between proctored and other exams?*

## The survey

### Sample

In total, 1902 students were invited for this Q2 survey. Not all of these were eligible for the study since some did not follow a traditional course but conducted a project, such as a Bachelor or Master Thesis project. Eventually, 808 students replied (42%). Of these students, 616 students followed at least one course and completed the full survey (final response rate 32%). Students completed the questionnaires between February 4 and March 15, 2021, so in the weeks following Q2. The final sample consists of 254 (41%) female students, and 39 (6.3%) students with a non-Dutch nationality. An overview of the study programs in the sample can be found in Figure 1.

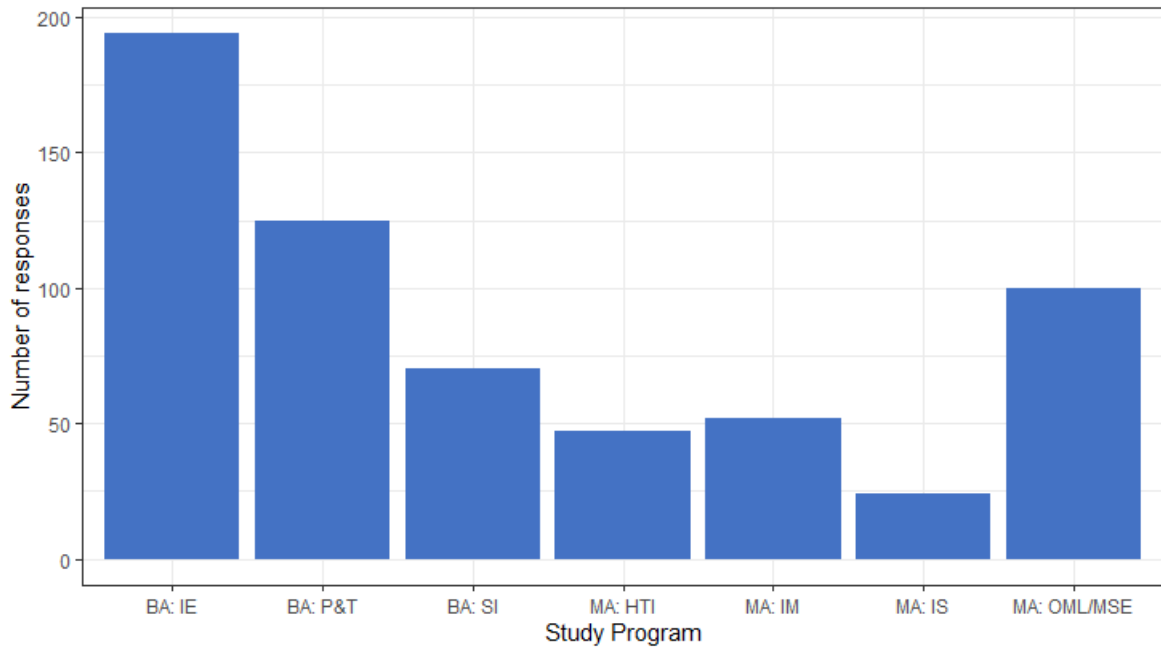


Figure 1. Overview of the study programs in the sample for the Q2 survey

The relative sizes of the different student groups are in line with the number of enrolled students in the study programs. The largest group of respondents comprises Bachelor students of the program “Industrial Engineering” and the smallest group comprises Master students of the program “Innovation Sciences”.

## Student well-being

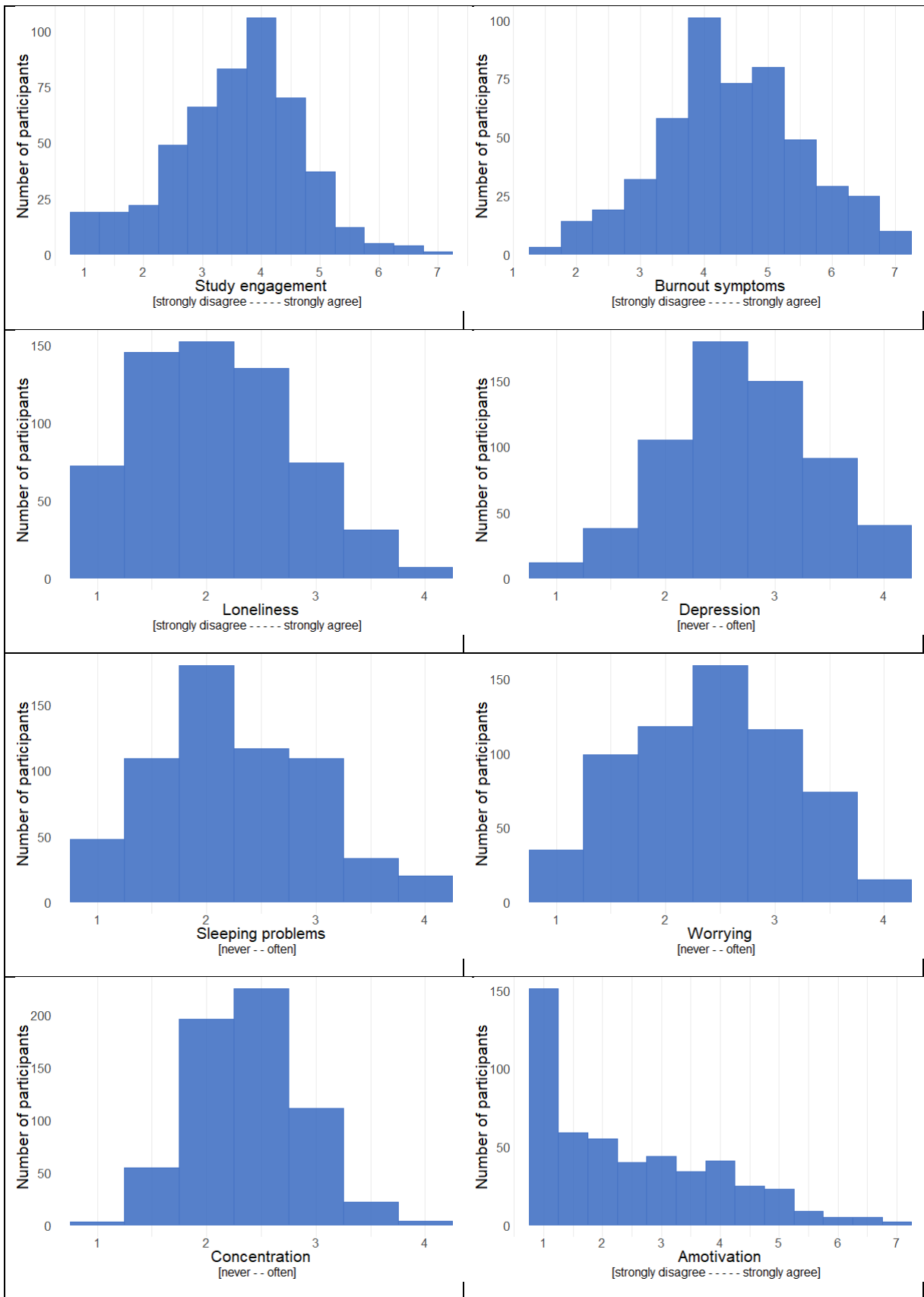
Eight indicators of student well-being can be found in Table 1.

**Table 1. Overview of reported well-being in Q2**

|                        | scale | Mean | SD   | % Problematic* |
|------------------------|-------|------|------|----------------|
| Study Engagement       | 1-7   | 3.68 | 1.11 | 17%            |
| Burnout                | 1-7   | 4.51 | 1.13 | 20%            |
| Loneliness             | 1-4   | 2.16 | 0.69 | 4%             |
| Depression             | 1-4   | 2.69 | 0.67 | 15%            |
| Sleeping problems      | 1-4   | 2.26 | 0.72 | 5%             |
| Worrying               | 1-4   | 2.54 | 0.74 | 14%            |
| Concentration problems | 1-4   | 2.51 | 0.50 | 4%             |
| Amotivation            | 1-7   | 2.55 | 1.49 | 4%             |

\* Often ( $\geq 3.50$  on a 4-point scale), agree/strongly agree ( $\geq 5.50$  on a 7-point scale), except for study engagement (disagree/strongly disagree,  $\leq 2.50$ )

These eight constructs have been measured via established scales, consisting of several seven- or four-point Likert scales. All scales have satisfactory reliabilities. The figures below show the distribution of these well-being factors in more detail.



### **Study engagement**

Study engagement was measured by three validated questions: 'When I was studying, I felt bursting with energy', 'I was immersed in my studies', and 'I was enthusiastic about my studies' that tapped into the vigor, absorption, and dedication facets of study engagement. The mean score is slightly below the midpoint of the scale (3.7; SD = 1.1). Approximately 17 percent of the students disagree or strongly disagree with the statements ( $\leq 2.5$ ) and report a rather low degree of engagement.

### **Burnout**

In measuring burnout, we focused on *exhaustion* (because the other facet of burnout – disengagement – is covered by study engagement). The average student experiences relatively moderate signs of burnout (M=4.5, SD = 1.1). However, about 20 percent agrees or strongly agrees with eight statements about burnout, such as 'While I was studying, I often felt emotionally drained' and 'There were days when I felt tired before I joined the online class or started studying', indicating a higher risk of burnout.

### **Loneliness**

We measured loneliness with eight questions, including 'I lacked companionship' and 'I felt isolated from others' on a four-point scale: never (1), rarely, sometimes, often (4). On average, students rarely experience loneliness (M=2.2, SD=0.7). Nevertheless, about 4 percent of the students indicate that they are often lonely.

### **Depression**

Eight questions were used to measure depression, including 'I felt nervous or tense' and 'I felt hopeless about the future' and 'I felt unhappy, sad, or depressed', on a four-point scale: never (1), rarely, sometimes, often (4). On average, students moderately experience depression (M=2.7, SD=0.7). Approximately 15 percent of the students indicate they are often feel depressed.

### **Sleeping problems**

We measured sleeping problems with five questions, including 'I fell asleep easily' and 'When I woke up at night I had difficulties falling asleep again' (both reversed), on a four-point scale: never (1), rarely, sometimes, often (4). On average, students moderately experience sleeping problems (M=2.3, SD=0.7). Approximately 5 percent of the students indicate they have severe sleeping problems.

### **Worrying**

Four questions were employed to measure worrying, including 'When I stopped studying I continued to worry about study issues' and 'I often lay awake at night because my study haunted me, on a four-point scale: never (1), rarely, sometimes, often (4). On average, students rarely to moderately experience worrying (M=2.5, SD=0.7). At the same time, approximately 14 percent of the students indicate that they worry often.

### **Concentration problems**

We measured concentration problems with four (course-specific) questions, e.g., 'My mind wandered a lot when I studied', on a four-point scale: never (1), rarely, sometimes, often (4). On average, students rarely to moderately experience concentration problems (M=2.5, SD=0.5). Only about 4 percent of the students indicate that they often have concentration problems.

### **Amotivation**

Amotivation refers to the lack of a specific motivation for studying at TU/e, measured with four questions, including 'I really felt that I was wasting my time at university', and 'I once had good reasons for going to university; however, in Q1 after the transition, I wondered whether I should continue.' On average, students rarely to sometimes report this lack of motivation (M=2.6, SD=1.5 on the four-point scale). About 4 percent of the students report very high levels of amotivation ( $\geq 5.50$ ).

## Comparison of well-being indicators between Q1 and Q2

Table 2 compares several well-being indicators between Q1 and Q2 of the academic year 2020-2021.

**Table 2. Overview of reported well-being**

| Scale                  | Q1    |       |      |                | Q2    |      |                |
|------------------------|-------|-------|------|----------------|-------|------|----------------|
|                        | Range | Mean  | SD   | %“Problematic” | Mean  | SD   | %“Problematic” |
| Study Engagement       | 1-7   | 4.03* | 1.05 | 8%             | 3.68* | 1.11 | 17%            |
| Burnout                | 1-7   | 4.18* | 1.05 | 12%            | 4.51* | 1.13 | 20%            |
| Loneliness             | 1-4   | 2.12  | 0.64 | 3%             | 2.16  | 0.69 | 4%             |
| Depression             | 1-4   | 2.50* | 0.70 | 11%            | 2.69* | 0.67 | 15%            |
| Worrying               | 1-4   | 2.42* | 0.70 | 9%             | 2.54* | 0.74 | 14%            |
| Concentration problems | 1-4   | 2.41* | 0.50 | 4%             | 2.51* | 0.50 | 4%             |
| Amotivation            | 1-7   | 2.34* | 1.30 | 14%            | 2.55* | 1.49 | 4%             |

+ Often ( $\geq 3.50$  on 4-pt scale), agree/strongly agree ( $\geq 5.50$  on 7-pt scale), except for study engagement (disagree/ strongly disagree,  $\leq 2.33$ ) and amotivation ( $\geq 4.00$  on 7-point scale); \*Means are significantly different ( $p < .001$ )

The comparisons shown in Table 2 utilize large sample sizes in Q1 ( $n_1=679$ ) and Q2 ( $n_2=616$ ), meaning that they can distinguish even small differences (if they exist in the population). Therefore, the analysis focuses not only on the significance of the differences (using  $p = 0.001$  as a conservative threshold of significance) but also on the effect sizes.

Table 2 shows no significant difference in the degree of loneliness among students ( $p > .05$ ). Furthermore, worrying, concentration problems, and amotivation increased significantly (all  $p$ -values  $< 0.001$ , for worrying  $p = 0.001$ ), but the effect sizes (differences between Q1 and Q2) are, according to Cohen’s rules of thumb<sup>1</sup>, “small” (respectively  $d = 0.18$ ,  $d = 0.20$ , and  $d = 0.18$ ). For the other three well-being indicators (study engagement, burnout, and depression), there are significant differences (all  $p$ -values  $< .001$ ) and the effect sizes are small to moderate ( $d$ ’s of 0.32, 0.30, and 0.28, respectively).

So, apart from loneliness, the other six well-being indicators change in an undesirable direction. Compared to Q1, students in Q2 suffer somewhat more from feelings of worrying, depression, burnout, concentration problems, amotivation, and a lack of study engagement. All differences are small (or moderate, at most), but the overall pattern is consistent, as all changes are going in an undesirable direction. For some indicators of well-being, the percentage of students who suffer in a problematic way grows to a substantial size. For instance, in Q2, 20% of students report suffering from burnout in a problematic way, 17% report a problematically low degree of study engagement, and 15% report feelings of depression to a problematic extent.

<sup>1</sup> Small:  $d = 0.2$ ; medium:  $d = 0.5$ , large:  $d = 0.8$ .

## Factors related to student well-being

In the survey, we included eight factors that may explain the well-being results found for Q1. Each factor was measured with four to eight questions to attain sufficient reliability. These factors describe characteristics of the students' learning environment at home or in the online classes, as well as students' learning strategies. These factors are:

1. *Home situation issues* (lack of suitable study space, health issues, care for family members, conflicting work schedules)

Learning strategies:

2. *Time-management* (e.g., I made good use of my study time for this (online) course.)

3. *Persistence* (e.g., When I was feeling bored studying for this online course, I forced myself to pay attention.)

4. *Using a suitable study environment* (e.g., I had a regular place set aside for studying in this (online) course.)

Resource-seeking:

5. *Proactively seeking support from fellow-students and teachers/tutors* (social)(e.g., I asked fellow students who take the same course for help when I needed it / I asked the course teacher(s) (or tutors, teaching-assistants) for help when I had trouble understanding a topic or carrying out an assignment

6. *Seeking resources online* (non-social)(e.g., When faced with a difficult question or problem, I looked for (online) resources provided in the course that may have contained the answer or solution)

Course-related:

7. *Teacher communication & support* (e.g., Overall, the instructor for this course helped to keep students engaged and participating in a productive dialog.)

8. *Autonomy* (e.g., I could decide on my own what to work on during the course weeks)

For each of the well-being outcomes, a regression analysis was conducted with all eight factors as predictors. Table 3 (next page) shows the significant predictors for each well-being outcome, with the numbers representing standardized regression weights ( $\beta$ ). A green score represents a positive (i.e., a good/desirable) effect; an orange score represents a negative (i.e., a bad/undesirable) effect.

As the table demonstrates, two factors are related to all well-being outcomes. Firstly, *issues in the home situation* are related to all negative outcomes. The issues included in this measure are quite varied (lack of suitable study space, health issues, care for family members, conflicting work schedules) and the issue(s) playing a role may differ among students. The more issues the students have, the lower their level of well-being. For instance, students who suffer from more issues with their home environment report to be less motivated in their study program, they feel more depressed, have more intense sleeping problems, and struggle with a higher level of burnout.

Conversely, students who experience a higher degree of *autonomy* in a course report higher well-being for all indicators. For instance, the higher they perceive their autonomy in their respective course to be, the more study engagement they show, the less they suffer from burnout and the fewer problems

of concentration they have. As already argued in the previous report (see the second report about the Q1 period), we suspect that autonomy provides access to motivational resources that enable students to better handle their study workload and pressure.

The other factors are related to fewer well-being outcomes. Some learning strategies of students are associated with fewer problems. For example, *seeking social resources* is positively related to study engagement and negatively related to loneliness. The latter relation comes as no surprise as seeking more social resources leads to increased interactions with other students and/or teachers, which is likely to decrease feelings of loneliness.

**Table 3. The relation between home, student, and teacher/course factors and well-being outcomes**

|                           | Study engagement | Burnout | Loneliness | Depression | Sleeping problems* | Worrying | Concentration problems | Amotivation |
|---------------------------|------------------|---------|------------|------------|--------------------|----------|------------------------|-------------|
| Home situation issues     | -0.10            | 0.32    | 0.33       | 0.35       | 0.34               | 0.29     | 0.15                   | 0.32        |
| Learn strat: time         |                  |         |            |            |                    |          |                        |             |
| Learn. strat: persistence | 0.20             |         |            |            |                    |          | -0.46                  |             |
| Learn strat: environment  |                  |         |            | -0.11      |                    |          |                        |             |
| Seeking social resources  | 0.23             | -0.15   | -0.22      | -0.12      |                    |          |                        |             |
| Seeking online res.       |                  |         |            | 0.10       |                    |          |                        |             |
| Teacher comm & supp       |                  |         |            |            |                    |          |                        |             |
| Autonomy                  | 0.24             | -0.25   | -0.16      | -0.15      | -0.11              | -0.21    | -0.26                  | -0.22       |
| Variance explained*       | 33%              | 29%     | 20%        | 22%        | 18%                | 16%      | 35%                    | 26%         |

Note. The percentage of variance in the well-being outcome that is accounted for by all predictors (adjusted R2). \*Not analyzed for Q1.

A further remarkable finding is that students’ time management and teacher communication and support, contrary to findings in the earlier report about the first quarter Q1, were no longer significant predictors of any of the well-being indicators. The noteworthy findings on student autonomy and about issues with the home learning environment are in line with a similar pattern of effects on student well-being that were reported in the report about the Q1 period.

As already mentioned in the earlier report, the current survey about the second quarter alone does not allow for easy causal conclusions. Both the factors and the well-being outcomes were measured at the same point in time. This may explain the negative role of seeking online resources. Perhaps it is not the seeking of online resources that leads to higher burnout, depression, and worrying, but the other way around: perhaps students that are exhausted, depressed or worrisome turn more to online resources.



## (Online) exams, proctoring, and test anxiety

Due to the Corona pandemic, many courses switched to online (proctored) exams and assignments. In the Q2 questionnaires, we focused on how these different types of examinations affected students.

**Table 4. Overview of reported perceptions of exams**

|   | scale | Mean | SD   | % Problematic* |
|---|-------|------|------|----------------|
| Exams were appropriate                            | 1-7   | 4.53 | 1.48 | 11%            |
| Exams were doable                                 | 1-7   | 4.35 | 1.54 | 14%            |
| I expected to be able to cope with the exam       | 1-7   | 4.65 | 1.34 | 7%             |
| I felt much more nervous compared to offline exam | 1-7   | 4.02 | 2.07 | 30%            |
| Other students cheated                            | 1-7   | 1.97 | 1.47 | 3%             |
| I felt tempted to trick the course teacher        | 1-7   | 2.30 | 1.41 | 1%             |
| Test anxiety                                      | 1-7   | 4.22 | 1.43 | 21%            |

\* disagree/strongly disagree ( $\leq 2.50$  on a 7-point scale) for appropriate, doable, and coping, agree/strongly agree ( $\geq 5.50$  on a 7-point scale) for nervous, cheating, tricking, and anxiety.

On average, students regarded their exams in Q2 as moderately appropriate and doable. They had some degree of confidence in their ability to cope with the exams. Students reported that they felt hardly tempted to trick the teacher and disagreed (somewhat) to have heard of other students who cheated during tests or exams. The average student experienced test anxiety at a moderate level. Furthermore, the average student was only slightly more nervous about the exams in Q2 when compared to exams before the Corona transition.

Simultaneously, there is quite some variation in the students' answers on some of these issues. Their relative degree of nervousness varied quite much. About 30 percent of the students agreed or strongly agreed that they felt much more nervous about their exams in Q2. About 21 percent of the students felt test anxiety to a problematic degree, and 14 percent of the students disagreed or disagreed strongly with the proposition that the exams were doable.

### Differences between proctored versus non-proctored exams:

Of the twenty-two courses that were examined in the survey, seven employed a proctored final exam, which covered 254 students in our sample.<sup>2</sup>

Students who took a proctored exam indicated they were similar in terms of their perception of exam appropriateness compared to students who took a non-proctored exam. In addition, the amount of perceived cheating by other students and the temptation to trick the teacher by the student him/herself both did not differ between proctored and non-proctored exams.

Interestingly, there was a statistically significant difference in how doable the exam was for non-proctored exams compared to proctored exams, albeit with a small effect size ( $t(554) = 2.87, p = .004, d = 0.23$ ). Non-proctored exams ( $M = 4.50, SD = 1.55$ ) were perceived as more doable compared to proctored exams ( $M = 4.14, SD = 1.50$ ). In addition, there also was a statistically significant difference

<sup>2</sup> In proctored courses, not all students participated in the proctored exams as they were free to choose for an on-campus version of the same exam. We repeated the analyses and considered whether a student actually participated in the proctored exam version. The conclusions did not change.

with respect to how well students expected to be able to cope with the exam ( $t(572) = 3.77, p < .001, d = 0.30$ ). Students who conducted a non-proctored exam ( $M = 4.81, SD = 1.37$ ) expected to be better able to cope with the exam compared to students who conducted a proctored exam ( $M = 4.41, SD = 1.26$ ).

Lastly, there was a statistically significant difference in test anxiety for students who followed a non-proctored exam compared to students who followed a proctored exam ( $t(596) = 3.78, p < .001, d = 0.30$ ). Students who conducted a non-proctored exam ( $M = 4.04, SD = 1.52$ ) showed lower test anxiety compared to students who conducted a proctored exam ( $M = 4.47, SD = 1.26$ ).

## **Answers to the research questions**

This third report has contributed to 1. the identification of (changes in) students' well-being, 2. how students' well-being relates to characteristics of the students' learning environments and learning strategies, and 3. how students perceive exams, to what extent they experience test anxiety and what the role of online proctoring for these issues is.

Concerning the first research question, the findings indicate that, apart from loneliness, there are changes in the six indicators of well-being in an undesirable direction. However, absolute changes for each of the six indicators is typically small. The pattern across the indicators, however, is noteworthy. Also, for some indicators, the percentage of students who report suffering in a problematic way is substantial. For instance, about 20 percent of the students indicate that they experience severe symptoms of burnout.

The findings on the influencing factors - the focus of the second question – largely point toward the same potential causes and remedies that we described already in the previous second report. The most important factor that appears to increase study engagement and reduces all problematic well-being aspects is autonomy. This relates to how courses are structured: courses with fewer deadlines and more freedom in choosing what to do when and a lack of immediate pressure appear to be beneficial, likely because they offer students access to motivational resources that help to deal with the circumstances. On the other side, the most important factor that reduces study engagement and tends to diminish student well-being are issues with the learning environment at home. This includes, for instance, lack of suitable study space. Some learning strategies of students, e.g. seeking social resources, are associated with some specific aspects of well-being: students who more actively seek helpful resources are less likely to suffer from burnout or depression.

When it comes to test anxiety and students' perceptions of exams during Q3, the third question, we find that the average students felt confident in their ability to cope with the exams. Students showed a moderate degree of test anxiety, and they were only slightly more nervous because of exams than they were because of exams before the Corona transition. At the same time, there is much variety among students concerning test anxiety and nervousness. About 21 percent of the students reported having had symptoms of test anxiety to a problematic degree. Students who participated in a proctored exam suffered more from test anxiety and felt less confident about their ability to cope with the exam.

## Conclusion and future work

We can conclude that there is no indication that students' well-being improved from Q1 to Q2. Changes are small, but the average well-being seems to have deteriorated somewhat instead. On a few specific dimensions of well-being, a remarkably large proportion of students (17-20 percent) reported suffering from serious symptoms.

One way of addressing issues of student well-being would be to offer students study environments that make them more independent from limitations in their home environment. Such an offer, however, depends on the severity of the Corona situation and the related necessary constraints on public life. On the positive side, teachers can create more autonomy for students in their courses, and they can make it easier for students to approach fellow students and teachers to get help. These are possibilities to reduce well-being problems.

Test anxiety did not play a large role for the average student in general. However, for about twenty-one percent of students in our sample, it did in Q2. As it was designed and practiced in Q2, online proctoring seems to have aggravated test anxiety somewhat. To reduce test anxiety among students, online proctoring could either be limited or redesigned in such a way that students feel more able to cope with it.

This third express report is the final one within the project "The Corona Transition and Student Learning" that is based on new data about the ongoing situation from the point of view of students' experiences. However, the small changes that we found between Q1 and Q2 feed the concern that students' well-being may deteriorate more in the longer run if teaching cannot be changed because of the Corona constraints. We feel that it is worthwhile to continue monitoring students' well-being in the upcoming quartiles as well in sufficient detail.

This report did not intensively focus on differences between specific courses. We plan to combine the existing student survey data with data about course characteristics which may lead to more concrete suggestions on how online teaching could be improved. Importantly, we are busy collecting actual click-stream data from Canvas and will combine these with our existing data sets to develop more concrete recommendations. Furthermore, in a final report, we will offer recommendations for the long-term adjustments of the IE&IS education and student support, taking into account the TU/e 2030 strategy.