

**UNIVERSITY STUDENTS' WELL-BEING AND ENGAGEMENT IN ACTIVITIES IN THE  
EARLY DAYS OF COVID-19**

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The authors declare that they have no conflict of interest (see Declarations at the end of manuscript).

All procedures performed involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent was obtained from all individual participants included in the study.

### **Abstract**

Governments worldwide took measures to contain the spread of the coronavirus COVID-19. Universities moved to online teaching almost overnight. This paper explores Belgian university students' perceptions, behaviors, and emotional well-being during the first weeks of strict preventive measures. We conducted a survey with 614 business administration students at the University of Antwerp. The results indicate that, in comparison to the pre-lockdown period, students feel less productive, engage less in healthy behaviors (e.g., healthy snacking, exercising alone), and report more study problems. Based on the emotional quality of their everyday experience, students can be clustered into two groups. One group (54.5%) experiences mostly negative affect, while the other reports experiencing mostly positive affect and personal optimism. The "negative affect" group consists of more women and students in the early years of their bachelor's. This group experiences more financial difficulties and spends more time on social media. These students seem to have a more challenging time coping with the lockdown: they perceive higher study load increase and more significant reduction of social contacts while facing more study problems, studying fewer hours, and perceiving a lower study efficiency. They also engage in less healthy behaviors (e.g., unhealthy snacking more, drinking more alcohol, and exercising alone less) to a greater extent than the positive affect group. These results confirm previous research, demonstrating a positive relationship between emotional well-being and the engagement in and the intensity of productive and healthy activities. Several recommendations are provided in light of these findings.

*Keywords:* university students, emotional well-being, COVID-19, behaviors

### **Introduction**

Governments all over the world have taken measures to contain the spread of the new coronavirus (COVID-19). Most European governments, like Belgium, closed non-essential businesses, schools, and universities and solicited residents to distance themselves physically. The impact on students was drastic: around the world, over 1.5 billion learners were affected by the closing of schools and universities (Psacharopoulos, Collis, Patrinos, & Vegas, 2020). Research has already revealed negative impacts of the pandemic on people's mental health (Brodeur, Clark, Fleche, & Powdthavee, 2021; Fernández-Abascal & Martín-Díaz, 2021; Ferreira, Pereira, da Fé Brás, & Ilchuk, 2021) and on their physical activity engagement (Castañeda-Babarro, Arbillaga-Etxarri, Gutiérrez-Santamaría, & Coca, 2020; Robinson et al., 2021; Symons et al., 2021; Tison et al., 2020). In addition, recent studies focusing on the impacts of the COVID-19 pandemic on students' mental health found a significant negative effect (Dodd, Dadaczynski, Okan, McCaffery, & Pickles, 2021; Khan et al., 2020).

This paper aims to advance current knowledge about the effects of the pandemic on students by investigating their emotional well-being, their studying behaviors, and changes in their daily activities (e.g., exercising, socializing) in the early days after the measures became effective in Belgium. Through descriptive statistics, sign tests, a two-step cluster analysis, and independent-samples t-tests, we analyze survey data of 614 business students from the University of Antwerp (Belgium) to investigate how they were feeling, how they changed their behaviors and daily activities, and if there were differences between how students were reacting to the COVID-19 pandemic.

Understanding the impact of COVID-19 measures on university students is important. The extant literature has demonstrated that pandemics and other crises can lead to lower educational attainment, foregone earnings, and higher morbidity among young people (Psacharopoulos et al., 2020). In response to the current pandemic, universities were forced to

transition to online teaching forcedly and quickly (Krishnapatria, 2020), which likely impeded this next generation's development. It has become clear that today's situation will impact future labor market dynamics as well. In light of these potential negative consequences, a better comprehension of how pandemic-containing measures impact students is of paramount importance. A better understanding can assist universities and governments in offering more effective support and guiding students to change their behavior to handle better the current COVID-19 and potentially upcoming pandemics. It can also contribute to minimizing negative impacts on students' mental health, smoothing their transition to the labor market, and combating further aggravations of the economic situation.

### **Literature Review**

The impact of tragedies on psychological health can last longer and be of greater prevalence than the tragedy itself (Shigemura, Ursano, Morganstein, Kurosawa, & Benedek, 2020). A review article on previous pandemics found that quarantines can have similar effects, resulting in lower psychological health; for example, post-traumatic stress symptoms and confusion (Brooks et al., 2020). Various physical distancing measures during the COVID-19 pandemic imposed quarantine-like restrictions. The impact of these restrictions on students is likely to be even more intense compared to the general population. Using Twitter, a recent study has found that college students expressed more negative sentiments towards the central issues of COVID-19 than the general population (Duong, Luo, Pham, Yang, & Wang, 2020). In addition, many physical distancing measures lead to typical activities of students being migrated to the online sphere (Roose, 2020). For example, the existing literature documents increases in online teaching activities (Ortiz, 2020) and time spent on Zoom (Lorenz, Griffith, & Isaac, 2020). These measures have been challenging for students: around 81% of college students dislike remote learning (Duong et al., 2020). It is, thus, not surprising that preliminary studies on students' psychological health during the

COVID-19 pandemic revealed increased mental health risks, such as higher levels of stress and anxiety (Conrad, Koire, Pinder-Amaker, & Liu, 2021; Hagedorn, Wattick, & Olfert, 2021).

Whereas the negative consequences of isolation measures on students' mental health seem well understood, less is known about the impact of these measures on students' emotional well-being. Emotional well-being is related to, but different from, psychological and mental health. Emotional well-being refers to the emotional quality of individuals' everyday experience, i.e., the frequency and intensity with which they experience happiness, anger and sadness, and other feelings (Kahneman & Deaton, 2010). The extant literature shows that emotional well-being is positively related to mental health and inversely related to negative affect (Cohen, Doyle, Turner, Alper, & Skoner, 2003; Mandal, Arya, & Pandey, 2012). High levels of well-being indicate that people feel good (Gugushvili et al., 2020). Compared to subjective, social, and psychological well-being, assessing emotional well-being can indicate certain mental health states while minimizing the retrospection bias, generating more reliable person-level data (Diehl, Hay, & Berg, 2011). It is, therefore, a highly relevant concept to assess the impact of lockdown policies on well-being. Well-being is especially relevant for students because it highly influences their academic and professional development (Hagedorn et al., 2021). Furthermore, a focus on emotional well-being can shed light on policies that may help reduce negative affect, which may decrease people's propensity to break the lockdown rules (Boylan, Seli, Scholer, & Danckert, 2021).

In order to assess the impacts of the pandemic on students' quality of life, it is also important to consider their daily activities and how they may have changed due to the pandemic. Prior research has demonstrated that not only students' emotional well-being but also their environment and social interactions can influence their ability to thrive (Schreiner, 2010). E-learning potentially left students with more free time and more freedom of choice

on how to spend their free time (Shek, 2020). Whether or not students used their additional freedom to promote well-being is unclear. We know from pre-pandemic research that leisure-time physical activity is positively associated with increased happiness (Wang et al., 2012). In contrast, online media use has been consistently associated with decreases in well-being (Morahan-Martin & Schumacher, 2003). A thorough understanding of changes in students' daily activities can shed further light on their emotional well-being and ways of minimizing the negative impacts of pandemic containing measures on them.

### **Aim of the Study**

This paper aims to understand university students' emotional well-being, study behaviors, and daily activities in the first weeks after COVID-19 preventive measures became effective in Belgium. Following Kahneman and Deaton (2010), emotional well-being is conceptualized as the emotional quality of individuals' everyday experience. Based on the reviewed literature, we expected that students would report suffering in terms of emotional well-being and a lack of social interactions. We also expected to see changes in their daily activities, including differences in their studying and (un)healthy behaviors. As the pandemic has caused a drastic disruption of routines, the size of these changes is yet unknown. Thus, rather than hypothesizing regarding these changes, we aim to answer the following research questions: How were Belgian university students feeling in the early days of the COVID-19 pandemic? How have Belgian university students' changed their studying behaviors and daily activities in response to the measures to fight the spread of the COVID-19 pandemic? Are all students experiencing the impacts of the pandemic similarly, or are different groups experiencing it differently?

Our focus on changes in behavior and activities will help us identify students' responses to COVID-19 preventive measures in Belgium. In addition, this investigation

should clarify which areas and themes are priorities for initiatives aiming to support students overcome the negative impacts of pandemic containing measures.

## Method

### Design and Participants

The target population consisted of undergraduate and graduate students of the Faculty of Business and Economics at the University of Antwerp, Belgium. Belgium implemented physical distancing measures in mid-March 2020 (Federal Public Service, 2020).<sup>1</sup> Respondents were conveniently sampled (contacted by the student body via e-mail and social media). Between April 1<sup>st</sup> and 10<sup>th</sup>, 614 anonymous questionnaires were completed, all of which were included in the final analysis (29.1% response rate). Our sample was composed of 60.6% female students. Most respondents were Bachelor students (66.1%), followed by Master students (28.7%), exchange students (4.9%), and students participating in a preparatory program (0.3%). Half of the bachelor students were first-year students (50%), with the other half in their second (20.3%) or third year (29.7%). All respondents studied at the Faculty of Business and Economics – the biggest faculty of the University of Antwerp in terms of student enrollment. They were subject to the same guidelines regarding distance learning in response to the COVID-19 crisis, set at the faculty level. In particular, all classes were taught entirely online, and pre-recorded (rather than live-streamed) sessions were recommended for large groups (to prevent connectivity issues). Professors were asked to

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<sup>1</sup> Main measures: Residents were required to stay home, except for essential movements (shopping for groceries, going to the doctor, and going to and from working if teleworking was not possible); educational institutions, cafes, restaurants, and sports centers were closed; physical activities were the only outdoor activities allowed, individuals were allowed outside for physical activity with members of their household or one other person, as long as they kept the 1.5m distance from each other; internal Schengen border controls. Fines were applied to those who disrespected the rules.

respect the regular class schedules and to upload recordings before their standard class time. Support was provided on how to teach and record sessions through Blackboard Collaborate.

### **Measures**

As this research was conducted in partnership with the student body, the questionnaire also included questions to assess students' experience with distance learning (e.g., the image quality of the lessons). In the following, we focus on the variables relevant to the paper at hand. The complete questionnaire is available on the project's OSF page ([https://osf.io/wpy5v/?view\\_only=1214a59375644e01b13084d2c2c5f07c](https://osf.io/wpy5v/?view_only=1214a59375644e01b13084d2c2c5f07c)). The survey started with a welcome screen informing respondents of the purpose of the research and their rights. Students then indicated their gender (male/female) and their student status (Bachelor/Master/Preparatory Program/Exchange program student); the year of study they were in (e.g., last year of the master, or, first year of bachelor); and their study program (e.g., Business Economics, Business Engineering).

To assess participants' emotional well-being, we used the same procedure as Kahneman and Deaton (2010), based on the Gallup-Healthways Well-Being Index. Participants were asked to indicate if they experienced (yes/no) the following emotions/feelings the previous day: joy, happiness, laughed/smiled a lot, worry, sadness, stress, anger. Given the exceptional circumstances, we needed a more fine-grained picture of negative affect. Therefore, we expanded the original list of negative emotions and included uncertainty, boredom, loneliness, fatigue, fear, hopelessness, and physical pain in our survey. We used six of these items to calculate affect balance, following the OECD's approach. Affect balance refers to the weighting between positive and negative affective measures to evaluate which one is heavier (Veilleux et al., 2020). A positive balance means positive affective measures outweigh negative measures, while a negative affect balance indicates that

negative affect weights heavier than positive affect. Coding 'yes' responses as 1 and 'no' responses as 0, affect balance is simply the difference between the sum of responses over the three positive feelings (joy, happiness, laughed/smiled a lot) and the sum of three negative feelings (anger, sadness, and worry). For example, a respondent who experienced joy, happiness, and anger, but not the other emotions, would have an affect balance of  $2$  (positive)  $- 1$  (negative) =  $1$ .

Next, participants were asked to think back about their lives, routines, and time expenditure before the physical distancing measures to fight the spread of COVID-19 took effect. They were asked to compare it with their current routine and indicate the extent that they do more or less of a list of activities (5-points scale; 1 = "Much less now", 5 = "Much more now"). Self-reported changes in activities were assessed for sleep, watch TV/Netflix, study hours, exercise alone/together, socialize in-person/virtually, alcohol consumption, healthy/unhealthy snacking, and time spent on social media. At the time of the survey, Belgians were allowed to exercise with members of their household or one person outside their household, as long as it was outdoors and they kept a distance of 1.5 meters from this person. The same 5-points scale was used to assess study problems (2 items: "I have trouble keeping up", "I have trouble studying"; Spearman-Brown coefficient = .798). Students could further elaborate on concrete problems or suggestions for specific courses through an open-ended question.

Lack of social support (1 item, "I lack social contact"), and personal optimism (2 items, "I am sure everything will work out", "I can easily adapt to the changes"; Spearman-Brown coefficient = .787) were measured on a 5-points Likert scale (1 = "Completely disagree", 5 = "Completely agree"). Current perceived study efficiency and perceived study load change were measured as an "index" where students reported their perceived efficiency and study load at the moment, on a scale from 0 to 200%, with 100% being "the same as

before". Students were also asked if they experienced financial difficulties (yes/no) and what was the cause of it (options: "Income of my student job disappeared", "My parents/guardian lost their income due to temporary unemployment", "I am a working student and am currently unemployed", "Other (specify):"). Finally, students were invited to share any concerns, questions, or suggestions to organize distance learning (open-ended question) better. All questions were unforced, explaining minor differences in the sample sizes between questions.

### **Statistical Analysis**

The data analyses in this study relied on a series of descriptive statistics, sign tests (Dixon and Mood approach), two-step cluster analysis, and independent-samples t-tests. The significance level was set at  $< 0.05$  unless stated otherwise. Where necessary, we corrected the p-values to account for multiple comparison problems using the Holm–Bonferroni method. All analyses were done using SPSS 27.

Descriptive statistics were used to describe the sample in terms of demographic variables, emotional well-being (positive and negative affect), optimism, engagement in activities, student efficiency, and perceived study load change. We also descriptively compare the affect balance of students in this sample with that of young Belgians before the pandemic, the latter taken from OECD data.

Moreover, we applied the two-sided sign test to assess significance in self-reported changes in daily activities (Dixon & Mood, 1946; Sprent, 2012). We followed Dixon and Mood (1946), who recommended dividing neutral responses equally between the non-neutral response categories, representing a standard conservative approach to deal with neutral responses.

Further, two-step cluster analysis was used to group students based on their emotional well-being and personal optimism. Cluster analyses organize the data into homogeneous groups that are statistically tightly connected and sufficiently different from each other (Kettenring, 2006). A two-step cluster analysis is appropriate because it can deal with categorical and numeric data and is less sensitive to outliers than other clustering methods (Shih, Jheng, & Lai, 2010). It also allows for simultaneous analysis of demographic, psychographic, and self-reported behavioral data (Rundle-Thiele, Kubacki, Tkaczynski, & Parkinson, 2015). Finally, independent-samples t-tests (two-tailed) were conducted to compare group differences (studying behaviors and perceptions, engagement in daily activities, and personal characteristics).

## **Results**

### **Affect**

As the first step in our analyses, we report the descriptive statistics. Table 1 and Table 2 present the results concerning experienced emotions. Students reported experiencing more positive than negative emotions (average reported positive emotion is 47.4%; average reported negative emotions is 42.9% - see Table 1 and Table 2 for more details). Worry, stress, uncertainty, and fatigue were the most frequently experienced emotions/feelings. In line with these observations, our data furthermore reveals that only 2.2% of participants indicated that they did not experience any negative affect, whereas 28.7% indicated they did not experience any positive affect the day before. Concerning blue affect, worry, and sadness (Kahneman & Deaton, 2010), 30.5% of students indicated they had not felt any, 41.7% felt at least one of these emotions, and 27.9% felt both.

The descriptive data indicates that possibly following lockdown measures, Belgian students from our sample felt more negative affect and less positive affect than one would typically expect under normal circumstances. For example, the OECD reports that in 2018,

only 10.2% of young people (between 15 and 29) had a negative affect balance (OECD, 2020). We observe that 31.6% of students in our sample had a negative affect balance. We acknowledge that time trends may be present and that our sample is not perfectly representative of young people in Belgium. Our sample is considerably more educated, i.e., 100% of our respondents have entered tertiary education levels, but nationally this number ranges between 27.8% and 47.5% (depending on age range) (Eurostat, 2020). Our sample also contains relatively more women; the women to men ratio in our sample is 1.65, while it was 1.24 nationally in 2018 (UNESCO, 2018). It is, nevertheless, not unreasonable to assume that lockdown measures at least partially contributed to the high number of students reporting a negative affect balance. The responses provided on our personal optimism questions further support this interpretation. Optimism scores indicated that 52.6% of students were not optimistic about their abilities to adapt and that things would work out, 12.9% were neutral, and 34.5% felt somewhat optimistic. This is aligned with previous research that has also found a significant negative impact on university students' self-perceived psychological well-being in other countries (Dodd et al., 2021; Savage et al., 2020).

**Table 1**

*Experienced quality of daily life as in Kahneman and Deaton (2010), N = 581.*

	<b>Joy</b>	<b>Physical Pain</b>	<b>Worry</b>	<b>Sadness</b>	<b>Stress</b>	<b>Anger</b>	<b>Happiness</b>
No	55,10%	81,10%	34,30%	68,30%	29,30%	71,90%	50,10%
Yes	44,90%	18,90%	65,70%	31,70%	70,70%	28,10%	49,90%

**Table 2**

*Additional experienced emotions collected in our study, N = 581.*

	<b>Uncertainty</b>	<b>Boredom</b>	<b>Loneliness</b>	<b>Fatigue</b>	<b>Fear</b>	<b>Hopelessn ess</b>	<b>Smile/ Laugh a lot</b>
No	22,50%	44,20%	49,20%	33,20%	67,10%	45,40%	39,80%
Yes	77,50%	55,80%	50,80%	66,80%	32,90%	54,60%	60,20%

### **Studying behaviors**

Regarding their study activities, 68.7% of individuals indicated they perceived the study load to have increased somewhat, including 14.2% perceiving the current study load as more than 50% heavier than before the measures (N = 562). Additionally, 77.4% of participants indicated they studied at least somewhat less efficiently than before the measures, of which 36.6% perceived their current study efficiency to be 50% smaller than what it used to be (N = 562). Increased study problems were faced by 75% of students (9.4% indicated that they had faced fewer problems and 15.6%, the same level) (N = 571). 9.1% of students also reported experiencing financial difficulties, mainly because they lost their student job (N = 546).

We screened the answers to the open-ended question in which students could freely express their experience with distance learning and how the university had been dealing with it. One hundred fifty-one students answered this question. The most common complaint concerned the lack of concrete and definite information regarding lessons, exams, and/or master theses (66% of answers – see Appendix 1 for more details). Students also worried that exams and master theses defenses could not be organized safely. The second most common theme in the open answers regarded feelings that the university/faculty did not sufficiently acknowledge nor offered support to students' feelings, reality, or struggles (mentioned in 32%

of the cases). In 27% of cases, students also mentioned they had a hard time adapting to the new reality and keeping up with their studies. This could be because of procrastination (less pressure to attend recorded or the fact that it was more challenging to organize group projects online. They expressed concerns that they expected to fail and were unsure what the consequences would be.

### **Daily activities**

Students also reported engaging in activities differently from before the lockdown measures, see Table 3. We tested the null hypothesis that the number of students doing less or much less of an activity is equal to the number of students doing more or much more of the activity via a series of sign tests. Following Dixon and Mood (1946), we distributed the 'just-as-much' students equally between 'less-now' and 'more-now'. All differences except for healthy snacking were significant at 5% level after controlling for multiple testing via Holm-Bonferroni. Holm-Bonferroni was chosen as it is uniformly more powerful than the single-step Bonferroni correction (Abdi, 2010). Overall, the students were doing more or much more of the following: sleeping (more: 55.3%; less:18.8%), watching TV/Netflix (more: 61.2%; less: 8.3%), unhealthy snacking (more: 42.3%; less: 19.3%), exercising alone (more: 45.6%; less: 31.0%), virtually socializing (more: 78.8%; less: 4.5%) and spending time on social media (more: 80.3%; less: 2.4%) (all N = 575). On the other hand, students were consuming less alcohol (less: 67.8%; more: 7.5%), working/studying less (less: 52%; more: 27.7%), exercising together less (less: 54.4%; more: 25.4%) and socializing in-person less (less: 90.8%; more: 2.0%) than before (all N = 575). 76.3% of participants lacked social contact, whereas 10.6% indicated they had not missed social interactions (all N = 565).

**Table 3**

*Changes in activities (current vs. before the COVID-19 measures), N=575.*

	<b>Much less now</b>	<b>Less now</b>	<b>Just as much</b>	<b>More now</b>	<b>Much more now</b>
Study hours*	30.1%	21.9%	20.3%	18.8%	8.9%
Unhealthy snacking*	2.6%	16.7%	38.4%	35.3%	7.0%
Healthy snacking	5.2%	18.3%	46.3%	25.7%	4.5%
Alcohol Consumption*	49.7%	18.1%	24.7%	6.1%	1.4%
Sleep*	4.9%	13.9%	25.9%	39.8%	15.5%
Watch TV/Netflix*	1.2%	7.1%	30.4%	37.7%	23.5%
Exercise (alone) *	15.7%	15.3%	23.5%	29.7%	15.8%
Exercise (together) *	41.9%	12.5%	20.3%	17.4%	7.8%
Time on social media*	0.5%	1.9%	17.2%	46.4%	33.9%
In-person socializing*	67.7%	23.1%	7.1%	1.7%	0.3%
Virtually socializing*	1.4%	3.10%	16.70%	41.20%	37.60%

*Note.* Significant differences at the 5% level are marked with a \*. We corrected for multiple hypothesis testing via Holm-Bonferroni.

### **Exploratory analysis: Clustering**

As a next step, we conducted an exploratory two-step cluster analysis. This method organized students into statistically tightly related groups significantly different from each other, based on their affect balance scores and personal optimism scores (N = 565). For our cluster analysis, we used all emotions reported in Table 1 and Table 2. Our results highlight important differences between students to inform initiatives better and guide institutional assistance and governmental support.

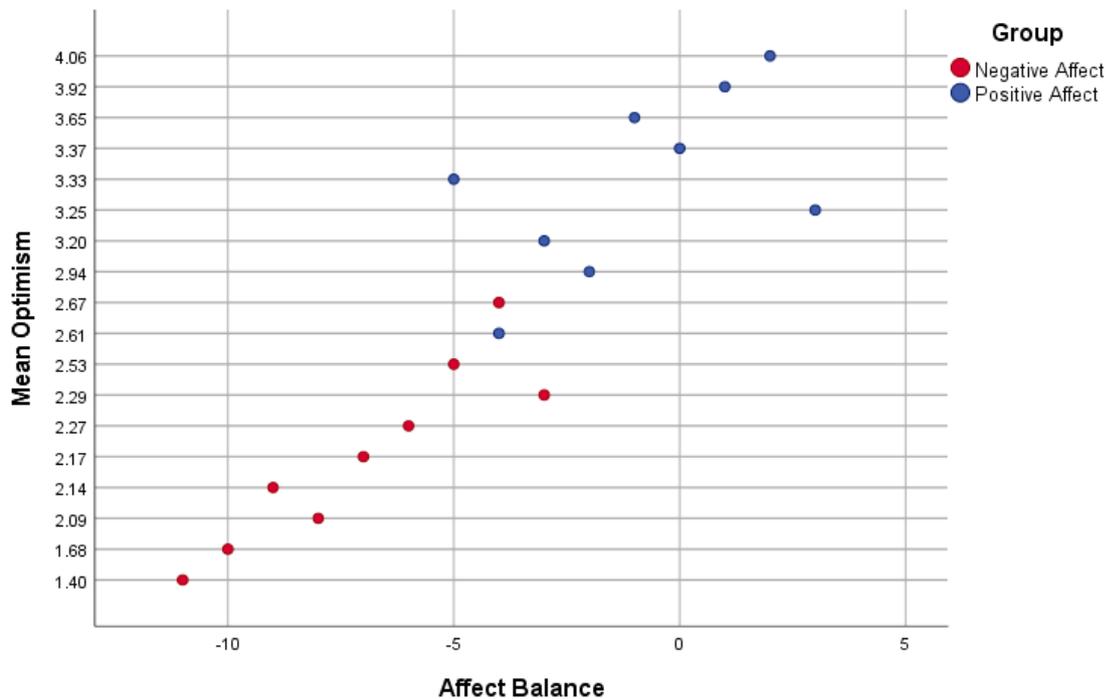
The affect and optimism-based cluster analysis unveiled two groups of students. Most participants belong to the first cluster, which we will henceforth refer to as the 'negative

affect group' (54.5%, N = 308). People in the negative affect group were less optimistic ( $M = 2.24$ ) than their peers in the positive affect group ( $M = 3.39$ ). Most people in this group indicated to experience stress (98% of members indicated "yes" to experiencing stress), worry (yes: 94.4%), fear (yes: 57.4%), hopelessness (yes: 76.7%), uncertainty (yes: 97%), sadness (yes: 50.5%), loneliness (yes: 69.8%), fatigue (yes: 84.3%), and boredom (yes: 64.9%). Mostly, they indicated not to have experienced happiness (61.6% of members indicated "no" to experiencing happiness) and joy (no: 71.8%) and did not smile or laugh a lot (no: 57%) the day before. People in the second cluster (45.5%, N = 257), the 'positive affect group', experienced mostly positive affect: joy (yes: 64.6%), happiness (yes: 62.7%), and smile/laugh a lot (yes: 81.2%). Although they mostly did not experience negative affect (stress (no: 61.9%), worry (no: 67.7%), fear (no: 96.2%), hopelessness (no: 71.9%), sadness (no: 90%), loneliness (no: 70.8%), fatigue (no: 53.8%) and boredom (no: 55.8%)), they did experience uncertainty (yes: 54.2%). Neither group experienced physical pain or anger.

Figure 1 below visualizes our cluster analysis. The horizontal axis captures the affective balance for all emotions/feelings we assessed (positive emotions minus negative ones). The vertical axis represents participants' mean scores on our two-item personal optimism construct. The circles in the graph represent multiple participants. Supporting our previous observations, the negative affect group is mainly located in the lower-left part of the graph (low personal optimism, highly negative affect balance). The positive group is mainly located in the upper left part of the graph (high personal optimism, positive/mildly negative affect balance).

**Figure 1**

*Mean of Optimism by Affect Balance per Group, N=565*



As our cluster analysis revealed two groups of students (a group that mainly experienced positive affect and a group that mainly experienced negative affect), we assessed differences in behavioral responses to COVID-19 between cluster groups. We aimed to show that our cluster analysis has implications for the various self-reported changes in behaviors/activities. Table 4 presents the differences between the groups in terms of the behaviors. As mentioned, independent-samples t-tests (two-tailed) were conducted to compare group differences (we find similar results utilizing regression analyses, see Appendix 2).

We remind the reader that we assessed self-reported changes in behaviors of all respondents, comparing their situation to before COVID-19. Comparing groups, we hence assess differences in changes. Both clusters experienced more study problems than before, but the negative affect group experienced more study problems ( $M_{NA} = 4.20$ ,  $M_{PA} = 3.52$ ,  $p$

< .001). Similarly, we observed fewer studying hours ( $M_{NA} = 2.36, M_{PA} = 2.76, p < .001$ ), a greater perceived increase in study load ( $M_{NA} = 124.9\%, M_{PA} = 112.7\% p < .001$ ), and a larger drop in study efficiency ( $M_{NA} = 64.2\%, M_{PA} = 87.4\%, p < .001$ ) for the negative affect group. The negative affect group also changed their healthy snacking behavior less ( $M_{NA} = 2.92, M_{PA} = 3.24, p < .001$ ), increased their unhealthy snacking more ( $M_{NA} = 3.41, M_{PA} = 3.09, p < .001$ ), and experienced less sleep ( $M_{NA} = 3.34, M_{PA} = 3.63, p < .001$ ) than the positive affective group. They got less exercise alone ( $M_{NA} = 2.86, M_{PA} = 3.51, p < .001$ ). Additionally, they experienced a greater drop in lack of social interaction ( $M_{NA} = 4.24, M_{PA} = 3.70, p < .001$ ) and increased their time spend on social media more ( $M_{NA} = 4.22, M_{PA} = 3.98, p < .001$ ). At the same time, they increased their virtual socializing to a lower degree ( $M_{NA} = 3.99, M_{PA} = 4.25, p < .001$ ).

**Table 4**

*Studying Behaviors, Daily Activities and Socio-Demographics per Cluster*

	<b>Cluster 1</b>		<b>Cluster 2</b>	
	<b>(Negative Affect)</b>		<b>(Positive Affect)</b>	
	<b>N = 308</b>		<b>N = 257</b>	
	<b>Mean</b>	<b>SD</b>	<b>Mean</b>	<b>SD</b>
Study problems*	4.20	0.85	3.52	0.83
Study hours*	2.36	1.38	2.76	1.24
Study load (index)*	124.9%	32.4%	112.7%	24.3%
Study efficiency (index)*	64.2%	38.0%	87.4%	32.3%
Unhealthy snacking*	3.41	0.91	3.09	0.87
Healthy snacking*	2.92	0.96	3.24	0.80
Alcohol Consumption	2.92	0.96	3.24	0.80
Sleep*	3.34	1.17	3.63	0.89

Watch TV/Netflix	3.80	0.92	3.69	0.94
Exercise (alone)*	2.86	1.38	3.51	1.11
Exercise (together)	2.29	1.38	2.47	1.36
Lack of social interactions*	4.24	0.86	3.70	1.10
Time on social media*	4.22	0.81	3.98	0.74
In-person socializing	1.38	0,72	1.53	0.75
Virtually socializing*	3.99	0.94	4.25	0.80
Female*	69.2% women		52.1% women	
Student Status	73.1% bachelor		58.8% bachelor	
1 <sup>st</sup> year*	(59.6% of which 1st year)		(35.8% of which 1st year)	
Financial difficulties*	11.7%		6.0%	

*Note.* Significant differences at the 5% level between clusters are marked with a \*. We used two-sample t-tests to assess differences between clusters and corrected for multiple hypothesis testing via Holm-Bonferroni.

We also analyzed the group compositions. Our analyses show that the negative affect group has significantly more women (69% vs. 52%,  $p < 0.001$ ). This group also has more bachelor students (73% vs. 59%,  $p = 0.074$ ), although the difference is not significant. Comparing the year of bachelor studies reveals that the negative affect group has significantly more first years (60% vs. 36%,  $p < 0.001$ ). This group was also facing significantly more financial difficulties (12% vs. 6%,  $p = 0.021$ ).

### Discussion

Our main findings can be summarized as follows. Overall, compared to the pre-lockdown period, students engaged more in unproductive and unhealthy behaviors and engaged less in productive and healthy ones. For example, they were sleeping more, spent more time on social media, or engaged more in unhealthy snacking. They also studied fewer

hours and reported experiencing more study problems. A two-step cluster analysis allowed us to identify two clusters of students based on their emotional well-being and personal optimism: one cluster experienced mostly negative affect, whereas the other experienced mostly positive affect. A series of t-tests revealed that the two cluster groups also displayed heterogeneous reactions to COVID-19 measures in terms of their behaviors. In particular, we observed that the detrimental impacts of COVID-19 measures were much more substantial for the negative affect group. For example, the increase in unproductive and unhealthy behaviors was less pronounced in the positive affect group than in the negative affect group. It is worth noting that the negative group comprised more females and individuals in the early years of the bachelor studies and experienced more financial difficulties.

Our results are aligned with the emerging literature on the negative impacts of the pandemic on students' well-being – emotional and/or psychological – effects that are found worldwide. For example, home-quarantined Bangladeshi students experienced stress, anxiety, and depression (Khan et al., 2020). In addition, the negative psychological impact of the pandemic was more significant on university students than on college students (Khan et al., 2020). In the United Kingdom, the "lockdown" adopted as a measure to fight the spread of COVID-19 was found to have impaired student mental health and movement behaviors (Savage et al., 2020). In China, decreased happiness was associated with community-level quarantine– especially for individuals in the lower happiness quantile (Lu, Nie, & Qian, 2021). Australian students also experienced a negative COVID-19 impact (Dodd et al., 2021). Some predictors of lower well-being were found to be being female, having lower subjective social status, or lower sense of coherence and higher anxiety (Dodd et al., 2021).

The outcome of our study also corroborates prior research on the link between emotional well-being and behavior. In previous research, emotional well-being was related to engagement in and intensity of certain activities (Bossmann, Kanning, Koudela-Hamila, Hey,

& Ebner-Priemer, 2013; Klumb, 2004; Menec, 2003). For example, the intensity of physical activity was found to positively correlate with affective arousal and valence (Bossmann et al., 2013). Consumptive leisure activities and being in the company of others were previously associated with greater positive affect (Klumb, 2004). Levels of informal and productive activities were related to happiness levels (Menec, 2003). Even the emotional experience of performing daily activities influenced life satisfaction scores (Bergstad et al., 2012). Our analysis not only shows that prior identified links between emotional well-being and behavior hold true under more extreme circumstances. We also show that negative and positive affect were associated with increases and decreases of these behaviors as a response to COVID-19 lockdown measures. These results provide strong evidence on the connection between the mind and the body, and sheds light on the importance of improving or at least maintain emotional well-being in these extraordinary times.

Our cluster analysis, furthermore, revealed a strong positive association between positive affect and personal optimism. Both were previously found to positively influence concurrent and long-term health behaviors (Hamid, 1990; Sin, Moskowitz, & Whooley, 2015). For example, individuals with higher well-being are more motivated and persistent in engaging in healthy behaviors (Sin et al., 2015), and optimists were found to monitor their nutrition and exercise more often than pessimists (Hamid, 1990). Furthermore, even when a situation is negative, optimism yields motivation to address the issue and confidence in success (Peter & Honea, 2012). Optimism is also crucial for dealing with long-lasting stressful events (Kavassanu & McAuley, 1995). Moreover, changes in optimism were positively related to changes in immunity, which was partially accounted for positive affect (and consequently emotional well-being) (Segerstrom & Sephton, 2010).

Our results contribute to the existing literature in two important ways. First, we clearly demonstrate that these well-established findings extend to changes in behavior so that

emotional well-being and optimism are also linked to uptake in more healthy and productive behaviors as a response to government COVID-19 measures. Second, we also show that the established relations between well-being and behaviors obtain under more special circumstances (young students during the time of a pandemic). Although beyond the scope of our study, we encourage future research on this topic to assess changes in both emotional well-being and behaviors. Analyzing the co-variation in changes between behaviors and well-being would help us to gain a deeper understanding of the interconnectedness between the mind and the body, and how it evolves after an extreme external shock like the current pandemic.

We also found that women and less senior students were more likely to be classified into the negative affect group. These findings are aligned with previous studies in the literature that show that women and less senior students are more sensitive to negative affect. Unfortunately, we could not include more questions to assess other socio-economic characteristics and psychological constructs (e.g., personality) in the survey due to practical constraints. It would be interesting to understand how these additional variables would correlate within the two clusters and with changes in behavior. Such analysis would strongly complement our findings and help relevant authorities, including universities, identify which people are more likely to deserve special attention.

It is important to mention three potential limitations of this study. Firstly, we relied on self-reported measures of behaviors, which are subject to recall bias and, as such, might overestimate or underestimate true effects or associations (Althubaiti, 2016). Secondly, as this is a cross-sectional study, we do not have information regarding how the students in our sample felt before the pandemic. It is possible that the positive affect group was already experiencing more positive affect before COVID-19. Further, due to the nature of this design, causal relationships could not be derived (Setia, 2016). Previous studies support the argument

that students' well-being has decreased due to the pandemic (Bono, Reil, & Hescocx, 2020; Dodd et al., 2021; Savage et al., 2020). All we can say is that those who feel more positive are also those who have changed their behaviors in a more "positive" way. Future research could address these limitations by directly asking respondents to estimate changes in their well-being due to the pandemic – to correlate it to changes behaviors – or relying on a longitudinal design, which could further clarify the predictors of emotional well-being.

Putting together our findings and findings from the related literature, several concrete implications can be derived on how to combat the negative impact of COVID-19 government measures on students' emotional well-being. First, initiatives can be taken both by the educational institutions and students. Individuals should consider increasing their well-being awareness – found to have a positive effect on well-being (Ludwigs, Lucas, Burger, Veenhoven, & Arends, 2018) – and their gratitude – found to decrease the negative impact of the pandemic on the academic functioning of college students (Bono, Reil, et al., 2020). A good exercise to increase well-being awareness is using a diary to report daily episodes and their emotional content (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004), while expressing thanks to peers and teachers can promote genuine gratitude practice (Bono, Mangan, Fauteux, & Sender, 2020; Bono, Reil, et al., 2020). Additionally, a meta-analysis found that engagement in positive psychological interventions also contributes to increasing well-being measures – an effect that was, in the short term, especially beneficial for young adults (Koydemir, Sökmez, & Schütz, 2020). These interventions were also found to increase optimism scores (Malouff & Schutte, 2016; Peters, Flink, Boersma, & Linton, 2010; Peters, Meevissen, & Hanssen, 2013). Effective interventions were found to be "The Best Possible Self intervention" (which involves developing goals and visualizing a "best possible future self") (Malouff & Schutte, 2016; Peters et al., 2013), practicing gratitude (Emmons, McCullough, & Tsang, 2003) and performing acts of kindness or altruism (Giovanis &

Ozdamar, 2020; Otake, Shimai, Tanaka-Matsumi, Otsui, & Fredrickson, 2006). Individuals can actively engage in such interventions while educational institutions can promote them.

Exercising can also contribute to feeling good. Physical activity, especially in light to moderate intensities, was found to reduce negative states such as stress, anxiety, and depression (Sharma, Madaan, & Petty, 2006). It was also found to lead to pleasure and positive mood (Biddle, 2016; Duvall, 2011). The benefits of exercise on mental health seem to be associated with doing what individuals want and like (Biddle, 2016). So individuals should focus on their intrinsic motivation (relaxation, pleasure) when engaging in physical activity – which was also found to associate with a surplus on life satisfaction (Jetzke & Mutz, 2019).

Previous research had found significant decreases in students' learning and health outcomes due to COVID-19 disruptions, as well as frustration with technology, family, emotional, social and other aspects of life (Hagedorn et al., 2021). Similarly, our results unveiled students' low study efficiency and perceptions of increased study load. Answers to our open-ended question show that students required more direct, clear, and definite communications regarding learning practicalities (i.e., dealings with exams, their master theses, and lessons). Indeed, in a pandemic situation, when massive information is available, having access to relevant information was found to be critical to (improved) life satisfaction (Ye et al., 2021). Students also found it more challenging to organize group work online. Students also voiced that their realities, struggles, and feelings were not sufficiently recognized by the university/faculty. Although only one-quarter of respondents commented on the open-ended questions, the results provide evidence of students' need for displays of empathy. Empathy is critical for cultivating good student-teacher relationships, which is positively related to student achievement (Carter, 2009; Swan & Riley, 2015). Considering students' troubles with studying behaviors (e.g., studying fewer hours), empathy displays

seem to be a quick and easy initiative to improve students' performance and morale quickly. Aligned with previous findings that financial status impacts quality of life (Ikeda, Igarashi, Odani, Murakami, & Tabuchi, 2021), students that are experiencing financial difficulties are also experiencing substantially more negative affect. For those students, guidance counselors or social aid should also be considered to help alleviate the burden (Yao & Wu, 2021). Future research could focus on qualitative assessments of students' well-being and quality of life to paint a more complete picture.

Finally, feeling lonely, i.e., not sufficiently connected with others, was found to compromise physical and mental health, as well as well-being (Hawkey & Cacioppo, 2010). A study has found that online social interactions can be used to compensate lower levels of interactions on consumers' physical space (Berezan, Krishen, & Jenveja, 2019). Initiatives to promote virtual connectedness can help increase individuals' well-being. For example, the University of Antwerp has launched [www.fromyourkot.be](http://www.fromyourkot.be), an online community for students and staff to connect and "hang out together" virtually. The platform offers ideas to study together, exercise together (e.g., a virtual Strava group set up by a student), experience culture and leisure, and bring (positive) stories of students and staff. Institutional initiatives are important to increase trust in organizations, which is determinant for levels of compliance, such as to the measures to fight the spread of COVID-19 (Toya & Skidmore, 2014). Young and more educated people have been found to have less trust in governments (Gozgor, 2021). Additionally, lower levels of institutional trust have been associated with lower life satisfaction (Bittmann, 2021).

Online initiatives have great potential because smartphone usage was found to have increased by 45 minutes per day/person during this pandemic (Ohme, Vanden Abeele, Van Gaeveren, Durnez, & De Marez, 2020). Since students experiencing negative affect are also

more likely to report a lack of social interaction, this could be a great way to help fill this need. Students are highly encouraged to join these initiatives as much as possible.

### **Conclusion**

The Belgian university students in our sample indicated that, compared to a pre-lockdown period, they handled their studies less productively and engaged less in healthy behaviors (e.g., exercising) and more in unhealthy behaviors (e.g., spending more time on social media). When students were grouped based on their emotional well-being and personal optimism, two substantially different groups were identified. The group with the most students was identified as the "negative affect group". Students in this group mainly experienced negative affect, faced more financial and studying difficulties, and missed social interactions more. The increase in unproductive and unhealthy behaviors was more pronounced in this group than in the other cluster group. Further, the negative affect group held more females and younger students than the other group. This study was limited to using self-reported measures and a cross-sectional design. Nevertheless, this study reaffirms the connection between body and mind, and highlights the importance of improving students' emotional well-being in hard times. We suggest five strategies for that based on prior research. First, governments and universities can increase the number and support of guidance counselors and social aids (Yao & Wu, 2021), or at least ensure students are aware of existing support systems and that these are accessible to all students. Second, all university staff should demonstrate more empathy towards students' struggles (Carter, 2009; Swan & Riley, 2015). Finally, students themselves could be encouraged by positive psychological interventions, such as performing acts of kindness (Otake et al., 2006), stimulated to exercise more (Biddle, 2016), and participate in virtual (social) activities (Berezan et al., 2019) as much as possible.

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## Appendix 1

### Open-ended question analysis

Students were given the option to answer an open-ended question in which they could freely express themselves regarding their experience with distance learning and how the university had been dealing with it. One hundred fifty-one students answered this question (all comments were translated from Dutch using the DeepL translator) – a summary of the topics discussed in these comments can be found in Table 5. The most common complaint concerned the lack of concrete and definite information regarding lessons, exams, and/or master theses (indicated by 66% of answers). For example, student S1's wrote: *"A little more clarity on the defenses of the master's thesis. For example, do we still have to submit our paper physically? If they still go ahead, is it still the last week, since the exams have already been moved up a week?"* Students also worried regarding the safety measures that would be taken to organize exams and master thesis defenses. E.g., student S2 stated: *"(...) I know that the exams will be organized differently, but I still think it is way too early. For example, I do not believe that we can take exams in the Antwerp Expo in full compliance with the social distancing rules. In addition, how should I get there? Via public transport? I refuse to take public transport in this crisis! (...)"*.

The second most common theme in the open answers regarded feelings that the university/faculty did not sufficiently acknowledge students' feelings/reality/struggles and that they would appreciate expressions of support (mentioned by 32% of respondents). For example, student S3 said: *"It would be nice if the university somehow showed that they realize that this complicates the study situation for many students. I know it is not obvious to accommodate this, but it sure would be nice to at least know that the university is thinking about this."* Students also mentioned they had a hard time adapting to the situation and

keeping up with their studies (mentioned by 25% of students). They expressed concerns regarding failing and its consequences. Student S4's statement illustrates: *"I find it difficult to study at home since I do not have a quiet place to work and am constantly disturbed. Because of this, I am behind on a lot of subjects. I am afraid that this will get me into trouble after a bad first semester. (...)"*

Besides receiving practical information and guidance from the university/faculty, students also indicated they would like to have more contact with professors (15%) and wanted more live sessions – instead of recorded ones (11%). Student S5's comment refers to both more interaction with professors and more live sessions: *"I would love to have more interactive lessons for the working lectures. (...)Work out an exercise step by step and explain more clearly why something is happening. Then, during the explanation, do the exercise together. There is a big difference between doing an exercise together during an explanation and simply reading out the solutions."*

**Table 5**

*Open-ended question's topics*

	<b>Mentions #</b>	<b>% of students who mentioned it</b>
Lack of concrete and definite information (exams/lessons/thesis)	100	66%
University/Faculty does not consider students' realities/struggles/feelings	49	32%
Hard to adapt and keep up with the studies	41	27%
Lack of contact with professors	22	15%
More live sessions are desired	16	11%
University is doing well/handling things satisfactorily	9	6%
Too many announcements	8	5%
Lack of contact with other students	4	3%

More recordings would be appreciated	2	1%
There were technical issues	1	1%
Cheaper books are desired (financial struggles due to COVID-19)	1	1%

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*Note.* N = 151

## Appendix 2

We conducted a stepwise linear regression to identify which factors predicted affect balance scores. Stepwise regression does a set of iterative search and model comparison procedures aimed to identify which independent variables (thought to be of some importance) have the strongest association with the dependent variable (Henderson & Denison, 1989). Stepwise regression does multiple regression analysis many times, each time removing the weakest correlated variable until the best grouping of predictor variables that account for the most variance in the outcome (R-square) is identified (Lewis, 2007). Thus, it is an appropriate approach for exploratory research or testing for associations (Thompson, 1995), and hence, complementarily interesting analysis to the paper.

Two stepwise regression analyses were conducted, both aiming at answering which perceived behavioral changes predicted affect balance. A positive affect balance meant positive affective measures outweighed negative measures, while a negative affect balance indicated that negative affect weights heavier than positive affect. Coding 'yes' responses as 1 and 'no' responses as 0, affect balance is simply the difference between the sum of responses over the positive feelings (e.g., joy, happiness) and the sum of the negative feelings (e.g., anger, sadness). For example, a respondent who experienced joy, happiness, and anger, but not the other emotions, would have an affect balance of 2 (positive) – 1 (negative) = 1. In our sample, affect scores varied from -11 (experiencing all negative affect items and no positive affect) to +3 (experiencing all positive affect items and no negative affect) ( $M = -3.98$ ,  $SD = 3.44$ ). The first regression analysis considered affect balance as the sum of all measured affect variables (which were also the variables used as the basis for the cluster analysis). The second regression analysis used the OECD's measure of affect balance (as it was a more balanced scale). The measure considers the 3 positive feelings (joy, happiness,

laughed/smiled a lot) and only 3 negative feelings (anger, sadness, and worry). Affect balance values thus varied from -3 to +3 ( $M = 0.296$ ,  $SD = 1.79$ ).

The results of the regression analyses mostly overlap with the analysis conducted in the paper. The exception is that in the cluster analysis, significant differences were also identified between the two clusters (group experiencing negative affect and group experiencing positive affect) for unhealthy snacking, time spent on social media, financial difficulties, and student status (bachelor versus master student). These variables were not included in the final regression model (implying they did not significantly affect them). The detailed regression results are presented below.

### **Regression 1: Complete affect balance**

The best model contained ten variables and explained 39.2% of the variance in affect,  $F(10, 537) = 34.559$ ,  $p < .001$ . Multicollinearity was assessed by examining tolerance and the Variance Inflation Factor (VIF). These diagnostic factors indicated that collinearity assumptions were not violated (all Tolerance values were higher than 0.1 and VIF values were lower than 2.5), so multicollinearity should not be a concern. Tolerance varied from 0.605 (Study efficiency) to 0.964 (Sleep), while VIF varied from 1.653 (Study efficiency) to 1.038 (Sleep).

Six variables positively contributed to a higher affect balance: perceiving a more positive study efficiency change ( $\beta = .127$ ,  $p = .004$ ), exercising more alone ( $\beta = .135$ ,  $p < .001$ ), sleeping more ( $\beta = .157$ ,  $p < .001$ ), healthy snacking more ( $\beta = .144$ ,  $p < .001$ ), virtually socializing more ( $\beta = .095$ ,  $p = .006$ ), and studying more hours ( $\beta = .098$ ,  $p = .006$ ). On the other hand, having more study problems ( $\beta = -.184$ ,  $p < .001$ ), lacking social contact more ( $\beta = -.267$ ,  $p < .001$ ), perceiving a higher study load change ( $\beta = -.083$ ,  $p = .019$ ) and being a woman (Gender:  $\beta = -.170$ ,  $p < .001$ ) negatively contributed to scoring lower on affect balance.

**Table 6***Stepwise Regression, Complete affect balance as DV*

	<b>B</b>	<b>SE</b>	<b>95% CI</b>		<b>p</b>
			<b>LL</b>	<b>UL</b>	
Study problems*	-0,661	0,150	-0,956	-0,366	0,000
Study hours*	0,254	0,092	0,072	0,435	0,006
Study load (index)*	-0,010	0,004	-0,018	-0,002	0,019
Study efficiency (index)*	0,011	0,004	0,004	0,019	0,004
Healthy snacking*	0,548	0,137	0,279	0,818	0,000
Sleep*	0,511	0,112	0,291	0,731	0,000
Exercise (alone)*	0,355	0,097	0,165	0,544	0,000
Lack of social interactions*	-0,910	0,120	-1,146	-0,675	0,000
Virtually socializing*	0,370	0,135	0,105	0,635	0,006
Gender*	-1,201	0,242	-1,676	-0,726	0,000

**Regression 2: OECD's affect balance**

The best model contained nine variables and explained 28.7% of the variance in affect,  $F(9, 538) = 24.035$ ,  $p < .001$ . Tests to see if the data met the assumption of collinearity indicated that multicollinearity was not a concern (Tolerance varied from 0.616 (Study efficiency) to 0.979 (Financial difficulties), while VIF varied from 1.624 (Study efficiency) to 1.022 (Financial difficulties)). Five variables positively contributed to a higher affect balance: perceiving a more positive study efficiency change ( $\beta = .097$ ,  $p = .037$ ), exercising more alone ( $\beta = .118$ ,  $p = .003$ ), sleeping more ( $\beta = .115$ ,  $p = .002$ ), healthy snacking more ( $\beta = .174$ ,  $p < .001$ ), and virtually socializing more ( $\beta = .089$ ,  $p = .018$ ). On the other hand, having more study problems ( $\beta = -.153$ ,  $p = .001$ ), lacking social contact more ( $\beta = -.258$ ,  $p < .001$ ),

facing financial difficulties ( $\beta = -.086$ ,  $p=.020$ ) and being a woman (Gender:  $\beta = -.138$ ,  $p<.001$ ) negatively contributed to scoring lower on affect balance.

**Table 7**

*Stepwise Regression, OECD's affect balance as DV*

	<b>B</b>	<b>SE</b>	<b>95% CI</b>		<b>p</b>
			<b>LL</b>	<b>UL</b>	
Study problems*	-0,285	0,082	-0,446	-0,124	0,001
Study efficiency (index)*	0,004	0,002	0,000	0,009	0,037
Healthy snacking*	0,342	0,077	0,191	0,493	0,000
Sleep*	0,195	0,063	0,072	0,318	0,002
Exercise (alone)*	0,160	0,054	0,054	0,266	0,003
Lack of social interactions*	-0,910	0,120	-1,146	-0,675	0,000
Virtually socializing*	0,180	0,075	0,031	0,328	0,018
Gender*	-0,504	0,135	-0,768	-0,239	0,000
Financial difficulties*	-0,528	0,227	-0,974	-0,082	0,020