The influence of big five personality traits on academic performance, well-being and home study satisfaction in corona times.

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Data availability statement

The data, materials and the statistical analyses are available on the OSF repository

(non-frozen version of the project: <https://osf.io/zektw/>)

For further interest beyond these analyses and data contact the first author.

preregistration: <https://osf.io/fbsdq>

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Abstract

As a result of the protective measures taken to contain the COVID-19 pandemic, studies at German universities were restructured. Students were forced to move into Home Study in the spring of 2020, with their daily study routine changing to predominantly online-based teaching methods and digital content delivery. The present study addressed the relation between coping with the Home Study situation and personality: The interrelations of the Big Five factors extraversion and conscientiousness with students' well-being, study satisfaction and academic performance were examined in 287 German online participants. The results showed significant positive correlations of positive affect and conscientiousness, as well as of better academic performance and academic satisfaction. For Extraversion, also supporting evidence on the affective level emerged, although previous studies suggested negative influences of extraversion on affect in Home Study settings. Yet, in the present study, possibly due to the phase of the pandemic, extraversion correlated negatively with negative affect and showed positive correlation with positive affect. Furthermore, neuroticism showed negative correlations with all constructs tested, indicating a negative influence on satisfaction, mood and performance also in Home study. In summary, conscientious students coped well with the challenge of the pandemic Home Study situation in terms of well-being, study satisfaction and academic performance. Extraverts were able to cope with the situation better than expected, yet only regarding mood and affect, while neuroticism leads to unfavorable effects in general. When making decisions about study conditions, the personalities of students should be considered, not to favor any negative effects for certain individuals.

Keywords: COVID 19, big five personality, academic performance, home studies

Introduction

The novel COVID-19 virus, which spread rapidly from China in late 2019, developed into a global pandemic in 2020, which was accompanied by enormous restrictions and protective measures. To slow the spread of the so-called "coronavirus", the population was urged to follow hygiene measures and keep their social contacts to a minimum, which affected almost all areas of life. Gathering in groups was prohibited, curfews were imposed, planned events, both private and public, had to be cancelled, and travel opportunities at home and abroad were restricted (Usher et al., 2020). In addition to their private lives, large segments of the population also saw their daily work lives change. For example, the percentage of people working in home offices in Germany more than doubled to 26.1 % during the first lockdown compared to the pre-pandemic period (Möhring et al., 2020). Yet, while the majority of employed persons in Germany were working regularly at their workplaces despite the pandemic (Möhring et al., 2020), the picture was different among students in Germany.

At all German universities, teaching had to be unceremoniously converted to online teaching in spring 2020, with a few exceptions such as lab work. Hence, there could be no more face-to-face teaching and it came down to the use of online-based formats that were used from home. Study materials were only made available via online platforms and could be accessed and worked through at any time. Libraries, refectories, and workrooms remained largely closed, which virtually precluded meeting for learning and exchanging ideas with other students. Although digital teaching was not a completely new concept, as distance learning universities, for example, have been working in this way for some time, the required changeover for students - away from face-to-face study - presented a challenge.

Well-being during COVID 19 pandemic

The World Health Organization (WHO) defined mental health as a state of well-being in which an individual recognizes his or her own abilities, can cope with the normal stresses of life, can work productively, and is able to contribute to his or her community. More specifically, WHO explains that positive mental health can be conceptualized as a subjective sense of well-being. In this

vein, Bradburn developed a scale to measure the positive and negative facets of mental well-being (World Health Organization, 2004).

Studies on the psychological well-being of the population during the COVID-19 pandemic showed that the measures of the first lockdown in Germany resulted in the population's well-being deteriorating significantly and anxiety and depressive symptoms increasing (Matos Fialho et al., 2021; Schwinger et al., 2020). It was further differentiated that lower well-being was due to increased negative affect and concurrently decreased positive affect, which was evident in people's mood (Anglim & Horwood, 2021). These developments, as well as increased anxiety scores and rising negative affect among students, were strongly related to restrictions in the university context (Li et al., 2020). Of those studying in Germany, approximately half reported feeling that their workload at university or college had increased significantly since the COVID-19 outbreak. In addition, 54% felt anxious about the expectations in various courses, 47.9% were concerned that they would not be able to successfully complete the academic year, and 47.2% agreed that the change in teaching methods caused them significant stress (Matos Fialho et al., 2021). The higher-than-average stress and stress experienced due to study conditions during digital teaching was also reflected in decreased student satisfaction (Loton et al., 2020). The interrelation of study satisfaction and well-being can be concluded from the work context. Even before the pandemic, it has been demonstrated that job satisfaction and subjective well-being influence each other (Bowling et al., 2010) and job satisfaction is in turn under the influence of working conditions and the work environment (Aziri, 2011). Moreover, psychological well-being and job satisfaction also determine job performance (Judge et al., 2001; Wright & Cropanzano, 2000). Similarly, for students, lower academic satisfaction is associated with lower academic performance, i.e., lower grades in their examinations (Martirosyan et al., 2014).

However, against the backdrop of the COVID-19 pandemic, differences in how students cope with the new Home Study situation and the level of perceived stress have been identified in the past year in Germany (Traus et al., 2020). One approach that has been increasingly studied to explain these differences deals with student personality.

The influence of the Big Five of personality during the COVID 19 pandemic

The Big Five model (Costa & McCrae, 1992) assumes that the individual differences of personalities can be described based on five factors. Two of these factors are of particular interest concerning our study:

The factor „conscientiousness“ is a personality dimension that reflects the degree of self-discipline and control. Individuals who are highly conscientious plan events in their lives in advance, are careful, thorough, responsible organized, and scrupulous (Roccas et al., 2002). Furthermore, conscientious individuals exhibit higher levels of diligence, are orderly, and behave according to rules and responsibly toward others (Roberts et al., 2009). The other end of the continuum characterizes people who are irresponsible, disorganized, and unscrupulous (Roccas et al., 2002). Going further, this personality dimension comes into play especially in the occupational context, hence the name "work dimension" in some cases (Tett & Burnett, 2003). Conscientiousness is a powerful predictor of work engagement, work performance - independent of performance criteria and job type (Barrick et al., 2001) - and is also considered a conditional personality trait for success in work that is to a considerable extent not performed from the traditional workplace but, for example, from home (Clark et al., 2012). Self-management is an indispensable criterion for the successful completion of such tasks and is attributed to individuals with a high degree of conscientiousness (Lamond, 2000). Concerning the compliance with pandemic restrictions, conscientious people are expected to have fewer problems with restrictions due to the pronounced conformity to rules and their sense of responsibility (Krupić et al., 2021). Also, conscientiousness helps to withstand the negative psychological influence of the COVID-19 pandemic (Zhang et al., 2021).

"Extraversion", measures an individual's sociability. Extraverts are very energetic, optimistic, friendly, assertive and sociable (McCrae & John, 1992). In contrast, so-called introverts, individuals with a low expression of this factor, tend to be reserved, socially independent, and fluctuate in their pace of work, although they are not sluggish (McCrae & John, 1992; Tett & Burnett, 2003). In relation to the limitations imposed by the pandemic on social interaction and social support, extraverts could be more heavily influenced by the pandemic as they rely on social support in stressful situations

(Amirkhan et al., 1995) and the perceived accessibility to such social support is responsible for the extent to which extraverts can cope with negative stressful situations (Swickert et al., 2002). Accordingly, in the context of the initial lockdown of the 2020 emerging pandemic, extraverts experienced higher stress levels (Liu et al., 2021; Weiß et al., 2020; Zacher & Rudolph, 2021). Hence, a dampened response concerning well-being and performance was expected.

Other aspects of the Big Five personality traits that are not directly in the focus of this work are openness, agreeableness, and neuroticism. The openness to experience factor includes traits such as intellectual curiosity, divergent thinking, a willingness to consider new ideas, and a strong imagination. Individuals high on this factor think unconventionally and independently, whereas individuals low on openness to experience are more conventional and prefer the familiar (McCrae & John, 1992; Tett & Burnett, 2003). Agreeableness is associated with positive social interaction, i.e., trusting, helpful, soft-hearted and sympathetic people; conversely, a low level represents distrustful, hostile, skeptical, uncooperative and unhelpful people (McCrae & John, 1992; Tett & Burnett, 2003). Neuroticism forms a measure of an individual's emotional stability and personal adjustment, which is why this dimension is sometimes referred to as "emotional stability". High levels of neuroticism are reflected in strong mood swings and characterize people who are very volatile in their emotions. In contrast, individuals with low neuroticism are calm, well-adjusted individuals who are not prone to extreme inappropriate emotional states (McCrae & John, 1992; Tett & Burnett, 2003).

Personality and Home Study

Regarding students during the pandemic, who mostly studied from home, extraversion and conscientiousness came into focus due to the explained characteristics of the individual personality dimensions of the Big Five. Due to the lack of infrastructure at the universities, socializing with other students was curbed during pandemic online semesters (Traus et al., 2020). Students with high extraversion consequently felt more stressed by the pandemic than introverted fellow students (Fichter et al., 2021) and during Home Study well-being was negatively related to extraversion (Gupta & Parimal, 2020). Students additionally expressed motivational or attentional problems with home office learning during the COVID-19 pandemic (Fichter et al., 2021). However, even before the Corona

crisis, conscientiousness was found to be related to motivation and satisfaction in online learning and performance (Schniederjans & Kim, 2005; Shih et al., 2013). The motivational self-regulation and self-efficacy of more conscientious students likewise favored better handling of the Home Study situation in the context of pandemic online semesters (Staller et al., 2021).

Concluding the previously mentioned literature, we were especially interested in the influence of extraversion and conscientiousness on Home Study success, yet not only focusing on the well-being aspect, but also on the performance.

Hypotheses

Given the previous findings, we expected a relationship of extraversion and negative psychological well-being as well as a relationship of conscientiousness and positive psychological well-being (e.g., Gupta & Parimal, 2020). Further, it was expected that differences in student satisfaction in the Home Study situation can also be revealed based on students' personality traits. Considering the results of previous studies and the influence of well-being on satisfaction (Bowling et al., 2010), similar patterns as for the well-being were expected. Given the influence of students' satisfaction with their study situation on their academic performance (Martirosyan et al., 2014), an effect was also expected in this context for the personality traits extraversion and conscientiousness like the two previous hypotheses with conscientiousness leading to better performance, while extraversion should lead to worse performance.

Other traits were not expected to have a specific influence on the academic performance, well-being or satisfaction in Home Study context. However, with this decision we had neglected the influence of neuroticism, which was addressed exploratorily and in the limitation section.

Methods

Ethical statement

The study was carried out in accordance with the recommendations of "Ethical guidelines, of the psychological association of the country of the institution with written informed consent from all subjects. All subjects gave written informed consent in accordance with the Declaration of Helsinki

before they participated in the experiment. The protocol was approved by the local ethics committee.

Preregistration

The preregistration (blinded) of the study is given here:

https://osf.io/fbsdpr/?view_only=e564fd3d22ba471fb767c5256a39b9a8.

Participants

An a-priori sampling size calculation was performed using an estimated effect of $r=.17$ (Gupta & Parimal, 2020; Weiß et al., 2020). 269 participants were estimated using G*Power (Faul et al., 2007, 2009) to find such a correlation effect at an alpha level of .05 and a power of .80 (https://osf.io/fbsdpr/?view_only=e564fd3d22ba471fb767c5256a39b9a8).

To collect sufficient data and to account for possible data loss, in total 287 completed questionnaires could be used for evaluation after excluding prematurely terminated participation. The completed questionnaires consisted of 220 female and 65 male students; two participants did not give any information about their gender. The mean age was 22.679 years ($SD = 3.47$), with ages varying from 18 to 48 years. Further detail can be seen in supplemental material S1.

Procedure

Participants were recruited via personal contacts as well as social media and circulars at German universities. They were students who, at the time of the survey, had already studied at a university or college in the previous semester, the winter semester 2020/21, and had thus experienced at least one complete online semester during the pandemic. Students could receive participation credits, but no monetary compensation was offered.

To collect the data, an online questionnaire was compiled using SoSci Survey (Leiner, 2021), which could be completed via the internet platform *soscisurvey.de*. The processing time for the questionnaire took about 30 minutes.

Questionnaires/items

The descriptive statistics and internal consistencies of the questionnaire data are shown in Table S2 in supplemental materials.

Demographical data

In order to characterize the sample collected, age, gender, course of study, the semester they were currently in, and the federal state of their university were collected. Furthermore, the predominant living situation of the students during the online semesters in the pandemic was also asked, whereby the participants could choose between "shared apartment", "living alone", "in the parental home" or "living with the family" or "other living situation". The demographical data can be seen in supplement S1.

Big Five personality factors

The Big Five Inventory-SOEP (BFI-S; Schupp & Gerlitz, 2014) was used to assess the personality dimensions of the Big Five. The short scale measures the personality factors neuroticism, extraversion, openness, conscientiousness, and agreeableness based on 15 items. For each trait, respondents indicate on the BFI-S the extent to which they attribute the described trait to themselves on a seven-point scale ranging from "1 = not at all true" to "7 = strongly true". Each personality factor is addressed by three items with different polarity.

Well-being

Students' subjective well-being was assessed using two survey instruments: The Current Mood Scale (ASTS; Dalbert, 2002) was used, which captures the current mood, i.e., the state portion of the respondents' subjective well-being. The self-report measure comprises 19 items, which are assigned to five subscales: sadness (TR), hopelessness (HO), fatigue (MT), anger (ZO), and positive mood (PO). The 19 items are adjectives that reflect emotional states and are to be rated on a seven-point rating scale from "1 = not at all" to "7 = very strongly". The individual dimensions can be considered separately but can also be used to form an overall measure to describe current negative mood (NE).

The second instrument used to assess students' well-being was the German version of the Positive and Negative Affect Schedule (PANAS; Breyer & Bluemke, 2016). The PANAS questionnaire consists of 20 items that capture both positive and negative affect independently. For this purpose, adjectives describing different sensations and feelings are queried and assessed using a 5-level response format for a specific period of time - in this case during the Home Study of the last semesters. Ten adjectives each capture the dimensions of Positive Affect (PA) and Negative Affect (NA). The response alternatives are "1 = not at all", "2 = a little", "3 = to some extent", "4 = considerably" and "5 = extremely".

Study satisfaction

Two measurement instruments were also used to assess student satisfaction. First, the general study satisfaction was determined with the help of the Short Questionnaire for the Assessment of Study Satisfaction (FB-SZ-K; Westermann et al., 2018), which consists of 9 items, each of which includes three statements on satisfaction with the study content, the study conditions and coping with the study load. The items are to be answered by indicating on a scale from "0 = The statement does not apply at all" to "10 = The statement applies completely" to what extent the respective statement sentences correspond to the opinion of the students.

As a second measurement instrument for study satisfaction, the job satisfaction questionnaire (Neuberger & Allerbeck, 2014) was used in a modified form. The original questionnaire is based on the seven subscales "My colleagues", "My supervisor", "My job", "My working conditions", "Organization and management", "My development" and "My pay", for which an answer must be selected on a four-point Likert scale between the choices "1 = yes", "2 = rather yes", "3 = rather no" and "4 = no". At the end of each scale, a summary satisfaction question is asked, represented by Kuhn faces. The answers here range from "1 = lowest satisfaction" to "7 = highest satisfaction", but without the verbal labeling (Neuberger & Allerbeck, 2014). For the present research question the scales "My job", "My working conditions" and "Organisation and management" were singled out and adapted to the research question of the Home Study satisfaction. For this purpose, "My job" was used to inquire about the content of the Home Study, "My working conditions" was used to inquire

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about the home office, and "Organization and management" was used to inquire about the university's handling of the pandemic or the online semester. The exact reformulations of the questionnaire items used can be found in supplemental materials S3. Furthermore, instead of a 7-point scale, a 5-point scale ("1 = lowest satisfaction" to "5 = highest satisfaction") was used for the nonverbal Kunin faces of the summary satisfaction questions.

Academic achievement

In the context of this study, academic performance was referred to as examination performance, i.e., the grades achieved by the students. The respondents were asked in advance to provide the grades they had achieved in the previous semester, the winter semester 2020/2021, and thus the second semester that had taken place in the Home Study, so that first-year students were not included in the survey. In the survey of grades, all university achievements of the winter semester were to be entered as far as possible. A maximum of seven entry fields were available for this purpose, and at least one had to be completed. The grades were to be entered with one decimal place, which is why students should, if possible, only refer to numerically recorded performances and leave out performances that were recorded as "passed" or "not passed". If the students did not have any of the grades just described in the previous semester, they had the option of indicating this in the first input field. For each grade given, it was also asked whether the subject in which the grade was achieved corresponded to the student's personal interest. Students were asked to select whether their interest in the subject was "rather high", "average" or "rather low". Finally, for each grade entered, the students were asked to indicate how representative the grade was regarding their own performance assessment in this subject, i.e., whether the grade was "in line" with their own assessment, "better than expected" or "worse than expected". A mean score was then calculated from the indicated grades, which allowed for subsequent comparison of academic performance, with a lower grade point average representing better academic performance than a higher-grade point average.

Statistical analysis and evaluation

The study was pre-registered on the Open Science Framework (OSF) prior to the survey https://osf.io/fbsd/p/?view_only=e564fd3d22ba471fb767c5256a39b9a8. Associations between variables were tested using Pearson correlation coefficient r . A significance level of $\alpha = .05$ was set for all analyses, with Bonferroni-Holm post-hoc alpha correction applied for multiple testing (see supplemental Table S4). Data processing, as well as statistical analysis, were performed entirely using *Jamovi* (The jamovi project, 2021).

Exploratory Pearson-correlations of the five personality scales of the BFI-S with the individual scales of the ASTS were also analyzed, and relationships between the constructs of well-being, study satisfaction, and academic performance were examined. In addition, the relationship of the personality factors conscientiousness and extraversion with aspects of well-being not considered in the hypotheses above (preregistration: 1a and 1b) was considered.

Results

Confirmatory analysis

The first hypothesis included the assumption that the personality factor conscientiousness is related to a higher sense of well-being. The correlation of conscientiousness and positive affect was significantly positive ($r = .309$, $p_{holm} < .001$), as well as for the correlation of conscientiousness and positive mood ($r = .170$, $p_{holm} < .05$), see Figure 1.

Regarding well-being and extraversion, lower well-being was expected and thus a positive relationship of extraversion and negative affect and of extraversion and negative mood was hypothesized. Contrary to the hypothesis, no positive relationship of extraversion and negative affect ($r = -.191$, $p_{holm} = .999$) was found (see Figure 1). The correlation of extraversion and negative mood (see Figure 1) was also not positively correlated ($r = -.063$, $p_{holm} = 1$).

Figure 1

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Correlations between conscientiousness and positive well-being and extraversion and negative well-being (positive/negative affect and positive/negative mood). The blue shaded area represents the respective standard error.

The second hypothesis dealt with study satisfaction as a function of the personality traits conscientiousness and extraversion. Study satisfaction was assessed on the one hand by means of general study satisfaction, and on the other hand individual aspects of the Home Study were surveyed. As expected, the results showed a positive correlation of conscientiousness and general study satisfaction ($r = .206$, $p_{holm} < .01$) during the online semesters in Home Study (see Figure 2). The satisfactions of one aspect of Home Study, Home Study content ($r = .284$, $p_{holm} < .001$), correlated also significantly positively with conscientiousness (see Fig. 2). However, although being in the correct

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direction, after alpha correction, the two other aspects University ($r = .147$, $p_{holm} = .058$) and Home Office ($r = .114$, $p_{holm} = .212$), were no longer significant (for details see Table S4).

Regarding the personality factor extraversion, a negative correlation was suspected with Home Study satisfaction, yet no significant effect was found ($r = .055$, $p_{holm} = 1$). Also, no significant correlation could be found for Home Study content ($r = -.023$, $p_{holm} = 1$), University ($r = .038$, $p_{holm} = 1$) and Home Office ($r = -.064$, $p_{holm} = 1$).

Figure 2

Correlations between conscientiousness and general study satisfaction, as well as Home Study content. The blue shaded area represents the respective standard error.

The results for academic performance were based on 260 records collected, because of missing data. In particular, we excluded data that could not be interpreted, due to not following the given grade format, i.e., data that fell outside the outlier limits of the grading scale. We expected better academic performance in students in Home Study situation with high conscientiousness and poorer performance with high extraversion. Since in Germany the lower the grade point average, the better the performance, a negative relationship with grade point average was hypothesized for conscientiousness and a positive relationship was hypothesized for extraversion. The results (see Figure 3) showed, as expected, a significant negative correlation of grade point average and conscientiousness ($r = -.228$, $p_{holm} < .01$), yet no positive correlation with extraversion was found ($r = .025$, $p_{holm} = 1$).

Figure 3

Correlations between conscientiousness and extraversion and academic performance (grade point average of performance achieved, lower grade indicate better academic performance). The blue shaded area represents the respective standard error.

Lastly, it was hypothesized that there would be no significant relationship between the personality traits of agreeableness, openness, and neuroticism and the constructs of well-being, study satisfaction, and academic performance in the Home Study setting. Therefore, using positive and negative affect for well-being, overall study satisfaction for academic satisfaction, and grade point average for academic achievement, a correlational analysis was conducted including the 90% confidence intervals (90% CI) and no alpha correction. This procedure was used as the hypothesis was that no correlation was given, hence a test on H0 was performed.

However, only for the personality factor openness, positive affect was unrelated ($r = .093$, $p_{uncorrected} = .114$, 90% CI $[-.004, .189]$) as expected. For all other relations, significant results were found (see Table 1).

Table 1: Correlation patterns and 90% confidence intervals of wellbeing and general study satisfaction with agreeableness, neuroticism and openness

		agreeableness	openness	neuroticism
positive affect	Pearson's r	0.138*	0.093	-0.317***
	p-value	0.020	0.114	0.000
	90% CI Upper	0.232	0.189	-0.227
	90% CI Lower	0.041	-0.004	-0.402

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negative affect	Pearson's r	-0.154**	0.136*	0.522***
	p-value	0.009	0.021	0.000
	90% CI Upper	-0.057	0.23	0.59
	90% CI Lower	-0.247	0.039	0.448
general study satisfaction	Pearson's r	0.123*	-0.126*	-0.388***
	p-value	0.038	0.033	0.000
	90% CI Upper	0.217	-0.029	-0.302
	90% CI Lower	0.026	-0.221	-0.467

Note. * $p < .05$, ** $p < .01$, *** $p < .001$

Exploratory analysis

In the exploratory examination of affect in relation to conscientiousness and extraversion without underlying hypotheses, there was a significant positive correlation of extraversion and positive affect ($r = .205$, $p_{uncorrected} < .001$) as well as a negative correlation with negative affect ($r = -.191$, $p_{uncorrected} = .001$) and a negative correlation of conscientiousness and negative affect ($r = -.175$, $p_{uncorrected} = .003$).

Furthermore, the correlations of the individual scales of the ASTS and the five personality factors were examined. Regarding conscientiousness, significant negative correlations were found with the subscales sadness ($r = -.183$, $p_{uncorrected} = .002$), hopelessness ($r = -.173$, $p_{uncorrected} = .003$), fatigue ($r = -.121$, $p_{uncorrected} = .04$) and the total scale for negative mood ($r = -.163$, $p_{uncorrected} = .006$); the personality factor extraversion did not correlate significantly with any individual scale of the ASTS. For the Big Five factor agreeableness, there was only a significant negative correlation with the anger subscale ($r = -.234$, $p_{uncorrected} < .001$). When considering the personality expression of openness, significant positive correlations were shown with the sadness ($r = .154$, $p_{uncorrected} = .009$), hopelessness ($r = .137$, $p_{uncorrected} = .020$), and fatigue ($r = .144$, $p_{uncorrected} = .014$) subscales, as well as the Negative Mood total scale ($r = .124$, $p_{uncorrected} = .035$). The strongest correlations were found in the exploratory analysis of the subscales of the ASTS and the relationship with neuroticism. Neuroticism was significantly and positively correlated with both sadness ($r = .406$, $p_{uncorrected} < .001$), as well as hopelessness ($r = .367$, $p_{uncorrected} < .001$) and fatigue ($r = .364$, $p_{uncorrected} < .001$), yet only a weakly significant positive correlation was found for anger ($r = .167$, $p_{uncorrected} = .005$). Regarding the total negative mood scale, a

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significant positive correlation was found with neuroticism ($r = .378, p_{\text{uncorrected}} < .001$) and with the positive mood scale, neuroticism correlated significantly negatively ($r = -.274, p_{\text{uncorrected}} < .001$).

The correlations of the constructs of well-being, study satisfaction, and academic performance were also analyzed independently of personality. Here, general study satisfaction correlated strongly and significantly with positive and negative aspects of well-being, both for affect (PA: $r = .478, p_{\text{uncorrected}} < .001$; NA: $r = -.513, p_{\text{uncorrected}} < .001$) and mood (PO: $r = .504, p_{\text{uncorrected}} < .001$; NE: $r = -.668, p_{\text{uncorrected}} < .001$). For correlations with academic performance, no significant correlations were shown with well-being other than for hopelessness leading to worse performance ($r(259) = .142, p_{\text{uncorrected}} = .022$); however, overall academic satisfaction was slightly significantly correlated with a better grade point average ($r(259) = -.154, p = .013$).

For further details see Table S5 in supplemental materials.

Discussion

The aim of the work was to show the differences in dealing with the Home Study situation that arose during the COVID-19 pandemic in Germany, depending on the personality of the students. The focus was on the relation of the personality factors extraversion and conscientiousness with well-being, study satisfaction and academic performance.

The results showed that students with high conscientiousness scores were better able to cope with the challenges of Home Study. Conscientiousness was conducive to well-being, study satisfaction, and better academic performance in such a situation. Regarding extraversion, the results suggested, that well-being was increased by extraversion, and the expected negative effect was not given.

Personality and well-being in Home Study

The results indicate that positive psychological well-being in the pandemic Home Study situation was strongly related to the personality factor conscientiousness of students, thus confirming our hypothesis. The results fit with the findings that pandemic adversity does not affect the well-being of conscientious individuals (Zhang et al., 2021). One possible explanation for this effect is rule

compliance and sense of responsibility, which are associated with high levels of the personality factor (Roberts et al., 2009). As complying with the restrictions does not prove to be a burden for conscientious individuals, the psychological well-being does not suffer from the Home Study situation and conscientious students may not find it difficult to cope with the imposed changes (Gupta & Parimal, 2020). In contrast, it has been suggested that students who are highly sociable and usually derive their support in difficult situations from social interactions, i.e., are highly extraverted, suffer from the restrictions during online semesters, especially in the social domain, and this manifests itself in negative psychological well-being. Contrary to these assumptions (Fichter et al., 2021; Gupta & Parimal, 2020) this study did not show a positive relationship between extraversion and negative well-being. On the contrary, the personality factor extraversion revealed a similar supporting pattern regarding well-being as already observed for conscientiousness, suggesting that higher extraversion expression is associated with higher positive well-being and low negative well-being. Although the effect is not that pronounced than for conscientiousness, it nevertheless suggests that extraversion is beneficial to well-being during Home Study, rather than a hindrance as expected. Comparable studies explained the findings in terms of the positive influence on psychological well-being fundamentally attributed to extraversion, which is attenuated by the constraints and stresses of the pandemic but still protectively present (e.g., Anglim & Horwood, 2021). Yet, the exploratory positive association found between positive affect and extraversion can also be explained by the phase of the pandemic in which the study was conducted. After all, it was already the third semester that took place under pandemic conditions. Extraverts may have found ways to cope with the situation and maintain social contacts using also digital infrastructure. In addition, the progress of the vaccination and the decreasing number of infections gave reason to hope that normality would soon return, which may have strengthened the positive affect. Although the focus of this paper was on the personality factors extraversion and conscientiousness, the salient associations of neuroticism with almost every construct examined are worth noting. That neuroticism is strongly related to well-being was not explicitly expected in the context of this work but was also not surprising given the emotional instability that characterizes this personality factor. Regardless of a pandemic and its associated negative

consequences, neuroticism is considered an important predictor of subjective well-being, with pronounced neuroticism being associated with negative affect (e.g., Librán, 2006). Therefore, it is quite conceivable that students with higher neuroticism scores suffer more from the constraints and uncertainty of the pandemic or the Home Study situation and exhibit more negative well-being (Modersitzki et al., 2021).

Personality and study satisfaction in Home Study

Higher conscientiousness was associated with greater study satisfaction in Home Study. This pattern was evident in both overall satisfaction and satisfaction with individual aspects of study, content, home office, and university, yet being partly not that pronounced. Satisfaction with the type of study tasks and their content, on the other hand, clearly correlated with students' conscientiousness. Because Home Study was also partly asynchronous, self-discipline and organization, partial characteristics of the conscientiousness factor, played a major role in the completion of the study tasks also during the pandemic (Audet et al., 2021). However, the expectation of a negative relationship of extraversion and study satisfaction in Home Study could not be confirmed by the present study: Extraversion was not related to study satisfaction during Home Study at all. This was shown both in very low correlations between extraversion and the queried satisfactions regarding studying in the past semesters and is in line with recent findings (Sahinidis & Tsaknis, 2021). They also fit to the higher well-being for extraversion; consequently not leading to a negative relation with study satisfaction (Bowling et al., 2010). Furthermore, and in line with the underlying relationship between well-being and satisfaction and the results of Sahinidis and Tsaknis (2021), we found that the personality factor neuroticism also showed a strong negative correlation with study satisfaction in Home Study. This may further indicate the risk factor of neuroticism, leading to generally unfavorable feelings in this rather uncertain situation.

Personality and Academic Performance in Home Study

Regarding academic performance, the study was able to confirm, as hypothesized, a clear relationship between conscientiousness and better grades in home study. On the one hand, this can be

explained by the relationship between study satisfaction and better academic performance (Martirosyan et al., 2014), which was also exploratively found in this current study. Since the results also showed that highly conscientious students did not experience tremendous negativity in well-being or dissatisfaction with home study, the role of conscientiousness held in academic performance during online semesters is additionally important. Yet, conscientiousness is also considered to be the Big Five personality factor predictive of successful academic performance independent of a pandemic or general Home Study situation (Kappe & Van Der Flier, 2012), so the finding is just as expected. Yet, the effect seems to be significantly dampened compared to normal circumstances ($r_{\text{Kappe \& Van Der Flier 2012}} = .47$, $r_{\text{study}} = .228$, $z = 2.609$, $p = .005$). Concerning extraversion, we did not find the expected tendency that high extraversion expression was associated with a lower grade point average in Home Study. Thus, the results are not in line with the predicted influence of extraversion on poorer academic performance in the online conditions during the pandemic (Yu, 2021). The reason for this lack of finding could be manifold. One reason could be that the proposed lack of performance could be due to the higher effort extraverts had to invest in their social stimulation in the beginning of the pandemic times. This may have deprived them of the academic success early, but as the social networks are now established, adapted and in use in the ongoing pandemic situation, many coping mechanisms may be at hand. For example, learning groups that were cancelled at the beginning of the pandemic were restarted at later stages of the pandemic in smaller online groups. Hence, this missing motivation that may have caused differences in performance has been regained in later stages of the pandemic. Hence, datasets that are recorded in earlier times in the pandemic might be more suited to explore the question about the negative influence of extraversion, as the data of Yu (2021) suggests.

Limitations and criticism

One limitation is that the relation to academic performance was not investigated with the expected 269, but only 260 participants. Missing data led to an insufficient sample size concerning the academic performance, although only 9 persons are missing. Nevertheless, we were not able to pursue our data collection due to time constraints, as we did not want to extend our data collection

to an additional semester, especially in these pandemic times, where drastic changes are given in the rules that apply as well as the perception of the rules.

Furthermore, the validity and comparability of academic performance should also be questioned in that the number of grades reported as well as the subjects, their difficulty and the type of examination performance varied between students, potentially constituting a confounding variable. Online semesters included changing many examination formats, reverting to online-based performance reviews or written assignments, which could have an impact on the grades achieved regardless of Home Study.

Also, an important aspect in the limitation of this work is that the role of personality was only examined correlatively and thus no causal conclusions or directions of action can be drawn between the constructs. Although it is reasonable to assume that personality is an underlying aspect that persists over time, such a causal relationship was not tested in the analysis of the data of this study and therefore cannot be interpreted. Further, although the presumed correlations could be partially confirmed, a different underlying reason could be given. For example, in addition to personality, events in private life may also be related to well-being and study satisfaction and influence the experience of the Home Study situation in this respect.

Since the study was a snapshot and there were no repeated measurements at different times before and during the pandemic, the sole influence of the pandemic Home Study cannot be assumed beyond doubt. Moreover, the different phases of the pandemic, which also varied in the severity and extent of their restrictions, may have been perceived differently, which makes the findings not generally indicative of Home Study in general or of the period of the pandemic, but only of the Home Study during the period and phase of the survey. This period, in turn, extended into the summer months, during which the restrictions were less severe, the weather allowed for meeting outside, and the vaccination progress allowed students more and more freedom. Moreover, we are not able to separate the effect to the pandemic clearly from general Home Study effects. Hence this confound is given in our data and poses a great limitation.

Concerning the methodological approaches of the study, it can be assumed that the multiple assessment of a construct, such as well-being using the ASTS and the PANAS, and the associated Bonferroni-Holm alpha correction for multiple testing, resulted in too strict an adjustment and that interesting significant results were overseen. Yet, for that reason, the exploratory correlational results were included to provide a better overall view on the data. Future studies could additionally include repeated measures of well-being, study satisfaction and academic performance to provide a wider view on the Home Study situation and performance linked to personality. In addition, a more detailed survey of personality traits with a more comprehensive questionnaire than the BFI-S could grant more precise assessments and more quality, whereas the survey of well-being with only one instead of two survey instruments should be sufficient. However, such studies would have to deal with the problem of a very long-lasting longitudinal design.

Outlook and conclusion

Although this work focused on specific aspects and correlations related to personality and Home Study during the pandemic, the results provide interesting insights into the field of Home Study per se. Yet, the present study only provides a starting point for many interesting questions. For example, a more detailed analysis of possible factors influencing the living situation on the subjective Home Study experience could be made or the remaining three Big Five factors - agreeableness, openness, and neuroticism could be more closely examined in the context of Home Study or Home Study during the pandemic. As has been shown in the present study, for example neuroticism could possibly be one of the most influential personality factors on coping with the pandemic and the Home Study situation. Despite our global efforts to overcome the COVID-19 pandemic, some teaching formats are likely to not return to face-to-face after the pandemic, as a major boost to digitization in the university context was given by this situation. It is therefore reasonable to assume that Home Study and asynchronous learning and teaching will continue to be a part of student life in the future. The examination of Home Study therefore holds great potential to ensure equality concerning performance opportunities for different personality types, for example by providing help of guidance for persons needing it.

Concluding the present study, differences in how students deal with the Home Study situation in pandemic times were revealed, regarding the big five personality traits. The personality factor conscientiousness emerged as a beneficial factor on multiple levels, while extraversion might act as a mood enhancing trait. Neuroticism however emerged as a risk factor for performance and mood on multiple levels in Home Study. Not all students will be able to cope equally well with changes and university challenges in the future, and individual consideration, guidance and personalized design of learning environment may therefore be beneficial when designing study conditions or Home Study environment.

Conflict of interest statement

On behalf of all authors, the corresponding author states that there is no conflict of interest.

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