What if the computer crashes? Findings from an exploratory factor analysis on stressors in online exams

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Introduction and related work

Writing an online exam from home was uncommon until a few years ago but has become common practice for many students due to the Corona pandemic. However, to date, only little is known about the students' subjective experience in such new settings and about the stressors they might face in online exams (Harley et al., 2021). For instance, writing an online exam from home involves that students are asked to provide their own technical infrastructure (e.g., hardware, software, internet access). Thus, technical issues presumably arise due to a slower internet connection, poorer hardware quality or outdated or incompatible software. Besides technical problems, also social and emotional aspects of online exam settings might be challenging and stressful for students. Since a higher stress level negatively impacts one's performance (Hafeez et al., 2018) the identification of potential stressors in those novel exam settings is highly relevant. Thus, our goal for this study was to identify and investigate stressors in online exams via exploratory factor analysis. Our results may provide insights for the development of futures online exams.

Methods

As part of a larger project at our university, we investigated the subjective experiences of students during online exams. The sample of this study consisted of 93 psychology bachelor students (73 females, 19 males, 1 diverse; Mage = 26.81, SDage = 5.14). After finishing their individual exams at the end of the spring semester in 2021, participants were invited (via email) to participate in an online survey (conducted via EFS Survey (2021)) including a total of six scales concerning their subjective experiences in online exams (stressors, emotions, appropriateness of exam formats etc.). Participation in the study took an average time of 16 minutes. The stressors questionnaire consisted of 26 items (e.g., Stress_14; "The exam software no longer works") which were created following the scales used in a study by Caltabiano et al. (2021). The participants reported their level of stress (i.e., "**For each of the following statements, please indicate how stressful the situation is for you during an online exam.**") on a scale from 1 – "not stressful at all" to 5 – "extremely stressful". To examine the questionnaire, we conducted an exploratory factor analysis.

Exploratory Factor Analysis of Stressors in Online Exams.

Items	Factor					Label
	1	2	3	4	5	
Item 15	**0.917**	-0.023	0.065	-0.022	-0.095	System failures
Item 16	**0.841**	-0.007	-0.014	-0.015	0.113	
Item 14	**0.821**	0.034	-0.045	-0.053	0.019	
Item 13	**0.596**	0.046	0.008	0.043	0.188	
Item 5	-0.011	**0.705**	0.028	-0.109	0.127	Social pressure
Item 6	-0.055	**0.613**	0.091	-0.074	0.102	
Item 23	0.218	**0.578**	-0.068	0.028	-0.058	
Item 25	0.034	**0.506**	-0.089	0.126	0.047	
Item 22	0.068	**0.452**	-0.123	0.160	0.146	
Item 21	0.106	**0.320**	0.152	0.024	0.069	
Item 8	0.022	-0.081	**0.919**	0.029	-0.001	Self-inflicted noises
Item 7	-0.037	0.065	**0.908**	0.012	0.020	
Item 9	0.172	0.074	**0.466**	-0.196	0.019	
Item 3	-0.055	-0.026	0.031	**0.890**	0.048	Time indications
Item 1	0.007	0.040	0.009	**0.751**	0.003	
Item 10	-0.021	0.248	0.112	-0.093	**0.712**	External disturbances
Item 12	0.098	-0.164	0.055	0.231	**0.614**	
Item 2	0.090	-0.049	-0.007	0.219	**0.517**	

Note. For each item the largest factor loadings are bold. Due to limited space, items which did not indicate a sufficient factor loading (> .3) were not included in this table.

Findings

Since a multivariate normality test indicated a non-normal distribution, we conducted the factor analysis with axis factoring instead of maximum likelihood. Moreover, we decided to use an oblimin rotation, which is better suited for an exploratory factor analysis, as we had no indicators for possible correlations between the factors (Osborne, 2015). The exploratory factor analysis yielded five factors, with 18 items indicating sufficient loadings to a factor (> .3) and low complexity (factor loadings are presented in Table 1). The following five factors were derived and named based on the items' common subjects (see Table 1): (1) The factor '*system failures'* consists of items that apply to possible external failures of the exam software or the technical infrastructure. (2) The factor '*social pressure'* includes items regarding stressors that stem from either monitoring through a proctor or social comparison. (3) The factor '*self-inflicted noises'* includes items relating to self-produced noises. (4) The factor '*time indication'* consists of items that convey to stressors inflicted by time indication. Finally, (5) the factor '*external disturbances'* consists of items that assesses stressors inflicted by external factors. We refrained from attributing a total of eight items to the factors, since either the factor loadings were too low, the item was too complex, or the item did not semantically match to the other applied items (even though the factor loadings would have been high enough).

In a next step, we descriptively investigated the level of stress induced by the respective factors as perceived by the participants. The results suggested that the factor *system failures* caused the highest level of stress (M = 4.67, SD = 0.59), followed by *social pressure* (M = 3.67, SD = 0.75), *external disturbances* (M = 3.35, SD = 0.91), *time indications* (M = 2.47, SD = 1.00), and lastly *self-inflicted noises* (M = 1.63, SD = 0.82). In conclusion, students seem to be afraid that the technical infrastructure, (i.e., soft- or hardware) may cause problems, which presumably might affect their performance in an exam. Moreover, *social pressure* including monitoring during online exams was perceived as second largest stressor by students. Monitoring may also include the presence of a proctor (e.g., through webcam) which – apart from ethical considerations – might also result in additional perceived stress. As a next step we plan to increase our sample and expand it to more universities to subsequently validate the questionnaire with a confirmatory factors analysis. Nevertheless, this study helped us in further developing the questionnaire for future survey of subjective experiences in online exams and may also provide insights for related research.

Selected (translated) original items

Item_1	A visible time display during the test (e.g., by a clock on the screen)
Item_3	A visible countdown clock on the screen
Item_5	Presence of an examiner via superimposed video
Item_6	Presence of an examiner via audio
Item_7	Sounds of own mouse when clicking further
Item_8	Noise of own keyboard while typing
Item_10	Sounds of footsteps in your own room
Item_12	Noise from outside your own room (e.g. traffic, children playing, conversations, music)
Item_15	The internet fails
Item_16	Individual elements of the exam cannot be opened

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