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Effects of an online self-help intervention on university students' mental health during COVID-19: A non-randomized controlled pilot study^{*}

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ABSTRACT

The COVID-19 pandemic has had a major impact on university students, particularly on their mental health. However, little is yet known about how to prevent and/or reduce this impact. Prior to COVID-19, some studies have shown that online stress management programs were successful enough to improve students' mental health and stress adjustment strategies, suggesting that these interventions should be further developed during the pandemic. Our study explored the effects on mental health of an online program that targeted stress management and learning. A total of 347 university students were initially recruited to take part in a non-randomized controlled study. After dropout, our final sample consisted of 114 participants, divided into two groups: an intervention group (participants who took part in the program) and the control group (participants who did not participate in the program). The variables measured were: anxiety and depressive symptoms, academic burnout, learned helplessness, and coping strategies. Means comparisons between baseline (T0) and an assessment at 8 weeks (T1) revealed reductions in anxiety symptoms and learned helplessness in the intervention group, but not in the control group. Our pilot study reports promising effects of an online program on students' psychological state.

1. Introduction

The closure of universities owing to the COVID-19 pandemic brought about a digital revolution in higher education (Strielkowski, 2020), but came with undesirable consequences in terms of students' stress levels (IAU, 2020). The multiple challenges (e.g., widespread transition to remote online learning, changes in assessment and examinations) the students faced had deleterious effects on their mental health (Lee, 2020; Sahu, 2020). More specifically, very high levels of anxiety and depressive symptoms were observed in university students during lockdown (Charbonnier et al., 2021; Essadek & Rabeyron, 2020; Husky et al., 2020; Le Vigouroux et al., 2021). These symptoms are associated with greater academic difficulty (Mills & Blankstein, 2000) and less use of effective learning strategies (Warr & Downing, 2000).

High levels of academic burnout were also identified (Fernández-Castillo, 2021; Zis et al., 2021). *Academic burnout* is defined as a contextual psychological syndrome caused by excessive and long-term academic pressure, which can lead students to gradually lose their

energy, exhibit reduced enthusiasm for learning, and experience a lower sense of achievement (Meier, 1983). It has three dimensions (Maslach et al., 1996; Schaufeli et al., 2002): emotional exhaustion (i.e., feeling of being overworked and exhausted by university studies); cynicism (i.e., indifferent or distant attitude toward studies and learning), and a sense of accomplishment (i.e., tendency to view one's university studies positively; reverse-scored). High academic burnout can have detrimental effects on students' academic achievement and performance (Fiorilli et al., 2017; Rahmati, 2015), as well as their mental health (Schaufeli et al., 2002). Furthermore, burnout is closely associated with learned helplessness (Campbell & Martinko, 1998; McMullen & Krantz, 1988; Tayfur et al., 2013), which leads students to view academic tasks as being beyond their control (Carden et al., 2004), and to make poor strategy choices after failure (Dickhäuser et al., 2011; Ruthig et al., 2008), thus affecting their academic success (Macher et al., 2012; Peixoto & Almeida, 2010).

Prior to the COVID-19 pandemic, a central element of a students' psychological distress was difficulty coping with an accumulation of

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hassles (Réveillère et al., 2001). Public health measures in response to COVID-19 exposed students to new events that challenged their coping strategies (de Oliveira Araújo et al., 2020; Zhai & Du, 2020). Coping strategies can be defined as cognitive and behavioral efforts undertaken by individuals to deal with stressful situations (Lazarus & Folkman, 1984). They can be divided into maladaptive and adaptive strategies. Adaptive strategies, such as acceptance, include efforts to promote resolution and reduce stress (Muller & Spitz, 2003). Conversely, maladaptive strategies, such as behavioral disengagement, involve rigid and inappropriate adaptation that does not improve the situation and may increase stress (Carver et al., 2010; Carver & Scheier, 1990; Folkman, 1997). Maladaptive coping is positively correlated with academic burnout (Vizoso et al., 2019) and learned helplessness (Wang et al., 2017). Furthermore, recent research has shown that the more university students used avoidance strategies during lockdown, the more likely they were to have anxiety and depression symptoms (Dawson & Golijani-Moghaddam, 2020; Le Vigouroux et al., 2021).

Taken together, these findings should convince universities of the need to pay close attention to their students' health. Indeed, Bonnano et al. (2007) and Lee et al. (2007) who tracked the long-term consequences of previous pandemics concluded that psychological problems may persist for months and even years after the event. In the current context, there are many obstacles to implementing conventional psychological interventions (e.g., face-to-face psychotherapy). To limit physical contact, online self-help interventions (e.g., web page, Facebook page, e-learning) have seemed a promising tool during the COVID-19 pandemic (Yang et al., 2020). Even before the pandemic, online self-help had proven to be effective for a range of mental health problems (Epping-Jordan et al., 2016; Moser et al., 2019; Zetterqvist et al., 2003). It was identified as being particularly valuable for university students, given their limited help-seeking behavior (Lintvedt et al., 2008; Ryan et al., 2010). In this regard, a systematic review and meta-analysis (Davies et al., 2014) suggests that online interventions might be beneficial in improving depressive symptoms, anxiety, and psychological distress outcomes in university students. More precisely, online self-help stress management programs can help reduce stress, anxiety and depression for students (Van Vliet & Andrews, 2009) and improve their coping strategies (George et al., 2013).

In the present research, we aimed to study the effects on students' psychological state of an online self-help program combining stress management and learning strategies. We hypothesized that university students who completed the program would have less anxiety symptoms (Hypothesis 1), fewer depressive symptoms (Hypothesis 2), less academic burnout (Hypothesis 3), less learned helplessness (Hypothesis 4), and would use fewer maladaptive strategies (Hypothesis 5), and more adaptive ones (Hypothesis 6), compared with students who did not participate in the program.

2. Methods

2.1. Ethics statement

This study respected the ethics code of the American Psychological Association (2002). Ethical review and approval were waived for this study, as it involved experiments in humanities and social sciences in the field of health, and was therefore not regarded as research involving human persons according to Article R1121-1 of the French Public Health Code. During the pre-inclusion information meetings, students were reminded that they could be seen by the university health service if they were experiencing difficulties. In addition, they were given contact information and appointment procedures. It should be noted that no students reported seeking psychological counseling during the 8 weeks of our study.

2.2. Participants

We initially recruited 347 participants. After dropout, our final sample was composed of 114 university students, divided into two groups (see Fig. 1). The only inclusion criterion was to be enrolled as a student at Nîmes University. The intervention group contained participants who completed the program ($n = 46$; 84.8% female; $M_{age} = 20.06 \pm 3.09$ years). They came from various disciplines (28 in psychology, 6 in law, 4 in literature and languages, 3 in history, 2 in physical activity and sports, 2 in biology, and 1 in mathematics), and had different higher education levels (16 in first year, 18 in second year, 7 in third year, 4 in fourth year and 1 in fifth year). The control group was composed of participants who did not take part in the program ($n = 68$; 88.2% female; $M_{age} = 22.76 \pm 8.01$ years; $U = 1233$, $p = .05$, rank biserial correlation, $r_{bb} = -0.21$). They came from various disciplines (33 in psychology, 10 in literature and languages, 8 in law, 6 in design, 5 in biology, 2 in sport and physical activities science, 2 in history, 1 in mathematics, and 1 in double degree), and different higher education levels (29 in first year, 18 in second year, 14 in third year, 5 in fourth year, and 2 in fifth year).

2.3. Measures

Anxiety and depressive symptoms were assessed using a French version of the Hospital Anxiety and Depression Scale (HADS; Lepine et al., 1985). This 14-item self-report questionnaire assesses anxiety and depressive symptoms (7 items for each dimension) with labels varying from one item to the next. Scores range from 0 to 21 for each dimension, with higher scores reflecting higher levels of anxiety or depressive symptoms. According to Bjelland et al. (2002), this scale has satisfactory correlations with other scales measuring depressive symptoms (r between 0.62 and 0.69) and anxiety (r between 0.44 and 0.65). Test-retest reliability is satisfactory, and the reliability coefficient is above 0.80 after 15 days. Internal consistency of the scale is good for both anxiety (α between 0.68 and 0.92) and depressive symptoms (α between 0.67 and 0.90). Although this scale has not been specifically validated with students, it is frequently administered in epidemiological studies in the

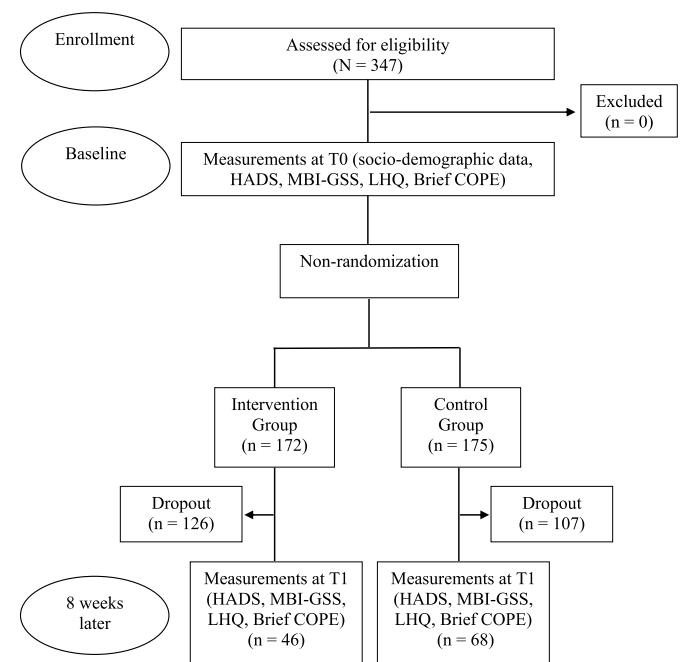


Fig. 1. Flowchart of study participants.

HADS = Hospital Anxiety and Depression Scale; MBI-GSS = Maslach Burnout Inventory – General Student Survey; LHQ = Learned Helplessness Questionnaire.

general population (Bjelland et al., 2002; Hinz & Brähler, 2011), and was used in the first French epidemiological study of mental health in relation to COVID-19 (Chan-Chee et al., 2020). In our study, the internal consistency of both subscales was satisfactory (see Table 3).

Academic burnout was measured with the French version of the Maslach Burnout Inventory-General Survey for Students (MBI-GSS; Copyright ©1996, 2016 Schaufeli, Leiter, Maslach & Jackson, used with the approval of Mind Garden Inc). This 16-item self-report questionnaire captures three dimensions of academic burnout: emotional exhaustion (e.g., “I feel exhausted at the end of a day at the university”), academic efficacy (reversed score; e.g., “I feel fulfilled when I achieve my academic goals”), and cynicism (e.g., “I feel less enthusiastic about my studies”). Each item is rated on a 7-point Likert-type scale, with responses ranging from 0 (*Never*) to 6 (*Always*). A high score indicates high academic burnout. When Schaufeli et al. (2002) examined the factorial validity and invariance of the MBI-GSS with European students, they showed that the three-factor structure (i.e., exhaustion, cynicism, and efficacy) of the MBI-GSS fitted the data. In our study, the internal consistency of these three dimensions was satisfactory (see Table 3).

Learned helplessness was assessed using a French version of the Learned Helplessness Questionnaire (LHQ; Sorrenti et al., 2014). Only the subscale measuring learned helplessness was included. Its 12 items are rated on a 5-point Likert scale ranging from *Not true* to *Absolutely true*. Higher scores reflect higher levels of an inability to learn. This scale has been validated with Italian students and has good internal reliability ($\alpha = 0.77$). In our study, internal consistency was also satisfactory (see Table 3).

Coping strategies were assessed using a French version of the situational version of the Brief-COPE (Muller & Spitz, 2003). Participants were instructed to refer to a stressful situation related to the COVID-19 pandemic. This self-report scale assesses 14 coping strategies (two items per strategy): active coping, planning, instrumental support, use of emotional support, venting, behavioral disengagement, self-distraction, self-blame, positive reframing, humor, denial, acceptance, religion, and substance use. Participants rate each of the 28 items on a 4-point Likert scale ranging from *Never* to *Always*. Higher scores reflect higher levels of strategy use. The French validation of this scale was performed with French students and revealed good psychometric properties. This scale has good external validity, showing consistent correlations with instruments assessing psychological equilibrium. It also has good structural validity. In our study, the internal consistency of the various factors was satisfactory, except for self-distraction (see Table 3).

2.4. Intervention

The 8-week program featured eight modules on the following themes: stress information, learning information, emotion and stress regulation strategies, cognitive and metacognitive learning strategies, cognitive reappraisal and self-blame, motivation for learning, managing worry and uncertainty, and synthesis. Each module was composed of two 10-min videos containing information, tools, student experiences, and quizzes, which were published each week on a private Facebook group. After watching the videos, participants had to validate the module on Facebook. The program is described in detail in Table 1.

Our program was based on modules from previous online mental health interventions that had already proven to be effective with students (Lintvedt et al., 2008; Ryan et al., 2010; Van Vliet & Andrews, 2009), but had two innovative aspects: 1) elements and examples specific to the COVID-19 pandemic, and 2) the addition of modules focused on learning strategies (Modules 2, 4 and 6). It was therefore an original program, designed for the purposes of this research, and adapted to the context of the COVID-19 pandemic (notably concerning the themes of worry, stressors, and distance learning courses). The different modules were designed by five associate professors: two specializing in cognitive psychology, both experts in learning; two specializing in clinical psychology and cognitive and behavioral therapy, experts in stress and

Table 1
Program description.

	Theme	Content	Medium used	Exercises and additional information
Module 1	Stress information	- Program schedule - Definition of stress and stressors - Definition of implicit theory of emotion - Introduction to Mindfulness - Sleep advice	- 2 videos (one with student interviews) - 1 information brochure	- Mindfulness - Breathing control
Module 2	Learning information	- Definition of learning - Strategies for learning - Distance learning strategies	- 2 videos (one with student interviews)	- Invitation to reflect on their learning strategies
Module 3	Acceptance and avoidance	- Definition of avoidance - Avoidance effects (short and long term) - Definition of acceptance - Acceptance effects (short and long term)	- 2 videos based on fictional student situations	- Exercise to observe emotions
Module 4	Cognitive and metacognitive learning strategies	- Misconceptions about failure - Metacognition - Promotion of most effective learning strategies	- 2 videos (one with student interviews)	- Invitation to reflect on their learning strategies
Module 5	Cognitive reappraisal and self-blame	- Definition of self-blame and its effects - Training in cognitive reappraisal - Introduction to ACT matrix	- 2 videos (one with student interviews)	- ACT matrix
Module 6	Motivation and learning goals	- Different learning goals (control and performance goals) - Processes involved in motivation - Beliefs about intelligence - Physical activity - Diet	- 4 videos (one with student interviews)	- Learning Goals Questionnaire - Physical activity - Diet
Module 7	Uncertainty and worry	- Definition of uncertainty - Definition of worry and the usefulness of worrying - Introduction to defusion	- 2 videos	- Cognitive restructuring exercise
Module 8	Synthesis	- Presentation of the highlights of the different modules	- 1 video	

emotion regulation; and one specializing in health psychology, an expert in acceptance and commitment therapy. Two clinical psychology Master's students and two psychology undergraduates were involved in the process. All the modules were the result of a collaborative effort between the associate professors, who contributed their expertise, and the students, who pre-tested the modules and helped improve their design so that they would be attractive to other students.

Participants were repeatedly reminded that the program was not a substitute for medical and/or psychotherapeutic care. They were also informed of the services provided by the university (in particular, preventive medicine and health promotion services) that could support them if need be.

2.5. Procedure

There were two program sessions. During the first session, data were collected between 1 and 25 October 2020 (T0), and between 11 and 20 December 2020 (T1). During the second session, data were collected between 15 and 23 February 2021 (T0), and between 20 and 30, 2021 (T1). Each participant was identified by a code, in order to aggregate their data from the two measurement times and preserve anonymity. Recruitment was based on voluntary participation, and no compensation was offered to participants. The latter signed an informed consent and were told that their information would remain anonymous. Their participation was voluntary and could be withdrawn at any time. All data were collected online and were stored on a secure university computer.

2.5.1. Intervention group

All students at Nîmes University were informed by email of the possibility of taking part in an online program focused on stress and learning, and were invited to two information meetings. Students who were interested in the program were then invited to answer an online survey after signing a consent form. Once they had completed the survey, participants were given access to the 8-week (excluding vacation periods) program via Facebook. For ethical reasons, participants in the intervention group were free to contact the program coordinators (via email or Facebook) if, at any point during the program, they had personal questions about stress management, learning, or technical issues. It is important to note that during our program, only two participants contacted the coordinators, and exclusively to request technical assistance in accessing the group or watching the videos. They could also comment on the materials used in the different modules and discuss with the other members of the program. Participation in the program was not anonymous, as participants could see each others' Facebook pseudonyms. However, the anonymity of their responses to the different measurement tools was guaranteed by the researchers. Finally, one week after the last module, participants once again completed an online survey after signing a consent form.

2.5.2. Control group

Meanwhile, an associate professor from Nîmes University sent an email to all the students at the university inviting them to participate in an online longitudinal study exploring students' psychological state during the COVID-19 pandemic. Interested students were asked to answer an online survey after signing a consent form. At the very beginning of the survey, we screened them to ensure for the possibility that they had not already taken part in the program. The questionnaire stopped for participants who answered "yes". Participants who answered "no" formed the control group. Nine weeks later, they received an email asking them to complete an online survey again after signing a consent form. Given the major mental issues observed during the pandemic, we decided not to randomize our sample by placing participants on a waiting list. Instead, we considered it all the more important to offer the program to any student who wished to take part. The different stages of the study are illustrated in Fig. 1.

2.6. Statistical analysis

As our data did not follow the normal distribution, we conducted non-parametric analyses to perform comparisons between and within groups at T0 and T1 (using respectively Mann-Whitney tests and Wilcoxon tests), and comparisons between those who dropped out and those who completed the program (Wilcoxon tests). Effect sizes are expressed as the rank biserial correlation (*r_{rb}*). Data were analyzed using the Jasp software (version 0.11.1).

3. Results

Before reporting our main analyses, we describe the profiles of the students who dropped out. The majority of these students were first-year undergraduates (see Table 2). In the intervention group, students who dropped out had higher levels of anxiety (*r_{rb}* = -.33) and learned helplessness (*r_{rb}* = -0.21) than students who completed the program, and exhibited more behavioral disengagement (*r_{rb}* = 0.25). In both groups, those who dropped out had higher levels of academic burnout (*r_{rb}* = -0.20 and 0.32). However, as effect sizes were low, these differences can be considered small (see Table 3).

Second, means, standard deviations, and comparison analyses between T0 and T1 for both groups are set out in Table 4. First, results showed that the two groups were comparable on most of our variables of interest at T0, except for some coping strategies (see Appendix 1). Second, mean comparisons between T0 and T1 in the intervention group showed reductions in anxiety (*r_{rb}* = 0.49) and learned helplessness (*r_{rb}* = 0.51), and an increase in the use of humor to cope with stress (*r_{rb}* = -0.55). This was not observed in the control group. Moreover, while participants in the control group reported a moderate increase in substance use to cope with stress (*r_{rb}* = -.76) and academic burnout (*r_{rb}* = -0.40), more precisely exhaustion (*r_{rb}* = -0.34), this was not the case in the intervention group.

4. Discussion

The COVID-19 pandemic and the resulting abrupt changes in daily life and ways of learning have had a substantial impact on university students, especially their mental health. However, little is yet known about how to prevent and/or reduce this impact. Before the pandemic, several studies had shown that online stress management programs can

Table 2
Comparisons between students who left the study and those who completed it on university grade.

	Control Group (chi ² = 7.05, p = .32)				Intervention Group (chi ² = 7.27, p = .40)			
	Final sample (n = 68)		Dropouts (n = 107)		Final sample (n = 46)		Dropouts (n = 126)	
	n	%	n	%	n	%	n	%
1st year of Bachelor's degree	29	42.65	47	43.93	16	34.78	67	53.17
2nd year of Bachelor's degree	18	26.47	34	31.78	18	39.13	29	23.02
3rd year of Bachelor's degree	12	17.65	20	18.69	7	15.22	18	14.29
Professional degree	2	2.94	3	2.80			1	0.79
1st year of Master's degree	5	7.35	1	0.93	4	8.70	7	5.56
2nd year of Master's degree	2	2.94	1	0.93	1	2.17	2	1.59
PhD student			1	0.93			1	0.79
Other							1	0.79

Table 3
Comparisons between students who left the study and those who completed it on clinical issues and coping strategies.

	Control Group						Intervention Group								
	α	Final sample (n = 68)		Dropouts (n = 107)		U	p	rbb [95% CI]	Final sample (n = 46)		Dropouts (n = 126)		U	p	rbb [95% CI]
		M	SD	M	SD				M	SD	M	SD			
Age in years		20.1	(3.09)	19.8	(1.85)	3523	.72	-.03 [-.21, .14]	22.8	(8.02)	21.3	(5.01)	3023	.66	.04 [-.15, .23]
Clinical issues															
Anxiety	.74	9.49	(4.14)	10.1	(4.42)	3352	.38	-.08 [-.25, .10]	10	(3.88)	12.3	(4.03)	1941	<.001	-.33 [-.49, -.15]
Depression	.71	11.5	(4.23)	11.4	(4.43)	3532	.75	-.03 [-.20, .15]	10.7	(4.79)	10.3	(3.85)	3202	.29	.11 [-.09, .29]
Academic burnout	.86	2.83	(1.09)	3.21	(1.13)	2917	.03	-.20 [-.36, -.03]	2.67	(1.01)	3.19	(1.05)	1977	<.001	-.32 [-.48, -.13]
Exhaustion	.87	3.3	(1.51)	3.81	(1.50)	2952	.04	-.19 [-.35, -.02]	3.35	(1.40)	3.86	(1.45)	2282	.03	-.21 [-.39, -.02]
Academic efficacy	.80	2.86	(1.22)	3.08	(1.35)	3357	.45	-.07 [-.24, .11]	2.56	(1.22)	3.11	(1.36)	2222	.02	-.23 [-.41, -.04]
Cynicism	.77	2.33	(1.44)	2.77	(1.58)	3045	.09	-.16 [-.32, .02]	2.13	(1.44)	2.61	(1.51)	2319	.05	-.20 [-.38, -.01]
Learned helplessness	.87	25.6	(8.28)	28.7	(10.30)	3038	.07	-.17 [-.33, .01]	26.7	(8.35)	30	(9.52)	2302	.04	-.21 [-.38, -.01]
Coping															
Active Coping	.70	4.47	(1.57)	4.29	(1.71)	3897	.42	.07 [-.10, .24]	4.67	(1.66)	4.5	(1.63)	3071	.55	.06 [-.14, .25]
Planning	.76	4.93	(1.80)	4.67	(1.69)	3948	.34	-.09 [-.09, .26]	5.24	(1.55)	4.79	(1.58)	3457	.05	.19 [0, .37]
Using instrumental support	.81	4.04	(1.63)	4.35	(1.65)	3229	.20	-.11 [-.28, .06]	4.89	(1.73)	4.71	(1.80)	3101	.48	.07 [-.13, .26]
Using emotional support	.81	4.16	(1.68)	4.5	(1.91)	3310	.31	-.09 [-.26, .09]	5.17	(1.76)	5.18	(1.89)	2865	.91	-.01 [-.20, .18]
Venting	.72	4.16	(1.67)	4.42	(1.57)	3234	.21	-.11 [-.28, .06]	5.02	(1.77)	4.6	(1.77)	3290	.17	.14 [-.06, .32]
Positive reframing	.78	4.56	(1.90)	4.79	(1.78)	3372	.41	-.07 [-.24, .10]	4.89	(1.51)	4.52	(1.60)	3337	.12	.15 [-.04, .34]
Humor	.79	3.21	(1.57)	3.45	(1.66)	3321	.31	-.09 [-.26, .09]	2.87	(1.33)	2.98	(1.34)	2726	.51	-.06 [-.25, .14]
Acceptance	.75	5.63	(1.53)	5.24	(1.80)	4020	.24	.11 [-.07, .27]	4.96	(1.63)	4.98	(1.47)	2853	.87	-.02 [-.21, .18]
Religion	.86	2.5	(1.11)	2.67	(1.40)	3486	.55	-.04 [-.21, .13]	3.28	(1.72)	3.47	(1.98)	2807	.74	-.03 [-.22, .16]
Behavioral disengagement	.80	3.49	(1.52)	3.78	(1.93)	3474	.60	-.05 [-.22, .13]	3.17	(1.54)	3.84	(1.68)	2164	.01	-.25 [-.43, -.06]
Self-blame	.76	4.53	(1.47)	4.26	(1.54)	4035	.22	.11 [-.07, .28]	4.85	(1.63)	5.36	(1.66)	2398	.08	-.17 [-.35, .02]
Self-distraction	.28	5.09	(1.72)	5.13	(1.41)	3596	.90	-.01 [-.19, .16]	5.3	(1.46)	5.18	(1.49)	2971	.80	.03 [-.17, .22]
Denial	.67	2.59	(1.04)	3.06	(1.45)	3054	.05	-.16 [-.33, .01]	3.22	(1.71)	3.24	(1.52)	2778	.66	-.04 [-.23, .15]
Substance use	.97	2.25	(0.74)	2.69	(1.51)	3193	.05	-.12 [-.29, .05]	2.59	(1.34)	3.09	(1.78)	2453	.06	-.15 [-.34, .04]

improve students' mental health and stress adjustment strategies (Davies et al., 2014; George et al., 2013; Van Vliet & Andrews, 2009), suggesting that these interventions could be developed further. Our nonrandomized controlled study explored the effects of an online self-help program targeting stress management and learning strategies on anxiety and depressive symptoms, academic burnout, learned helplessness and coping strategies among university students.

In line with our first hypothesis, results showed a decrease in anxiety for the university students who completed the program, whereas no change was observed for participants who did not take part. We can assume that the program, especially Modules 1 "stress information" and 7 "uncertainty and worry", was able to help them better understand and manage their stress and concerns, not least by leading them to mobilize new resources (e.g., breathing control, mindfulness). As Hatta (2020) states in his editorial, developing a simple way to manage stress appears to be particularly useful in dealing with the inconveniences, hassles and problems of the COVID-19 pandemic. The level of intolerance of uncertainty has been a key component of the decline in psychological well-being during the COVID-19 pandemic (Seligman, 1975). Thus, the university students who benefited from the program may have been able

to better understand their concerns and stress, and develop new resources, including ways of the coping with their pandemic-related worries. These factors may in turn have helped reduce their anxiety symptoms.

Similarly, in line with our fourth hypothesis, results revealed a decrease in learned helplessness among university students who benefited from the program, whereas no change was observed in participants who did not participate in the program. This program, especially Modules 2 "learning information", 4 "cognitive and metacognitive learning strategies" and 6 "motivation and learning goals", which included information about learning, learning strategies, and motivation to learn, may have allowed students to reflect on their strategies, opening the door to modifying some of them. This may have contributed to a decrease in learned helplessness, which is positively associated with maladaptive learning strategies (Dickhäuser et al., 2011; Ruthig et al., 2008). Given that a high level of learned helplessness is associated with more academic failures (Macher et al., 2012; Peixoto & Almeida, 2010), we can assume that a lowering of this level increases students' academic success. Future research would be worthwhile, to assess both the psychological state of the students, and their academic performance.

Table 4
Descriptive analyses of our variables of interest and pre-versus post-intervention comparison.

	Control Group (n = 68)					Intervention Group (n = 46)								
	T0		T1		W	p	rrb [95% CI]	T1		T2		W	p	rrb [95% CI]
	M	(SD)	M	(SD)				M	(SD)	M	(SD)			
Age in years	20.06	(3.1)						22.76	(8.02)					
Clinical issues														
Anxiety	9.49	(4.14)	9.57	(4.28)	815.5	.60	-.08 [-.36, .21]	10.02	(3.88)	8.74	(3.86)	552.5	.01	0.49 [.17, .72]
Depression	11.49	(4.23)	11.75	(4.25)	653	.32	-.15 [-.43, .15]	10.7	(4.79)	9.7	(5.39)	558.5	.18	0.24 [-.11, .53]
Academic burnout	2.83	(1.09)	3.01	(1.14)	341.5	.02	-.40 [-.63, -.09]	2.67	(1.01)	2.71	(1.05)	118.5	.81	-.06 [-.49, .39]
Exhaustion	3.30	(1.51)	3.58	(1.61)	641.5	.02	-.34 [-.57, -.07]	3.35	(1.40)	3.28	(1.58)	461.5	.70	0.07 [-.27, .40]
Academic efficacy	2.86	(1.22)	2.77	(1.21)	1037	.51	.10 [-.19, .37]	2.56	(1.22)	2.55	(1.19)	522	.96	0.01 [-.32, .33]
Cynicism	2.33	(1.44)	2.62	(1.43)	691.5	.10	-.24 [-.49, .04]	2.13	(1.44)	2.29	(1.44)	382	.71	-.07 [-.40, .28]
Learned helplessness	25.63	(8.28)	25.57	(8.60)	538	.98	-.01 [-.32, .32]	26.7	(8.35)	24.78	(8.21)	190.5	.04	0.51 [.08, .76]
Coping														
Active coping	4.47	(1.57)	4.63	(1.41)	407	.42	-.14 [-.45, .20]	4.67	(1.66)	5.11	(1.58)	165	.06	-.38 [-.66, 0]
Planning	4.93	(1.80)	4.91	(1.47)	469.5	.99	.003 [-.32, .33]	5.24	(1.55)	5.28	(1.68)	275.5	.93	-.02 [-.39, .36]
Using instrumental support	4.04	(1.63)	4.16	(1.80)	308.5	.36	-.17 [-.49, .19]	4.89	(1.73)	4.91	(1.64)	309.5	.84	0.04 [-.33, .40]
Using emotional support	4.16	(1.68)	4.27	(1.74)	403	.72	-.06 [-.39, .28]	5.17	(1.76)	4.83	(1.98)	318	.31	0.21 [-.19, .54]
Venting	4.16	(1.67)	4.31	(1.67)	44.5	.38	-.15 [-.45, .18]	5.02	(1.77)	5.26	(1.79)	249.5	.28	-.21 [-.53, .17]
Positive reframing	4.56	(1.90)	4.59	(1.96)	523.5	.95	.01 [-.31, .33]	4.89	(1.51)	5.26	(1.57)	285.5	.14	-.27 [-.56, .09]
Humor	3.21	(1.57)	3.18	(1.49)	269.5	.92	.02 [-.36, .39]	2.87	(1.33)	3.24	(1.66)	34.5	.04	-.55 [.82, .08]
Acceptance	5.63	(1.53)	5.4	(1.58)	642.5	.15	.24 [-.09, .52]	4.96	(1.63)	5.22	(1.76)	230	.16	-.27 [-.58, .10]
Religion	2.50	(1.11)	2.47	(1.06)	44.5	.69	.14 [-.46, .65]	3.28	(1.72)	3.46	(1.81)	70	.31	-.26 [-.65, .24]
Behavioral disengagement	3.49	(1.52)	3.52	(1.36)	406	.96	-.01 [-.35, .33]	3.17	(1.54)	3	(1.41)	264	.30	0.21 [-.20, .56]
Self-blame	4.53	(1.47)	4.54	(1.60)	389	.99	-.003 [-.35, .34]	4.85	(1.63)	4.7	(1.58)	389.5	.56	0.11 [-.26, .45]
Self-distraction	5.09	(1.72)	5.02	(1.72)	704.5	.69	.06 [-.25, .36]	5.3	(1.46)	5.22	(1.49)	312.5	.80	0.05 [-.32, .41]
Denial	2.59	(1.04)	2.47	(0.94)	175	.47	.17 [-.28, .56]	3.22	(1.71)	3.04	(1.46)	125	.46	0.19 [-.30, .60]
Substance use	2.25	(0.74)	2.57	(1.40)	9.5	.02	-.76 [-.93, -.33]	2.59	(1.34)	2.41	(1.22)	51.5	.34	0.32 [-.30, .75]

Finally, although a decrease in depressive symptoms was not observed at the end of the program (refuting Hypothesis 2), we are nevertheless confident in the beneficial effects of the program, as it positively impacted learned helplessness, a central component of the behavioral model of depression (Seligman, 1975). Although we refrain from speculating too much, we call for further research to deepen this understanding and explore the effect of the program on long-term depressive symptoms.

Finally, contrary to Hypotheses 5 and 6, our program had little effect on students' stress coping strategies. However, it is important to note that we observed an increase in substance abuse to cope with stressful situations over the semester among students who did not participate in the program. This is consistent with the notion that the pandemic may have made it harder for individuals to use their coping strategies efficiently (Dawson & Golijani-Moghaddam, 2020). Finally, contrary to Hypothesis 3, the program had no impact on students' academic burnout. However, it is important to note that an increase in academic exhaustion was observed among students who did not participate in the program, but there was no change for students who did participate. This suggests that the program may have protected participants against exhaustion.

The present results, albeit promising, need to be interpreted with caution, for the following reasons. First, our sample was small, which limited the generalization of results and the use of certain approaches, such as clustering. We also observed a high dropout rate consistent with the literature (George et al., 2013; Zetterqvist et al., 2003). This is an important issue, as the participants who dropped out had higher levels of clinical outcomes (e.g., anxiety, academic burnout), especially in the

intervention group. In addition, recruitment for the two groups was carried out on an exclusively voluntary basis, without randomization, and without stratified random sampling or clustering by characteristics. Consequently, reservations can legitimately be expressed about the representativeness of our sample and the homogeneity of our groups. It is nonetheless important to note that at inclusion, participants in the two groups had similar scores on our main variables of interest, except for some coping strategies, suggesting we should consider the results on coping strategies with more caution. Finally, all our participants came from a single university. Taken together, these factors reduce the generalizability of our results. Results need to be replicated with a more representative sample before they can be generalized. A second limitation is that our program was designed within the framework of this research, and adapted to the context of the COVID-19 pandemic, albeit inspired by programs that had already proven effective with students. Therefore, we had no prior evidence of the effectiveness of our program. Third, although our results indicated a promising effect of our program in the short term, further research efforts will be needed to assess its long-term impact. As the measures were obtained just a few days after the end of the program, we must refrain from overgeneralizing these findings, and from considering that the positive effects will persist over time. These results therefore deserve to be consolidated by research that includes several weeks after of follow up after the intervention.

To our knowledge, our study is the first to have assessed the effects of an innovative program targeting students' mental health during the COVID-19 pandemic. Further research efforts will be needed to confirm the beneficial effects of this type of program on university students and to explore the duration of this effect over time. This is all the more

essential given the known effects of the pandemic on mental health, both during (Charbonnier et al., 2021; Essadek & Rabeyron, 2020; Husky et al., 2020; Le Vigouroux et al., 2021) and after (Charbonnier et al., 2021; Woon et al., 2020) lockdown. The pandemic has also had a major impact in other areas, including diet and physical activity (Ammar et al., 2020; Goncalves et al., 2021; Hatta & Srijit, 2021), which may in turn have had psychological consequences (Hatta, 2020). For this reason, information on physical activity and diet was included in Module 6, and should be given greater importance in future research.

5. Conclusions

The COVID-19 pandemic and the abrupt changes it brought about in daily life and ways of learning have had a severe impact on university students, especially their mental health. It is therefore urgency for universities to take steps to prevent any further deterioration. Our pilot study highlighted promising effects on students' psychological state of an online self-help program focusing on stress and learning. More

specifically, results revealed reductions in anxiety and learned helplessness among students who completed the program. The latter also appeared to prevent a deterioration in students' ability to cope with stress and an increase in their academic exhaustion. Further research efforts are needed to confirm the beneficial effects of this type of program among university students.

Declaration of competing interest

None declared.

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Appendix 1. Comparison between control group and intervention group at T0

	Comparison at T0				
	U	P	r _{rb}	95% CI for r _{rb}	
				Lower	Upper
Age	-1233	.05	-.21	-.41	0.002
Clinical Issues					
Anxiety	1416.5	.39	-.09	-.30	0.12
Depression	1691	.46	.08	-.14	0.29
Academic burnout	1701.5	.43	.09	-.13	0.30
Exhaustion	1547.5	.92	-.01	-.22	0.20
Professional efficacy	1805	.16	.15	-.06	0.36
Cynicism	1713	.39	.09	-.12	0.30
Learned helplessness	1438	.47	-.08	-.29	0.14
Coping					
Active Coping	1471	.59	-.06	-.27	0.16
Planning	1372.5	.26	-.12	-.33	0.09
Using instrumental support	1110	.007	-.29	-.47	-0.08
Using emotional support	1081.5	.004	-.31	-.49	-0.10
Venting	1125.5	.01	-.28	-.47	-0.07
Positive reframing	1381.5	.29	-.12	-.32	0.10
Humor	1753.5	.23	.12	-.10	0.33
Acceptance	1940	.03	.24	.03	0.43
Religion	1144.5	.004	-.27	-.46	-0.06
Behavioral disengagement	1785	.18	.14	-.08	0.35
Self-blame	1408.5	.36	-.10	-.31	0.12
Self-distraction	1462	.55	-.07	-.28	0.15
Denial	1274.5	.06	-.19	-.38	0.03
Substance use	1428	.21	-.09	-.30	0.13

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