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► **To cite this version:**

Elodie Charbonnier, Sarah Le Vigouroux, Cecile Puechlong, Lucile Montalescot, Aurélie Goncalves, et al.. The Effect of Intervention Approaches of Emotion Regulation and Learning Strategies on Students' Learning and Mental Health. *Inquiry -Chicago then Finger Lakes-*, 2023, 60, pp.004695802311599. 10.1177/00469580231159962 . hal-04053289

HAL Id: hal-04053289

<https://hal.science/hal-04053289>

Submitted on 31 Mar 2023

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The Effect of Intervention Approaches of Emotion Regulation and Learning Strategies on Students' Learning and Mental Health

INQUIRY: The Journal of Health Care Organization, Provision, and Financing
Volume 60: 1–14
© The Author(s) 2023
Article reuse guidelines:
sagepub.com/journals-permissions
DOI: 10.1177/00469580231159962
journals.sagepub.com/home/inq



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Abstract

University students are a vulnerable population, and many recent studies show that anxiety, depressive symptoms, and academic burnout have been on the increase since the beginning of the COVID-19 pandemic. These findings point to a need for interventions to reduce these difficulties. The purpose of the present study was to assess the effects of 2 formats of an innovative program on students' mental health (anxiety, depressive symptoms, and academic burnout), intolerance of uncertainty, learned helplessness, and learning. Our sample was composed of 105 university students, recruited on a voluntary basis. They were divided into 3 groups: online intervention group (n=36), face-to-face intervention group (n=32), and control group (n=37). The following variables were measured through online questionnaires: anxiety and depressive symptoms, academic burnout, intolerance of uncertainty, learned helplessness, perceived social support, learning strategies, and beliefs. There were 2 assessments 10 weeks apart (ie, before and after the program in the case of the 2 intervention groups). We performed nonparametric analyses to run comparisons between the 2 assessment timepoints in each group. Results showed that participants in the 2 intervention groups had lower levels of learned helplessness and intolerance of uncertainty at the end of the program. Furthermore, participants in the face-to-face group reported higher levels of perceived social support, academic self-efficacy, and help-seeking strategies. The present study highlighted the benefits of our innovative program, especially its face-to-face format.

Clinical Trial - ID: NCT04978194.

Keywords

students, mental health, learning, anxiety, COVID-19

What do we already know about this topic?

Students have very poor mental health associated with intolerance of uncertainty, learned helplessness, and inappropriate learning strategies. As these difficulties have been exacerbated by the COVID-19 pandemic, there is an urgent need to develop interventions that can alleviate and/or prevent them.

How does your research contribute to the field?

Our results highlight the beneficial effects of both the face-to-face and online formats of an innovative program on students' learned helplessness, intolerance of uncertainty, and deep learning strategies.

What are your research's implications toward theory, practice, or policy?

These data indicate the usefulness of implementing this program in universities.

Introduction

University students are a vulnerable population,¹ with a worldwide prevalence of 30.6% for *depressive symptoms*,² and 24.5% for *anxiety*.³ Similar trends have been found among French students.⁴⁻⁶ Going to university can be a stressful experience, as students have to deal with the academic pressure and new responsibilities.^{1,7} *Academic burnout* is

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Received 26 September 2022; revised 7 February 2023; revised manuscript accepted 9 February 2023

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another form of poor mental health that is widely observed among students.⁸ It is a contextual psychological syndrome caused by excessive academic pressure. This syndrome is characterized by a loss of energy and a feeling of being overworked (emotional exhaustion dimension), reduced enthusiasm and an indifferent attitude toward studies and learning (cynicism dimension), and a feeling of academic inefficacy (sense of accomplishment dimension).^{8,9} Many recent studies show that anxiety, depressive symptoms, and academic burnout have been on the increase since the beginning of the COVID-19 pandemic.¹⁰⁻¹⁶ It is therefore even more important than before to study students' mental health, especially as poor mental health is associated with more academic difficulties¹⁷⁻²⁰ and more student dropouts.^{21,22} Several psychological factors (eg, intolerance of uncertainty²³⁻²⁶ and poor perceived social support)^{25,27} appear to contribute to the high levels of anxiety, depressive symptoms, and academic burnout among students, especially since the start of the COVID-19 pandemic.

Intolerance of uncertainty can be defined as the excessive tendency of an individual to view the possible occurrence of a negative event as unacceptable, however high or low the probability.²⁸ Intolerance of uncertainty is positively associated with anxiety, depressive symptoms,²⁹ and burnout.³⁰ One explanation for these relationships is that intolerance of uncertainty constitutes a cognitive bias that influences the way people perceive, interpret, and react to uncertain situations.³¹ Thus, the higher their level of uncertainty intolerance, the more likely they are to perceive ambiguous information as threatening,³² thereby strengthening the relationship between anxiety and everyday stressors.³³ University students generally exhibit high levels of intolerance of uncertainty, particularly in relation to their status as students, which generates a great deal of uncertainty.³⁴ Studying at university involves dealing with multiple sources of uncertainty (eg, exam results) in a very stressful environment—a combination of circumstances that is frequently associated with burnout.³⁰ With the advent of the COVID-19 pandemic, levels of intolerance of uncertainty (eg, uncertainty surrounding the health and economic impact of the pandemic and the duration of restrictions) increased dramatically,³⁵ and students were particularly badly affected.³⁶

Perceived social support refers to individuals' beliefs about the amount and quality of support potentially available from their social contacts and relationships.³⁷ Low perceived social support has been strongly and positively associated with poor mental health (eg, anxiety and depressive symptoms³⁸⁻⁴¹) and high levels of burnout,²⁶ whereas high levels of social support can facilitate resilience and promote learning, especially in very challenging times.⁴² According to the salutogenic model,⁴³ social support is a particularly important resource, as it may prompt people to perceive events as predictable, controllable, and understandable. By enabling them to adapt better to stressful situations, it may protect them from a decline in their mental health. Perceived

social support is frequently impaired in university students, especially first-year students, as going to university often means separation from high-school friends and/or family.^{44,45} The COVID-19 pandemic further reduced students' perceived social support and increased their isolation (primarily owing to lockdown restrictions), characterized by high levels of emotional loneliness⁴⁶ and social isolation.⁴⁷

Students are defined by the act of studying, so it seems only natural to focus on factors related to learning. Although researchers have paid less attention to them, factors such as learning strategies and learned helplessness may contribute to students' anxiety, depressive symptoms, and academic burnout (eg, Warr and Downing⁴⁸ and Campbell and Martinko⁴⁹). *Learning strategies* allow for the acquisition, integration and recall of knowledge that has to be learned. While their definitions can be quite blurred, owing to the diversity of theoretical frameworks,^{50,51} learning strategies include not only the methods used to learn (eg, rehearsing, organizing, elaborating), but also ways of thinking about the learning process (eg, planning, monitoring, regulating). They can be further divided into surface and deep learning strategies.^{52,53} *Deep learning strategies*, which are more effective for accomplishing academic tasks, involve active information processing by the learner in order to construct and integrate new knowledge, and imply a desire to understand. They include elaboration and organization strategies,⁵⁴ as well as metacognitive strategies (eg, monitoring, regulating, and planning). For example, help-seeking behavior, a self-regulated learning strategy,⁵⁵ enhances learning,⁵⁶ but learners often have difficulty engaging in it (for a selective review on interactive learning environments, see Aleven et al⁵⁷). *Surface learning strategies* correspond to rehearsal strategies. They allow learners to meet the requirements of the task, but the latter is perceived as externally imposed, so learners have less of a desire to understand. Associations have been demonstrated between learning strategies, anxiety, and depressive symptoms.⁴⁸ The more anxiety and depressive symptoms learners have, the greater their academic difficulties¹⁷ and the less successful their learning strategies.⁴⁸ The links between mental health and learning may be explained in part by the fact that a deterioration in mental health may affect motivation and the pleasure of learning.⁵⁸ Motivation is crucial in learning.⁵⁹ More specifically, if individuals lack motivation, they do not engage in the learning process, which explains why the main concern of teachers is to foster motivation, the pleasure of learning, and engagement in learning tasks.^{60,61}

Finally, *learned helplessness* is characterized by individuals' belief that they are not able to deal with unfavorable contexts, and are powerless to change things.^{62,63} This process is central to depression, and conducive to behavioral disengagement.⁶⁴ Learned helplessness is characterized by a lack of control, which is also a central dimension of burnout.⁶⁵ Indeed, according to Burisch,⁶⁶ learned helplessness is a symptom of burnout. In the education context, *learned*

helplessness is defined as a passive behavior characterized by an inability to learn.⁶⁷ It is observed in people who are frequently subject to unavoidable stressful, uncontrollable and negative events.⁶² Furthermore, links have been highlighted between learned helplessness and mental health.^{49,68,69} Students with a high level of learned helplessness may view academic tasks as being beyond their control,⁷⁰ and make poor strategy choices in the wake of failure.^{71,72} This may have a negative impact on their mood, sense of achievement and future projections, thus prompting a deterioration in their mental health.^{49,68,69} Learners often have a negative perception of the errors they make in the course of learning, but making mistakes and immediately receiving corrective feedback may induce better memory for the correct answers,⁷³ and thus better learning. Even learners who endorse a wrong answer with high confidence are more likely to change their answers when given feedback.⁷⁴ This is quite counterintuitive, as we might assume that the greater the confidence in an answer, the more difficult it is to change.

All these findings point to a need for interventions to reduce academic burnout, anxiety, and depressive symptoms. Many programs have already been developed to prevent or improve students' mental health (eg, Grégoire et al⁷⁵ and Strub and Shankland⁷⁶). However, they seldom directly target intolerance of uncertainty, learned helplessness, and learning strategies. It is therefore necessary to develop innovative programs that consider these 3 factors. Most universities in Western countries (eg, France) provide free healthcare access to students on campus, but take-up is low.⁷⁷⁻⁷⁹ Although traditional face-to-face group interventions have been shown to improve university students' mental health,⁸⁰ social support, self-efficacy, and understanding of their own emotions and those of others,⁸¹ they are often loath to engage in help-seeking behavior,^{82,83} and reluctant to engage in face-to-face interventions, owing to a fear of stigmatization or a lack of knowledge about mental health and health professionals.^{84,85} A systematic review showed that the main barriers were stigma and embarrassment, problems recognizing symptoms, and a preference for self-reliance.⁸⁶ The most common reasons given by students themselves for not going to counseling are absence of perceived need, the belief that stress is normal in school, and lack of time.^{87,88}

Thus, to promote student health, universities face 2 major challenges: generating interest among students, and maintaining their commitment over time. The development of online interventions is a promising way of overcoming these obstacles. They appear to be effective for students,⁸⁹⁻⁹³ are readily available and accessible at any time,^{94,95} and are easily disseminated.⁹⁶ In addition, they reduce the risk of stigma,⁹⁷ and their anonymity makes it easier to talk without feeling embarrassed.⁹⁸ However, online interventions also have their limitations, including high dropout levels^{91,97} and limited interactions, meaning that it is harder to foster relationships among group members pursuing common

goals.⁹⁹ Online interventions make little use of socialization techniques and interpersonal learning, even though these are crucial components of face-to-face group interventions.¹⁰⁰ In addition, the limited opportunities for connecting with other group members can lead some to feel alone on the web, especially if they are not receiving support from a professional.⁹⁸

Objectives and Hypotheses

In sum, these findings highlight the need to develop interventions that meet students' specific expectations and engage them. More specifically, these interventions need to use a generationally appropriate format (eg, short videos), be compatible with students' schedules (eg, embedded in classroom teaching or accessible whenever they want online), and be preventive (ie, not necessarily targeting students who already feel distressed), given the difficulty students have identifying their symptoms.^{87,88} The present study therefore explored the effects of an innovative program that (1) addressed a variety of topics (eg, learning strategies) that have been neglected in traditional interventions, (2) featured engaging materials (ie, short and simple videos), and (3) could be used in student-friendly formats (ie, either face-to-face in a classroom or online). We tested the effects of 2 program formats: face-to-face during a class and online.

First, we predicted that scores on our primary outcomes would be lower at the end of the program than at the start. More specifically, we expected students to have lower anxiety, depressive symptoms, and academic burnout after completing our program (Hypothesis 1). Second, we expected to observe a change in the factors associated with these different outcomes at the end of the program. More specifically, we predicted that students would be less intolerant of uncertainty (Hypothesis 2), and have less learned helplessness (Hypothesis 3), less biased beliefs about learning, and more strategic organization by the end of our program (Hypothesis 4). By contrast, we did not expect to observe any changes over time in the control group. Finally, in line with previous studies,⁸¹ we expected to observe an increase in students' perceived social support at the end of the program in the face-to-face format (Hypothesis 5). By the same token, we did not expect to observe any changes in perceived social support either in students who did not participate in the program or in those who participated in the online intervention.

Methods

Ethics Statement

This study was an experiment in human and social sciences in the field of health, and therefore did not require the approval of an institutional review board, according to Article R1121-1 of the French Public Health Code. It was conducted in accordance with institutional and national ethical standards, and in accordance with the Declaration of

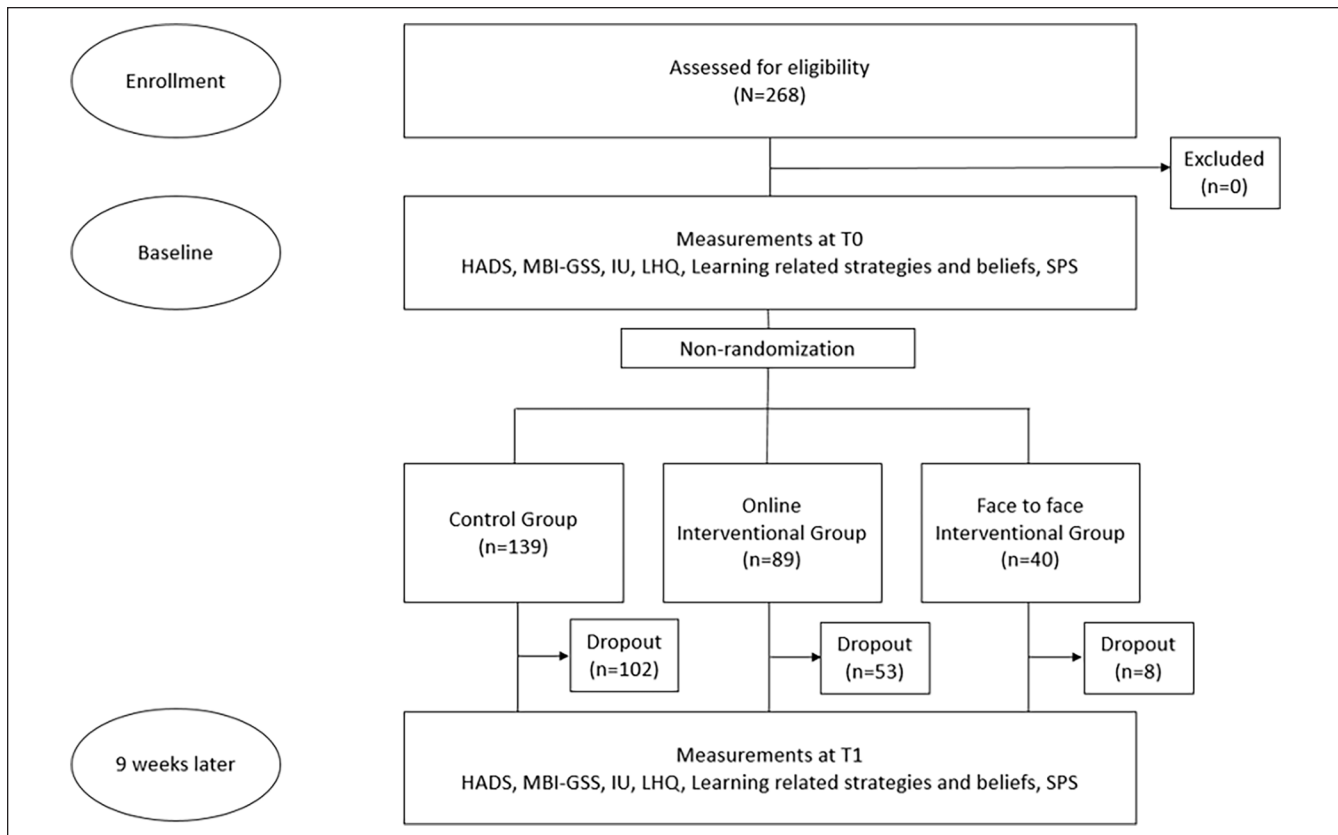


Figure 1. Flowchart of study participants. HADS=Hospital Anxiety and Depression Scale; MBI-GSS=Maslach Burnout Inventory-General Student Survey; IU=Intolerance of Uncertainty Scale—short form; LHQ=Learned Helplessness Questionnaire; SPS=Social Provisions Scale—shortened version.

Helsinki (2008). Recruitment was on a voluntary basis, and participants could withdraw at any time. No compensation was offered. Participants signed an online informed consent form indicating the names and academic affiliations of the experimenters, and were informed that their personal information would remain anonymous. All data were collected online and stored on a secure university computer. Most sessions were taught by an associate professor of psychology, and participants were repeatedly reminded that the program was not a substitute for medical and/or psychotherapeutic care. They were also informed of the services offered by the university (in particular, preventive medicine and health promotion services) which could offer care should they need it. The present study was registered on the Clinical Trials Register (NCT04978194) and followed the CONSORT-EHEALTH checklist.

Participants

We initially recruited 268 participants, but 163 of them did not respond at T1. Our final sample was therefore composed of 105 university students, divided into 3 groups (see Figure 1). The only inclusion criteria were to be a French student, enrolled at the University of Nîmes, France. The

first group (online intervention) contained participants who took part in the full online program ($n=36$; 94.4% female; $M_{age} = 19.3 \pm 1.6$ years). Of these, 18 studied psychology, 5 law, 4 design, 3 physical activity and sports, 2 biology, 2 economics and management, and 2 languages. There were 15 first-year students, 4 second-year students, 11 third-year students, 5 fourth-year students, and 1 fifth-year student. To constitute this group, an email was sent to all students at the University of Nîmes, France, inviting them to register for an online program focusing on emotions and learning. Thereafter, participants had follow the program for 9 weeks.

The second group (face-to-face intervention) contained students who took part in a full face-to-face program embedded in classroom teaching ($n=32$; 93.7% female; $M_{age} = 19.5 \pm 2.2$ years). Of these, 20 studied psychology, 7 languages and literature, 4 design, and 1 law. They were all second-year students. To become part of this group, students had to enroll on an optional course entitled *Managing emotions and learning*. Thereafter, they attended our program for 9 weeks, with one class per week.

The third group (control group) was composed of participants who did not take part in the program but who responded to our survey at the 2 timepoints ($n=37$; 78.3% female; $M_{age} = 19.4 \pm 2.3$ years). Of these, 16 studied psychology, 7

biology, 4 languages and literature, 4 history, 3 law, 1 design, 1 economics and management, and 1 physical activity and sports. There were 22 first-year, 8 second-year, and 7 third-year students. To form the control group, an associate professor from the University of Nimes, France, sent an email to all the students at the university inviting them to participate in an online longitudinal study exploring students' psychological state. Students were excluded if they were already enrolled on our online or face-to-face program.

Measures

Anxiety and depressive symptoms were assessed using a French version of the 14-item self-report Hospital Anxiety and Depression Scale.¹⁰¹ Scores range from 0 to 21 for each dimension. This scale is frequently administered in epidemiological studies in the general population,^{102,103} and was used in the first French epidemiological study of mental health in relation to COVID-19.¹⁰⁴

Academic burnout was measured with the French version of the Maslach Burnout Inventory-General Survey for Students (Copyright ©1996, 2016 Schaufeli, Leiter, Maslach & Jackson, used with the approval of Mind Garden, Inc.). This self-report questionnaire is composed of 15 items rated on a 7-point Likert scale ranging from 0 (*Never*) to 6 (*Always*). It captures three dimensions of academic burnout: emotional exhaustion (eg, "I feel exhausted at the end of a day at the university"), academic inefficacy (eg, "I feel fulfilled when I achieve my academic goals"; scores are inverted), and cynicism (eg, "I feel less enthusiastic about my studies"). A high score indicates high academic burnout.

Intolerance of uncertainty was assessed using the French version of the Intolerance of Uncertainty Scale—Short Form.¹⁰⁵ This self-report scale measures responses to uncertainty, ambiguous situations, and the future. The 12 items are rated on a 5-point Likert scale ranging from 1 (*Not at all characteristic of me*) to 5 (*Entirely characteristic of me*). Higher scores reflect higher levels of intolerance of uncertainty.

Learned helplessness was assessed using a French version of the Learned Helplessness Questionnaire.⁶⁷ This self-report questionnaire consists of 12 items rated on a 5-point Likert scale ranging from 1 (*Not true*) to 5 (*Absolutely true*). Higher scores reflect higher levels of learned helplessness.

Learning strategies and beliefs were assessed with 5 items rated on a visual analog scale ranging from 0 (*Not at all*) to 100 (*Completely*). These 5 items measured the following variables: *organization of workspace* ("How well do you organize your workspace when you are studying?"); *planning of learning sessions* ("How well do you plan your learning sessions? (eg, scheduling time slots, goals, subgoals, etc.)"); *perceived ease in seeking help* ("How easy do you find it to ask for help?"); *positive attitude toward errors* ("How much do you consider that making mistakes is a good thing when studying?"); and *enjoyment of academic learning*

("How much do you enjoy learning at the university?"). Participants also responded to an open-ended question asked them to freely describe their learning strategies. This allowed us to count the number of surface or deep learning strategies they used.

Perceived social support was assessed using a French version of the shortened form of the Social Provisions Scale.¹⁰⁶ This self-report questionnaire is composed of 10 items rated on a 4-point Likert scale ranging from 1 (*Strongly disagree*) to 4 (*Strongly agree*). Higher scores reflect higher levels of perceived social support. All the tools used in this research are available in the online Supplemental Material 1.

Intervention

The topics and videos of the online and face-to-face versions of our program were identical. There were 9 topics: stress, emotions, emotion regulation strategies, learning, learning strategies, motivation, nutrition, sleep, and worry. The program is described in detail in Table 1. The contents of our videos were inspired by modules from previous online mental health interventions that had already proved to be effective with students,^{82,83,107} and complemented by modules focused on learning strategies. The program was therefore tailored to our research objectives. The different modules were designed by 8 associate professors. Two clinical psychology Master's students and 2 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 pretested the modules and helped improve their design so that they would be attractive to other students. An initial version of the program was tested in 2 sessions conducted in 2020 to 2021. Based on student feedback, a second version (shorter videos, improved graphics) was produced in 2021 to 2022.

In the online program, every Thursday (except during vacations) for 9 weeks, participants were invited to watch a 10-minute video containing information, tools, exercises, student experiences, and quizzes on a YouTube channel (https://www.youtube.com/channel/UCfXEzpc_muAicJrN-wlFuL1g). They could watch these videos whenever they wanted, but were advised to watch them within a week. In addition, all the participants were made members of a Discord® community. Every Thursday, the Internet link to the video of the week was broadcast in this community, and one of the experimenters invited participants to share their opinions of the video and the proposed exercises. Participants could therefore interact with each other, and ask the experimenters questions at any time.

In the face-to-face program, students met in class every Thursday for 9 weeks, and each session was conducted in the following manner: (1) viewing of the video (same video as for the online group); (2) completion of the group exercises presented in the video; and (3) group discussions on the

Table 1. Module Content.

| Module | Objective | Key ideas |
|------------------------|--|--|
| 1. Stress | Understand what stress is and learn how to manage it better | <ul style="list-style-type: none"> - More than one in two students report being stressed. - Stress can lead to both psychological (eg, anxiety) and physical (eg, eczema) problems. - To manage stress, you need to understand why and when it occurs. - There are tools to reduce stress, some of which are explained in the video. |
| 2. Emotions | Identify and understand your emotions better | <ul style="list-style-type: none"> - An emotion is a set of psychological (eg, how we interpret a situation), physical (eg, sweating, increased heart rate), and behavioral (eg, avoiding situations) reactions. - All emotions are useful and have a function. - To manage your emotions, you need to know how to identify them. - There are tools that allow you to better understand your emotions, some of which are discussed in the video. - There are several ways of managing your emotions, and these are called <i>emotion regulation strategies</i>. - Some strategies are considered appropriate, and others inappropriate. - To manage your emotions well, you need to know which of the strategies you currently use actually work, and be prepared to extend your repertoire by trying new strategies. - The video provides techniques for using adaptive strategies. |
| 3. Learning | Understand learning | <ul style="list-style-type: none"> - <i>Learning</i> means processing new information in order to store it in your long-term memory and link it to your existing knowledge. - It is a difficult, tiring and time-consuming process. - People have only limited resources available for learning, which means that they cannot manage multiple learning tasks at the same time. - To learn well, you must therefore think about the way you learn and the conditions in which you learn. |
| 4. Learning strategies | Develop new learning strategies | <ul style="list-style-type: none"> - There are different types of cognitive strategies for learning, some of which are effective for superficial learning (eg, repeating, reciting), and others for deeper learning (eg, organizing information, summarizing). - Although people tend to use the same strategies over and over again, it is essential to choose the right strategy for a particular type of learning. - It is important to take the time to assess your learning, so that you know whether to continue with the same strategy or shift to a different one. |
| 5. Motivation | Understand motivation and goals for learning | <ul style="list-style-type: none"> - There are two forms of motivation: intrinsic motivation (linked to the activity), and extrinsic motivation (linked to reward or punishment). - People's motivation depends on their beliefs about themselves and their expertise, the importance they place on the task they are doing, and their beliefs about intelligence. - Motivation is a crucial factor in learning. |
| 6. Nutrition | Understand nutrition | <ul style="list-style-type: none"> - 42% of students do not engage in any physical activity, and 48% of students report skipping at least one meal during a typical week of classes. - Eating well means adopting a varied and balanced diet (ie, eating everything but in appropriate quantities). - Moving more does not mean playing sports, but increasing physical activity (eg, walking to university, walking the dog for longer, taking the stairs instead of the escalator). - A simple exercise you can do to move more is suggested in the video. |
| 7. Sleep | Understand the importance of sleep and how it is linked to stress and learning | <ul style="list-style-type: none"> - Sleep deficits are associated with decreased academic performance and increased stress. - Good-quality sleep is required to store important information in long-term memory. - Sleep requirements vary from one individual to another (between 4 and 10h). - Lack of sleep can have harmful effects at physical (eg, headaches), cognitive (eg, learning difficulties) and psychological (eg, mood) levels. |
| 8. Worry | Understand what worry is and how to manage it | <ul style="list-style-type: none"> - Worry is a mental process that occurs when we face one or more worrying events, perceived as negative and generating anxiety. - Worry is very common and affects nearly everyone. - To reduce worry, we need to become aware of the emotions and thoughts associated with it, and question the usefulness of our beliefs about worry. - An exercise to help you manage your worry is described in the video. |

usefulness and shortcomings of the video. Each session was led by one of the study's experimenters.

The procedure to set up the intervention is available here: <https://etuzen-sup.unimes.fr/etuzen/>

Procedure

Participants were assessed twice, 10 weeks apart. After agreeing to participate and signing a consent form, they completed an online survey containing 6 scales designed with Qualtrics software. Ten weeks later, participants completed the same online survey. For participants in the face-to-face group, these 2 assessments were conducted in class, during the first and last lessons, on their computer or smartphone. Participants in the online group completed the surveys online, 1 week before the program started and 1 week after the program ended. The different stages of the study are illustrated in Figure 1.

Statistical Analysis

As our data did not follow a normal distribution, we conducted nonparametric analyses. Preliminary analyses were run to check the similarity between the participants who dropped out and those who completed the program (Mann-Whitney and chi-squared), and the similarity between the 3 groups at T0 (Mann-Whitney). The main analyses assessing the impact of the program took the form of within-group comparisons (T0 vs T1; Wilcoxon tests). Effect sizes were expressed as the rank biserial correlation (r_{rb}) and its 95% confidence interval. Data were analyzed using JASP® software (0.9.2 version).

Results

First, preliminary analyses showed that scores at T0 on our variables of interest and sociodemographic data (field of study and sex) did not differ significantly between those who dropped out of the program (ie, they completed our survey at inclusion but subsequently withdrew from the program and therefore did not respond to the survey at T1) and those who completed it (see online Supplemental Material 2). The only difference was that in the online intervention group, the participants who completed the program were older than those who did not. We compared the 3 groups on our main variables of interest at T0. Analyses showed that our 3 groups were similar at inclusion, except for academic burnout and planning of learning sessions. More specifically, at T0, participants in the online intervention group scored lower on academic burnout than those in either the control group ($U=876.5$, $P=.02$, $r_{rb}=0.31$ [0.06, 0.53]) or the face-to-face intervention group ($U=761$, $P=.02$, $r_{rb}=0.32$ [-0.54, -0.05]). In addition, at T0, participants in the face-to-face intervention group scored higher on planning of learning

sessions than those in the control group ($U=393$, $P=.01$, $r_{rb}=-0.33$ [0.07, 0.55]).

Second, to investigate the impact of our program, we ran comparisons between T0 and T1 within each of the 3 groups (see Table 2). Consistent with our first hypothesis, results revealed a slight decrease in anxiety at T1 in the online intervention group. The intensity of anxiety symptoms did not change between T0 and T1 in the face-to-face intervention group, and increased in the control group. No change was observed at T1 in any of the groups for depressive symptoms and the total academic burnout score. However, it is important to note that scores on one dimension of academic burnout, namely academic inefficacy, were lower at T1 in the face-to-face intervention group, whereas they remained the same in the online intervention group and control group.

In line with our second hypothesis, both intervention groups had lower intolerance of uncertainty scores at T1 than at T0, whereas no change was observed in the control group (see Table 2). In the same vein, and in accordance with our third hypothesis, the intervention groups both had lower learned helplessness scores at T1, whereas no change was observed in the control group. In line with our fourth hypothesis, participants in the intervention groups reported more positive attitudes toward errors, whereas no change was observed in the control group. In addition, at T1, participants in the face-to-face intervention group planned their learning sessions more, and reported finding it easier to seek help. No such changes were observed in controls, who also had lower workspace organization and enjoyment of academic learning scores at T1. It should be noted that these scores also decreased in the online intervention group, but to a lesser extent. Responses to the open-ended question about strategy use highlighted that while there was no change in the control group, participants in the online intervention group reported using more deep learning strategies such as self-management ($M=0.39$, $SD=0.83$ at T0 vs $M=0.61$, $SD=0.81$ at T1; $W=19.5$, $P=.05$, $r_{rb}=-0.89$ [-0.95, -0.77]), as did participants in the face-to-face intervention group ($M=0.18$, $SD=0.39$ at T0 vs $M=0.59$, $SD=0.61$ at T1; $W=14$, $P=.005$, $r_{rb}=-0.94$ [-0.97, -0.88]). The latter also used fewer surface learning strategies such as rehearsal ($M=2.0$, $SD=1.24$ at T0 vs $M=1.59$, $SD=1.01$ at T1; $W=155.5$, $P=.05$, $r_{rb}=-0.41$ [-0.68, -0.04]). Finally, in accordance with our fifth hypothesis, we observed an increase in perceived social support in the face-to-face intervention group at T1, but not in the other 2 groups.

Discussion

It is now widely acknowledged that students often have poor mental health,¹ with high levels of anxiety, depressive symptoms, and academic burnout.^{2,3,8} These have been exacerbated by the COVID-19 pandemic.¹⁰⁻¹⁶ Both online^{92,93} and face-to-face^{76,80} interventions are effective for improving

Table 2. Descriptive Analyses of Variables of Interest and Pre- Versus Post-Intervention Comparison.

| | Control Group (n=37) | | | | | | Online Intervention Group (n=36) | | | | | | Face-to-Face Intervention Group (n=32) | | | | | | | | | |
|---------------------------------|----------------------|-------------|--------|--------|----------------------|---|----------------------------------|-------------|--------|--------|----------------------|---|--|----------------|--------------|--------|----------------------|--|---|---|----------------|--|
| | T0 | | T1 | | W | p | r_b [95% CI] | T0 | | T1 | | W | p | r_b [95% CI] | T0 | | T1 | | W | p | r_b [95% CI] | |
| | M (SD) | M (SD) | M (SD) | M (SD) | | | | M (SD) | M (SD) | M (SD) | M (SD) | | | | M (SD) | M (SD) | | | | | | |
| Age in years | 19.3 (1.6) | | | | | | | 21.5 (5.8) | | | | | | | 20.03 (3.08) | | | | | | | |
| Anxiety | 11.2 (4.8) | 12.0 (4.7) | 133.5 | .07 | -0.57 [-0.77, -0.27] | | 9.6 (4.1) | 8.6 (3.8) | 387.5 | .05 | 0.16 [-0.20, 0.49] | | 10.4 (3.9) | 11.5 (3.5) | 262.0 | .18 | -0.008 [-0.38, 0.37] | | | | | |
| Depressive symptoms | 6.7 (4.8) | 7.3 (5.1) | 197.0 | .46 | -0.37 [-0.64, -0.01] | | 5.2 (4.0) | 5.2 (3.9) | 229.0 | .81 | -0.31 [-0.60, 0.05] | | 5.9 (3.6) | 5.3 (3.0) | 198.0 | .48 | -0.25 [-0.57, 0.14] | | | | | |
| Academic burnout | 51.8 (17.5) | 53.0 (19.0) | 331.0 | .57 | -0.006 [-0.36, 0.35] | | 42.2 (16.6) | 42.2 (18.8) | 266.5 | .72 | -0.10 [-0.45, 0.27] | | 44.2 (15.5) | 50.5 (14.6) | 340.0 | .15 | 0.28 [-0.10, 0.60] | | | | | |
| Emotional exhaustion | 19.8 (6.2) | 20.2 (7.4) | 267.0 | .96 | -0.19 [-0.51, 0.17] | | 16.1 (7.4) | 16.9 (8.3) | 216.0 | .74 | -0.23 [-0.55, 0.15] | | 19.1 (7.2) | 19.3 (6.2) | 242.0 | .91 | -0.08 [-0.44, 0.30] | | | | | |
| Academic inefficacy | 19.3 (8.5) | 19.9 (8.0) | 248.5 | 1 | -0.25 [-0.56, 0.11] | | 16.7 (7.2) | 14.9 (8.0) | 298.5 | .08 | 0.06 [-0.31, 0.42] | | 13.9 (6.2) | 19.3 (8.7) | 334.0 | .03 | 0.26 [-0.12, 0.58] | | | | | |
| Cynicism | 12.6 (6.9) | 12.8 (8.3) | 308.0 | .62 | -0.07 [-0.42, 0.29] | | 9.2 (6.6) | 10.8 (7.0) | 156.5 | .44 | -0.44 [-0.69, -0.08] | | 11.1 (6.9) | 11.8 (6.9) | 236.5 | .45 | -0.10 [-0.46, 0.28] | | | | | |
| Intolerance of uncertainty | 40.6 (11.9) | 40.6 (11.7) | 313.5 | .56 | -0.05 [-0.36, 0.35] | | 37.2 (10.5) | 34.4 (9.2) | 397.0 | .01 | 0.33 [-0.03, 0.62] | | 35.2 (11.8) | 40.4 (11.1) | 325.0 | .02 | 0.31 [-0.08, 0.62] | | | | | |
| Learned helplessness | 27.9 (10.0) | 29.6 (10.6) | 193.5 | .12 | -0.45 [-0.69, -0.11] | | 26.9 (9.2) | 24.5 (7.4) | 326. | .05 | -0.02 [-0.37, 0.34] | | 24.3 (6.2) | 27.5 (7.3) | 438.0 | .001 | 0.65 [0.37, 0.83] | | | | | |
| Organization of workspace | 78.1 (16.8) | 66.8 (32.5) | 369.0 | .005 | 0.17 [-0.20, 0.50] | | 78.8 (27.9) | 75.4 (26.7) | 137.0 | .46 | -0.27 [-0.61, 0.14] | | 72.7 (30.7) | 73.9 (32.7) | 198.0 | .83 | -0.20 [-0.54, 0.19] | | | | | |
| Planning of learning sessions | 46.6 (33.1) | 49.7 (33.2) | 221.0 | .42 | -0.29 [-0.59, 0.17] | | 58.9 (33.9) | 62.2 (29.1) | 121.5 | .42 | -0.35 [-0.66, 0.05] | | 75.3 (30.4) | 66.1 (34.9) | 10.0 | .04 | -0.71 [-0.86, -0.46] | | | | | |
| Perceived ease in seeking help | 43.0 (33.6) | 41.4 (32.9) | 306.0 | .43 | -0.02 [-0.38, 0.33] | | 44.5 (30.6) | 47.9 (28.7) | 146.0 | .46 | -0.22 [-0.58, 0.19] | | 66.7 (26.6) | 42.1 (30.3) | 39.0 | <.001 | -0.84 [-0.92, -0.67] | | | | | |
| Positive attitude toward errors | 65.1 (23.5) | 69.8 (22.8) | 241.0 | .48 | -0.23 [-0.55, 0.14] | | 60.0 (23.8) | 66.5 (19.7) | 97.0 | .04 | -0.48 [-0.74, -0.10] | | 72.6 (22.2) | 66.6 (23.6) | 133.0 | .04 | -0.46 [-0.71, -0.09] | | | | | |
| Enjoyment of academic learning | 72.1 (21.5) | 58.9 (30.5) | 426.0 | .003 | 0.35 [-0.01, 0.63] | | 76.9 (21.4) | 67.6 (28.2) | 346.0 | .02 | 0.16 [-0.21, 0.50] | | 74.2 (22.2) | 76.3 (16.6) | 233.0 | .74 | -0.06 [-0.43, 0.33] | | | | | |
| Social support | 32.0 (7.3) | 32.5 (6.9) | 240.0 | .47 | -0.23 [-0.55, 0.13] | | 33.7 (5.3) | 33.7 (4.8) | 177.0 | .78 | -0.40 [-0.67, -0.04] | | 35.4 (4.3) | 34.1 (4.9) | 62.0 | .03 | -0.75 [-0.88, -0.51] | | | | | |

Note: Values below the significance level ($p \leq .05$) are specified in bold.

students' mental health. However, both formats have limitations, such as high dropout rates and limited interactions between members in the case of online programs,^{91,97,99} and difficulty accessing care and stigma in the case of face-to-face programs.^{84,85} It is therefore essential to assess the effects of these programs, in both their online and face-to-face formats. In addition, although anxiety, depressive symptoms, and academic burnout are linked to the use of less effective learning strategies^{17,48} and high levels of both uncertainty intolerance^{29,30} and learned helplessness,^{49,68,69} they are often neglected in interventions for students. The present study was therefore designed to investigate the impact of an innovative program that specifically targeted these issues, and to test the effectiveness of this program in 2 formats: face-to-face and online.

Results showed that by the end of the program (in both the online and face-to-face formats), participants had lower levels of learned helplessness. This finding is consistent with the results of our pilot study.¹⁰⁸ Given the acknowledged links between learned helplessness and learning strategies,^{71,72} this decrease can be explained by the topics addressed in our program, which encouraged students to reflect on their learning strategies and modify them if necessary (Modules 4 and 5). Our results highlighted changes in students' learning strategies after the program, with the use of more deep learning strategies (both formats) and fewer surface learning strategies (face-to-face format). Contrary to our expectations, even though learned helplessness is a central component of the behavioral model of depression,⁶⁴ we failed to find any decrease in depressive symptoms after the program. This may be because our measurement timepoints were too close together for us to observe a change (10 weeks). There may well have been a decrease in depressive symptoms over the longer term, but this is purely speculative and needs to be confirmed in future studies.

Results also showed that our program (both online and face-to-face formats) produced a moderate decrease in students' intolerance of uncertainty. This finding is particularly important in the current health context, which has exposed students to many additional uncertainties.^{109,110} This decrease may have occurred because the final module gave students tools to help them manage their worry, and intolerance of uncertainty plays a key role in the emergence and persistence of worry.¹¹¹ Intolerance of uncertainty is also one of the most important factors for proneness to anxiety,¹¹² and our results suggest that the online intervention slightly reduced the intensity of anxiety symptoms. This result is consistent with the results of our pilot study,¹⁰⁸ as well as other online interventions conducted during the pandemic based on mindfulness⁹² or cognitive behavioral therapy.¹¹³ It can be explained by our program's focus on stress (Module 1), emotion regulation (Module 3) and sleep (Module 8), all of which are related to anxiety.^{114,115} Contrary to our expectations, we failed to find a reduction

in anxiety in the face-to-face intervention group. However, it is important to note that participants did not actually experience any increase in anxiety, unlike controls. This suggests that the face-to-face format still had a protective effect. Taken together, these results indicate that our program had an impact on both anxiety and one of its underlying processes (ie, intolerance of uncertainty).

Finally, our analyses revealed that our face-to-face intervention resulted in a slight reduction in the sense of academic inefficacy and a large increase in perceived social support. In other words, by the end of the program, students felt more competent in their role as students and better supported. These results were not observed in the online group, and are therefore specifically related to the face-to-face format, which allowed for greater interaction, giving students the opportunity to learn from each other's experiences and ask for help—something they found easier to do by the end of the program. These explanations are consistent with data indicating that social support is related negatively to academic burnout¹¹⁶ and positively to academic achievement.¹¹⁷ It is therefore essential to give students more time to interact in the online format of this program. Some studies have suggested that sending encouraging and supportive messages can energize interactions.^{118,119}

In sum, both formats of our program appear to have had positive effects. Both formats had beneficial effects on learned helplessness, intolerance of uncertainty, and deep learning strategies. However, positive effects on students' perceived social support, sense of academic efficacy, help-seeking strategies and surface learning strategies were only observed in the face-to-face intervention group. Embedding the face-to-face format in classroom learning should therefore be the preferred option.

The present results, albeit promising, must be interpreted with caution. First, our sample was small, thus limiting the generalization of results, especially as our analyses showed that participants who completed the program were older than those who dropped out. It would be interesting to explore the effect of age in a larger sample, especially as older students have been identified as being more academically motivated than younger students,¹²⁰ and our analyses suggest that they may also engage more in programs that are available to them outside their courses. Our small sample size was largely due to the high dropout rate, primarily for the online format of our program. Given the difficulty of enrolling participants, we did not select an effect size beforehand, which is a further limitation of this study, and points to the need to replicate it with a larger sample. While our dropout rate was consistent with those of other online student interventions,^{91,97} it underscores the need to develop strategies for increasing student engagement. Second, although our results indicate a promising effect of our program in the short term, we need to assess its impact over the longer term, by conducting follow-up research several weeks after the end of the intervention.

Conclusion

Our study investigated the effects of an innovative program addressing a variety of topics that are not normally tackled in traditional interventions, with generationally appropriate format and can be used either face-to-face in a classroom context or online. Results revealed beneficial effects of both the face-to-face and online formats of the program on students' learned helplessness, intolerance of uncertainty, and deep learning strategies. They also highlighted specific effects of the face-to-face format on students' perceived social support, sense of academic efficacy, help-seeking strategies, and surface learning strategies. Although further research is needed to confirm the beneficial effects of this program and explore their persistence over time, these initial data capture many of the benefits, as well as the specifics of the 2 formats, and highlight the value of implementing this program in universities.


Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.


Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This research was funded by National Research Agency, grant number ANR-21-COVR-0005.

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Supplemental Material

Supplemental material for this article is available online.

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