RESEARCH PAPER

Can Students Learn to Optimize Their Need-Based Experiences and Mental Health During a Stressful Period? Testing a Need-Crafting Intervention in Higher Education

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Abstract

Abundant research has shown that the support of students' basic needs for autonomy, relatedness, and competence contributes to higher motivation and mental health. Yet, whether students themselves can craft their own need satisfactions and be trained herein has rarely been examined. The findings of the present online intervention study among university students indicates that a brief 7-day training on need crafting during a stressful period suffices to foster greater need satisfaction and well-being, while reducing need frustration and ill-being, with enhanced need crafting accounting for the training benefits. These effects were somewhat stronger for participants who were more actively engaged in the program, but did not depend on participants' type of motivation to initiate the training, the self-chosen pacing of the training or their use of WhatsApp during the training. Yet, more autonomously motivated participants, those using WhatsApp and choosing the fast track were less likely to drop-out of the training. The discussion focuses on the role of need crafting as a pro-active skill that fosters well-being and resilience in students.

Keywords University students · Need crafting · Need satisfaction · Mental health · Intervention

1 Introduction

Life as a student can be enriching but also complicated and distressing. On the one hand, university life offers opportunities for personal growth (Beri & Jain, 2016; Grier-Reed et al., 2012). Students typically gain further independence from their parents, with students receiving freedom to organize their activities, to develop new or deepen existing social relations, and to determine their study and vocational identity (Medalie, 1981). Yet, confronted with the opportunities of higher education, students may also experience an overwhelming sense of responsibility, resulting in indecisiveness or even existential and

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identity-related doubts. Students may feel unable or pressured to meet high and competitive standards for achievement and may struggle to adjust to new social environments, potentially evoking feelings of depression, anxiety, stress, failure and loneliness (Beiter et al., 2015; Ratelle & Guay, 2023).

Recent research suggests that mental health problems among students are increasing (Lipson et al., 2019). During the last decades (Twenge, 2011), and even more during the COVID-19 pandemic (Kaparounaki et al., 2020), students reported elevated levels of anxiety, depression, and suicidal thoughts. Considering the developmental challenges students face and the rise of mental health problems, it is important to develop theory-driven and empirically supported prevention programs aimed at strengthening students' resilience.

Self-Determination Theory (SDT; Ryan & Deci, 2017) offers a framework to understand the opportunities and pitfalls of student life by highlighting the importance of autonomy, relatedness, and competence as three basic psychological needs for individuals' psychosocial adjustment (Vansteenkiste et al., 2020, 2023). When satisfied, the basic psychological needs play an essential role in resilience and wellbeing, whereas frustration of the needs is a risk factor for mental illbeing and even psychopathology (Ryan & Deci, 2000; Vansteenkiste & Ryan, 2013). It is well-known based on previous research that the basic needs can be supported (or thwarted) by important figures in students' social environment, including parents (Okray, 2016), academic staff (Girelli et al., 2018), and friends (Shin & Johnson, 2021). Yet, students do not need to passively wait for contextual need supports, but can also take pro-active action in recruiting experiences of psychological need satisfaction. Adolescents engaging in a process of *need crafting* (Laporte et al., 2021a, 2021b) were found to optimize their own need satisfaction, with resulting benefits for their mental health. Yet, whether students can be effectively trained in need crafting remains an underexplored topic. The present study aimed to test an online intervention program entitled 'LifeCraft' that exactly targets students' capacity for need crafting during the exam period.

1.1 Students' Basic Psychological Needs

SDT is a well-established and widely used theory that specifies three fundamental nutrients that underlie mental health (Ryan & Deci, 2017; Vansteenkiste et al., 2020). *Autonomy* is defined as the need to experience a sense of choice and freedom in one's actions, feelings and thoughts. *Relatedness* represents the need to belong and to experience reciprocal, caring, and warm relationships. *Competence* refers to the experience of mastery and effectiveness when using, extending and refining skills. The basic psychological needs are essential and universal in nature, meaning that the frustration and satisfaction of the needs are predictive to, respectively, emotional problems and well-being in all individuals, regardless of age, cultural background, personality or need strength (Baumeister & Leary, 1995; Vansteenkiste et al., 2020).

The important role of the basic need experiences has been repeatedly demonstrated in the context of higher education. Satisfaction of the needs among students is positively associated with vitality, self-actualization and emotional well-being (Chen et al., 2015), self-esteem (Levesque et al., 2004), intrinsic motivation to learn (Goldman et al., 2017) and academic performance (Niemiec & Ryan, 2009). Conversely, need frustration among students is positively associated with negative affect (Behzadnia et al., 2018), symptoms of anxiety and depression (Reed-Fitzke & Lucier-Greer, 2021), disengagement (Jang et al., 2016) and academic dishonesty (Kanat-Maymon et al., 2015).

Besides the more straightforward benefits of need satisfaction and disadvantages of need frustration, the basic needs are also known to function as a source of resilience against stressors (Vansteenkiste & Ryan, 2013). When confronted with stressors, need satisfaction among school students (Abualkibash & Lera Rodríguez, 2017; Lera & Abualkibash, 2022) and medical students (Neufeld & Malin, 2019) contributed to resilience. Further, need-based experiences also contribute to the development of a solid identity (Luyckx et al., 2009) and a satisfying study career (Ratelle & Guay, 2023).

A variety of factors feed into students' need based experiences. First, although students function more independently during the college years, various key figures in their close environment, including parents, friends, romantic partners and academic staff, remain important in supporting basic needs by interacting in warm and caring ways, conveying confidence in students' abilities and providing help when students struggle, or creating room for students to make volitional choices and to behave in authentic ways (e.g., Koestner et al., 2020). Yet, students can also be approached in cold, conditional or indifferent ways, thereby getting the impression that they are not capable of meeting the expectations set by (student) life and feeling pushed into a direction they not fully endorse (e.g., Soucy & Larose, 2000).

Second, in addition to the key figures in students' microsystems, broader situational circumstances can also impact the satisfaction or frustration of the needs, with need-based experiences fluctuating over time as a function of changing circumstances. An example typical for student life is the exam period, during which students experience more stress (Zunhammer et al., 2013) and more need frustration (Campbell et al., 2015). Another illustration concerns the COVID-19 pandemic and its accompanying restrictive safety measures, which temporarily impacted students' basic needs (Šakan et al., 2020; Vermote et al., 2022). The safety measures precluded opportunities for direct and spontaneous interaction with peers and teachers (Holzer et al., 2021) and limited students' choice, both during their study and leisure time (Waterschoot et al., 2023).

1.2 Need Crafting as a Proactive Resource

Although contextual need support fosters students' need satisfaction and mental health, students can also steer their own functioning such that need-satisfying experiences get maximized. This idea is fully consistent with the notion that basic psychological needs are characterized as *directional* (Vansteenkiste et al., 2020). That is, basic needs represent growth-oriented propensities that give direction to people's functioning, thereby instigating action and eliciting pro-active attempts to search for need-conducive activities, partners, and circumstances (see also Sheldon & Gunz, 2009).

In recent research, this directive and proactive manifestation of human nature has been studied from individuals' capacity for *need crafting* (Laporte et al., 2021a; see also de Bloom et al., 2020). Need crafting involves "individuals' attempts to create optimal conditions for psychological need satisfaction to occur. Need crafting entails both awareness of one's personal sources of psychological need satisfaction and a tendency to act upon this awareness" (Laporte et al., 2021a, 2021b, p.68). In other words, with greater *awareness* of and receptivity for the activities, persons, and contexts that are need-conducive, a student can take more well-informed *action* to seek and create opportunities to fulfill the needs for autonomy, relatedness, and competence. For example, students with high need crafting skills may continue to free up some time during the exam period to spend with friends

because they are aware of the positive effects of experiencing a sense of connection and mutual care.

In a first correlational study, Laporte et al., (2021a, 2021b) developed and validated a measure of need crafting, thereby providing evidence for its internal, construct, and predictive validity. Specifically, need crafting correlated in positive and theory-consistent ways with mindfulness, pro-active personality, agentic engagement and asserted autonomy, and yielded a positive association with well-being through its effect on need-based experiences, an effect that held even after controlling for maternal need-support. Further, a diary study confirmed that need crafting varies both between as well as within persons, with daily variation in need crafting predicting corresponding benefits in daily need satisfaction and daily mental health (Laporte et al., 2021a, 2021b). Given that need crafting constitutes a unique source of need satisfaction above contextual support, it is critical to train individuals so they become more skilled in optimizing their need satisfaction. Unfortunately, such interventions are scarce within the SDT literature.

1.3 Interventions on Need Crafting

To the best of our knowledge, there are only a few interventions available that directly targeted individuals' capacity to maximize need satisfaction. These studies have been conducted among university community members (Sheldon et al., 2010), Syrian refugees (Weinstein et al., 2016), adults in the general population (Cantarero et al., 2021; Laporte et al., 2022) and among students (Behzadnia & FatahModares, 2020, 2023).

Sheldon et al. (2010) conducted an experiment in which participants were instructed to formulate four goals to either change certain life circumstances (control condition) or to get their psychological needs better met in the coming 6 months. The encouraged pursuit of improved need satisfaction enhanced well-being more than changing life circumstances, with the well-being benefits remaining only when participants continued to engage and succeed in pursuing their goals.

An intervention by Weinstein et al. (2016) targeted Syrian refugees aged between 15 and 68 years, who were followed up in person every other day for one week by members of a volunteer organization. Participants in the intervention condition were asked to select a need-conducive activity from a list of 12 activities, with concrete examples being offered (e.g., cooking a dish to fulfill the need for competence). Refugees in the intervention condition reported reduced symptoms of depression and generalized stress (but not of posttraumatic stress symptoms) as compared to a control group.

In the general population, Cantarero et al. (2021) tested a brief online intervention in which participants were asked to think back and write down a need-conducive experience during the COVID-19 outbreak. Participants who affirmed their basic-psychological need experiences, reported more momentary well-being and decreased stress directly after the intervention. Whereas this intervention only enhanced awareness of need-conducive activities and did not include follow-up measures, Laporte et al. (2022) reported the effect of a 7-day online program that addresses both components of need crafting. Participants were instructed to brainstorm about a specific need (i.e., awareness component), followed by the construction of a concrete action plan to get a basic need fulfilled the next day (i.e., action component). This intervention, which was also rolled out during the COVID-19 pandemic, significantly enhanced need satisfaction and well-being of participants after one week of training, with the gains being maintained one month later and improved need crafting

underlying these benefits (i.e., mediation). Yet, the effects of the training were only visible for those who had actively engaged in the program.

Two other intervention studies were conducted among students (Behzadnia & FatahModares, 2020, 2023). At the beginning of the COVID-19 pandemic, Behzadnia and FatahModares (2020) conducted a 10-day intervention in which students were instructed each day to engage in a need-relevant activity on a daily basis. Directly after the program participants of the treatment condition reported improved need satisfaction and autonomous self-regulation, and less need frustration, perceived stress, amotivation and controlled motivation compared to participants in the control condition. These findings were replicated and extended in a similar study by Behzadnia and FatahModares (2023), this time being conducted during a more stressful period (i.e., the university final exams during the COVID-19 outbreak). Students in the intervention, compared to a passive control condition, reported a significant increase in need satisfaction, vitality and mindfulness, and a decrease in need frustration and coronavirus- and test anxiety.

1.4 Effectiveness and Attrition

Universal prevention programs typically face two challenges. First, they yield small to moderate benefits (Sanchez et al., 2018; Stice et al., 2009; Weiss et al., 2016) and, second, there is a rather high attrition rate (Christensen et al., 2009; see also Laporte et al., 2022), with participants prematurely dropping out and thus not being capable to reap the training benefits at all. Both the issue of treatment effectiveness and drop-out deserves further scrutiny if one aims to increase the reach and impact of interventions (Hoorelbeke et al., 2022; Kazdin, 2023). Herein, we addressed both the role of participant characteristics (i.e., motivation, engagement) and program characteristics (i.e., self-chosen pacing, optional WhatsApp use).

First, because "becoming happier takes both a will and a proper way" (Lyubomirsky et al., 2011, p.391), we examined baseline differences in participants' motivation to enroll in the program to begin with and their ongoing engagement in the program. Consistent with SDT's viewpoint on different types of motivation, some participants may truly want to engage in the training (e.g., to improve their mental health) whereas others may feel forced (e.g., driven by guilt). Prior work found that autonomous or volitional, relative to the controlled or pressured, pursuit of goals predicts greater goal-attainment (Sheldon & Elliot, 1999). Also, prior work in the domains of education, health care, and sports has shown that autonomous motivation predicts greater retention (e.g., Vallerand et al., 1997; Vansteenkiste et al., 2005). Extrapolating these findings to the present intervention, we examined whether participants with higher autonomous motivation for training would be less likely to drop-out of the program and would reap greater benefits in case they complete the program. Apart from motivational differences at baseline, we also considered the role of in-training engagement. Similar to prior research showing that engagement in therapy (e.g., Becker et al., 2018) but also when engaging in a training (e.g., Laporte et al., 2024) is a critical condition to reap benefits, we expected program engagement to moderate the effects of the training.

Another factor we experimented with in the present study is the self-chosen pacing to go through the program. As Laporte et al. (2022) noticed, the large drop-out rate might have been due to the lack of flexibility to match the program with participants' time table. To align the program with participants' preferences, participants were offered the choice between a fast pace (i.e., one module per day) and a slower pace (i.e., one module every

other day). Allowing more flexibility is in line with recent recommendations for interventions to address drop-out and the observed gap between those who would potentially benefit from an intervention and people who make use of the intervention (see Kazdin, 2023).

A last factor examined in this study is the optional use of WhatsApp. The use of WhatsApp to provide instructions and the ability to communicate with a research assistant might have contributed to the fact that the drop-out rates of the interventions tested by Behzadnia and FatahModares (2020, 2023) were rather low (22% and 13%, respectively). WhatsApp use has been found to yield an additional effect on the abstinence rate and endurance of smokers (Durmaz et al., 2019) and medication adherence in diabetic patients (Sartori et al., 2020) compared to treatment as usual. In this study, WhatsApp use is a voluntary choice and is used to inform students of new modules sent to their email addresses and to create a safe environment to share experiences or ask questions to the researcher.

2 Present Study

The first aim of the present study is to examine the effectiveness of an online intervention, entitled LifeCraft, that fosters need crafting efforts among university students facing a stressful period caused by (upcoming) exams and COVID-19 circumstances. Second, we sought to better understand the conditions under which the training would be most effective and which factors account for participants' retention in the program, thereby attending to diverse participant (i.e., motivation; engagement) and program characteristics (i.e., pacing; WhatsApp use). The following preregistered hypotheses were tested (http://bit.ly/LC_Students).[1]

First, we expected that participants in the LifeCraft training would report enhanced need satisfaction and well-being and decreased need frustration and ill-being until one week after program ending compared to participants in a wait-list control group (Hypothesis 1). Second, the presumed benefits of the program were assumed to be driven by enhanced need crafting, which serves as intermediate mechanism accounting for the intervention benefits on need-based experiences (primary outcomes) and subsequent improved mental health (i.e., higher well-being, lower ill-being; secondary outcomes) (Hypothesis 2).

Third, as for the examination of the factors that determine the effectiveness of the program, we presumed the effectiveness of the program would be more pronounced among participants who report a better quality of motivation, who display higher engagement and who actively make use of WhatsApp (i.e., respond to messages). We expect to find no differences as a function of pacing (i.e., a faster one-week of slower two-week program), as participants got the same content and the self-chosen pace ensures a better match with participants' personal preferences. Finally, we expected drop-out of the training to be higher among participants with poor quality of motivation and among those who do not actively use WhatsApp. The role of self-chosen pacing was examined in a more explorative manner.

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[1] The order and type of hypotheses generally follows the same sequence as reported in the preregistration, with some slight deviations. For example, we did not include the moderating effect of personality differences for practical reasons (i.e., page length) and WhatsApp use was conceived as an indicator of a composite score of engagement' in the preregistration while both variables were separately examined to shed light on their unique effects.

3 Method

3.1 Participants

The "LifeCraft study" was announced via a digital education platform of Ghent University and via channels of the student council. The advertisement letter introduced LifeCraft as an online training that allows one to discover the things that boost one's energy. Timing and time investment of the program was made clear, as well as the number of measurement points. A link was provided to guide interested participants to the subscription page. At the time of enrollment, students indicated whether they preferred to receive WhatsApp support and whether they chose to receive modules on a daily basis or every other day (i.e., pacing). No rewards were promised or given but participants were promised and given individual feedback with respect to their need scores and well-being at the end of the program. Within 1,5 week 435 participants subscribed to the study of which 373 (86%) participants indicated to prefer using WhatsApp, with 54% of all participants making at least once use of the WhatsApp support. The rapid pace was chosen by 243 (i.e., 56%) participants. After subscription, participants were randomly assigned to either the experimental condition or the waiting list condition (control condition). Participants in the control condition could start the program after 2 weeks. The participation rate in the different measurements decreased across time, with Fig. 1 providing a detailed overview of the retention flow and time schedule of the program. Participation rate varied as a function of condition, with more drop-out in the experimental condition (42%) compared to the control condition (16%) at post measurement. We included all participants that filled out the need-based experiences at T1 (i.e., baseline measure), allowing an intention-to-treat approach. Power analysis indicated a sample size of at least 100 (N = 50 per condition) is required to detect small to medium effect sizes (d = 0.30; Cohen, 1988) with an alpha level of 0.05 and a power of 0.80. Similar to the small effect sizes that are reported in meta-analyses of universal prevention programs (Sanchez et al., 2018; Stice et al., 2009), we also expected a small effect size herein. At the start of the baseline measurement an active informed consent was obtained in which confidentiality and volitional participation was guaranteed. The university's institutional Review Board granted ethical approval for this study (IRB; 2021/28).

3.2 Procedure

The training LifeCraft consists of 7 online modules built in Qualtrics. In the first module, participants were provided with an animated video that introduced the notion of basic needs in an accessible and student-friendly way. Each of the first 6 modules consisted of two similar standardized components, with a different need being central each day. First, participants watched a short video that introduced the need-related challenge of the day and, second, they made an action plan. Specifically, informed by prior work in implementation intention literature (Gollwitzer, 1999), participants made their action plan as concrete as possible (i.e., specifying the what, when, how, and with whom they would engage in the need-relevant activity) and they anticipated on possible obstacles and associated solutions. This was done to maximize the probability that their need crafting intentions would get translated into effective need crafting the subsequent day. Apart from these common features, there was also a notable difference between the first three and the last three modules. Whereas the first three modules introduced need-crafting in an easy and accessible manner
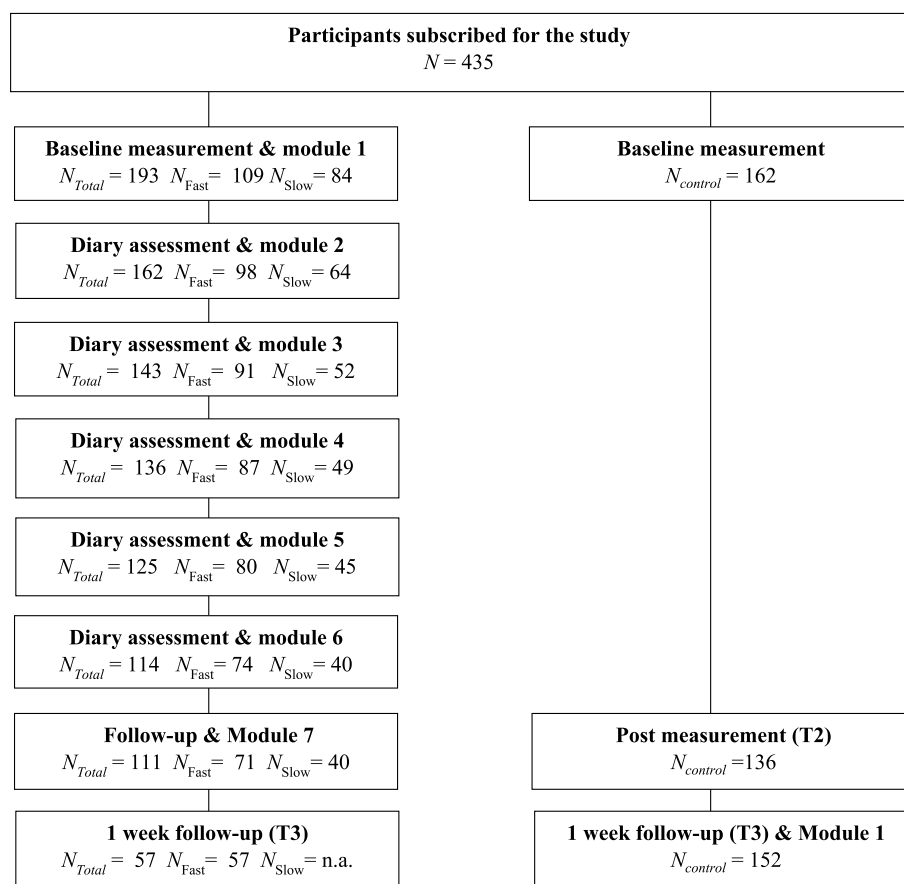
Participants subscribed for the study
$N = 435$

Baseline measurement & module 1	Baseline measurement
$N_{Total} = 193$ $N_{Fast} = 109$ $N_{Slow} = 84$	$N_{control} = 162$

Diary assessment & module 2
$N_{Total} = 162$ $N_{Fast} = 98$ $N_{Slow} = 64$

Diary assessment & module 3
$N_{Total} = 143$ $N_{Fast} = 91$ $N_{Slow} = 52$

Diary assessment & module 4
$N_{Total} = 136$ $N_{Fast} = 87$ $N_{Slow} = 49$

Diary assessment & module 5
$N_{Total} = 125$ $N_{Fast} = 80$ $N_{Slow} = 45$

Diary assessment & module 6
$N_{Total} = 114$ $N_{Fast} = 74$ $N_{Slow} = 40$

Follow-up & Module 7	Post measurement (T2)
$N_{Total} = 111$ $N_{Fast} = 71$ $N_{Slow} = 40$	$N_{control} = 136$

1 week follow-up (T3)	1 week follow-up (T3) & Module 1
$N_{Total} = 57$ $N_{Fast} = 57$ $N_{Slow} = $ n.a.	$N_{control} = 152$

Fig. 1 Retention flow and time schedule of the program

('light version'), the next three modules focused on a deeper understanding and anchoring of need-relevant activities in one's daily life. This was done by asking participant to reflect about need-related obstacles, which was facilitated through the provision of testimonials and an exercise. The training ended with module 7 in which post-measurement questionnaires and reflections about the training as a whole were offered. This program was a slight adaptation of the developed and validated LifeCraft program for the general population (Laporte et al., 2022), for instance, by including student-relevant testimonials or making clear that LifeCraft could be useful during a stressful exam period. A more detailed overview of the intervention is provided in the Supplementary Materials (Table 6).

Participants in both conditions filled out three questionnaires, that is, at baseline (T1), at the end of the training (i.e., one week later; T2) and one week after program completion (i.e., 2 weeks; T3). Questionnaires were sent through e-mail via Qualtrics. Each module (except module 1) started with a short diary questionnaire, measuring the daily need satisfaction and the experiences with executing their action plan of the former module. The waiting list participants did not receive these daily measurements to lower the burden and prevent drop-out.

Participants who had indicated to be interested in WhatsApp received a welcome message, thereby explaining when they would receive the first e-mail and assuring them to feel free to ask any question or drop any comment in the private chat. Throughout the program daily general messages were send to the experimental group (with WhatsApp use) by making use of the 'broadcast list' function on which participants could reply in a private chat. For example, we send the following message at day 2: "Hi, how did the first day of Life-Craft work out for you?".

3.3 Measures

Participants filled out the same battery of questionnaires at all time points, with exception of the demographic and moderator variables. We used the stem 'Last week…' for all outcome variables at all measurement points. The number of items used was limited to reduce the burden for students and to prevent drop-out from the study. Table 1 presents descriptives and Cronbach's alphas of the scales at the different measurement moments.

3.3.1 Demographics

At baseline all participants reported their age, gender, physical complaints, current psychological counselling and whether or not they combined their study with a student job or a professional job (i.e., ' *employment*').

3.3.2 Motivation

Motivation to enrol in the program was measured at baseline. On a 7-point Likert scale ranging from 1 (*not at all*) to 7 (*totally agree*), participants indicated why they participated in the program using one item tapping into controlled motivation ('*because I feel like I have to (from myself or somebody else)*)' and one item tapping into autonomous motivation ('*because I really want to'*). As both items were negatively correlated (i.e., $r = -0.18$, $p < 0.01$), they were subtracted from each other to create a composite score with higher scores reflecting relatively higher autonomous than controlled motives (Sheldon & Kasser, 1998). Both items, which had high face validity, were adapted from the Self-Regulation Questionnaire – Academics (Vansteenkiste et al., 2009), a well-validated questionnaire to assess motivation to study.

3.3.3 Program Engagement

We used the same measure for program engagement as Laporte et al. (2022). Participants in the experimental condition were asked on a daily basis to what extent they had managed to implement their action plan before entering a new module. This question was rated on a 5-point Likert scale ranging from 1 (*completely not performed*) to 5 (*completely performed*). Program engagement was calculated in the same way as in Laporte et al. (2022), that is, after recoding daily scores of 1–3 and 4–5 into, respectively, 0 and 1, these daily scores were added to create a week score ranging from 0–6. Participant were highly engaged if obtained a week score of 4 or more, while they were coded as lowly engaged if they obtained a week score of 3 or less.

Table 1 Descriptive statistics and internal consistencies of key constructs at three time points

	Means			Standard Deviations			Internal Consistencies			Range		
	M_{T1}	M_{T2}	M_{T3}	SD_{T1}	SD_{T2}	SD_{T3}	α_{T1}	α_{T2}	α_{T3}	Min-Max$_{T1}$	Min-Max$_{T2}$	Min-Max$_{T3}$
Need crafting	4.67	4.88	4.89	0.91	0.88	0.85	.81	.83	.81	1.83–7.00	2.00–6.83	1.83–7.00
Need satisfaction	3.35	3.45	3.47	0.59	0.53	0.54	.74	.76	.74	1.33–5.00	2.00–5.00	1.83–4.83
Need frustration	2.92	2.74	2.72	0.63	0.58	0.61	.67	.70	.73	1.33–5.00	1.00–4.50	1.00–4.17
Well-being	2.20	2.32	2.37	0.71	0.70	0.77	.75	.77	.83	1.00–4.00	1.00–4.00	1.00–4.00
Ill-being	2.24	2.05	1.99	0.56	0.58	0.61	.72	.75	.81	1.08–3.92	1.08–3.63	1.00–3.60

T3 variables are based on fast pace group and control condition ($N = 209$)

3.3.4 WhatsApp Use

A categorical score for optional WhatsApp use was created by assigning a score of 0 in case a participant did not make use of WhatsApp, while a score of 1 was used when a participants had sent a single sign.

3.3.5 Need Crafting

Nine items from the Need Crafting Scale (NCS: Laporte et al., 2021a, 2021b) were used to measure need crafting, with three items used per need (e.g. for relatedness '*last week it was clear to me which people love me, and which people I love*'). Items were rated on a 7-point Likert scale ranging from 1 (*completely not true*) to 7 (*completely true*). Prior confirmatory Factor Analysis (Laporte et al., 2021a, 2021b) confirmed a hierarchical structure with awareness and action as first-order components, with the three basic needs serving as second-order factors, and with general need crafting as a third-level overarching factor. Construct validity has equally been demonstrated through positive, yet moderate, associations with related constructs such as mindfulness and pro-active personality (Laporte et al., 2021a, 2021b). The short version of the NCS used in the current study was used successfully in previous research (Laporte et al., 2022). In the current study, the NCS had an average reliability of $\alpha = 0.82$, range across the measurements $= 0.81$–0.83.

3.3.6 Basic Needs

Need based experiences were measured by the 12-item short version of the Basic Psychological Need Satisfaction Need Frustration-scale (BPNSNF; Chen et al., 2015; Mabbe et al., 2018). The internal structure and measurement equivalence of the BPNSNF were confirmed across four countries. In terms of predictive validity, satisfaction of each need was found to uniquely contribute to the prediction of well-being, and frustration of each need was found to uniquely predict ill-being (Chen et al., 2015). The shortened, 12-item version of the BPNSNF scale has been used successfully in previous studies (e.g., Heissel et al., 2019; Schrooyen et al., 2021). Basic need frustration (e.g. "*last week, most things I did felt like "I had to*", for autonomy frustration) and basic need satisfaction (e.g. "*Last week, I felt confident that I can do things well*", for competence satisfaction*)* were both captured by two items per need. Items ranged from 1 (*completely not true*) to 5 (*completely true*) on a 5-point Likert scale. In the current study, need satisfaction had an average reliability of $\alpha = 0.75$, range $= 0.74$–0.76. Need frustration had an average reliability of $\alpha = 0.70$, range $= 0.67$–0.73.

3.3.7 Well-Being

Two indicators of well-being were collected. Participants filled out one item of the Satisfaction with Life Scale (SWLS: Diener et al., 1985; Neyrinck et al., 2006) "*Last week I was satisfied with my life*") and three items (e.g., "*Last week I felt very energetic*") from the Subjective Vitality Scale (SVS; Brenning et al., 2019; Ryan & Frederick, 1997). The SWLS is a widely used instrument showing configural and metric invariances across 26 countries (Jang et al., 2017). The SVS is frequently used as an indicator of psychological well-being, and has been applied to several populations, including university students (Bostic et al., 2000) and athletes (Wang et al., 2023). All items were scored on a 4-point

Likert scale ranging from 1 (*seldom or never*) to 4 (*most of the time or constantly*). A composite score was created by taking the average of the two scale means (Laporte et al., 2022). In the current study, scores for well-being showed an average reliability of α=0.78, range=0.75–0.83.

3.3.8 Ill-Being

Two indicators of ill-being were collected. Participants filled out the 7-item stress subscale from the short-version of the Depression Anxiety and Stress Scale (DASS; Lovibond & Lovibond, 2004; Van der Kaap-Deeder et al., 2019) (e.g., "*Last week it was hard for me to relax*") and a 6-item version of the Center for Epidemiological studies Depression Scale (CES-D: Radloff, 1977; Van Hiel & Vansteenkiste, 2009) (e.g., "*Last week I felt depressed*"). The DASS is a well validated instrument (Yeung et al., 2020) commonly used to assess psychological ill-being (Coker et al., 2018). The CES-D is a highly reliable and well-validated instrument to screen for depression in the general population (Park & Yu, 2021). Items from both scales were scored on a 4-point Likert scale ranging from 1 (*seldom or never*) to 4 (*most of the time or constantly*). A composite score was created by taking the average of the two scale means (Laporte et al., 2022). Scores for ill-being showed an average reliability of α=0.76, range=0.72–0.81.

3.4 Plan of Analysis

To examine the effectiveness of the intervention on the outcome variables (i.e., Hypothesis 1), we compared participants who chose the fast training with participants in the control group. This was done because only participants in the fast track provided a one week follow-up. To test the mediation hypothesis (i.e., Hypothesis 2) and the moderation hypotheses (i.e., Hypothesis 3), we used the entire intervention group (i.e., fast and slow pace combined), which got contrasted with the control group.

Latent change models (i.e., LCMs) were used to test the hypotheses in MPlus 8.7 (Muthén & Muthén, 2017). LCMs allow to estimate the absolute change between different measurement moments (i.e., Time 1, Time 2 and Time 3) of latent variables by taking into account the latent intercepts (i.e., level) and latent slopes (i.e., change over time) (Beyers & Goossens, 2008; De Clercq et al., 2021). The goodness of fit we used to evaluate the LCMs consists of a combination of the Root-Mean-Square Error of Approximation (RMSEA), the Standardized-Root-Square Residual (SRMR) and the Comparative Fit Index (CFI). Values of a RMSEA value below 0.08, a SRMR value below 0.06 and a CFI value of 0.90 or more are indicative of a good model fit (Hu & Bentler, 1999; Kline, 2023). Robust maximum likelihood was used as estimator, which is permissible because a Little's (1988) missing completely at random (MCAR) test returned normed chi-squares of 1.19 and 0.98 for the fast and total group respectively, indicating data is probably missing at random and can be estimated reliably (Bollen, 1989) using the Full Information Maximum Likelihood approach (FIML; Schafer & Graham, 2002). FIML allows for an intention-to-treat approach (Frangakis & Rubin, 1999) which is recommended for randomised controlled trials (Gupta, 2011; Ranganathan et al., 2016).

A first step in building the LCMs involved defining the measurement model, which consists of the latent level and latent change factors (e.g., change from T1-to-T2) for each of the main study variables (i.e., need crafting, need satisfaction, need frustration, well-being, and ill-being). The subscales of the observed variables were used as indicators for their

latent factors, conform the internal consistency approach (Kishton & Widaman, 1994). More specifically, the latent factor 'need crafting' was indicated by the need-specific subscales autonomy, competence, and relatedness crafting. Similarly, the latent factors 'need satisfaction' and 'need frustration' were built with the three need-specific subscales. The latent factor 'well-being' was constructed by the indicators life satisfaction and the mean of vitality, whereas the mean of depressive symptoms and stress served as indicators of 'ill-being'. By comparing the constraint model and unconstraint model of each latent variable, we tested the metric invariance, or in other words, whether the indicators loaded consistently on their latent variable at the different measurement moments (indicating the same meaning of the latent variable across time). Both models were compared by means of the difference in comparative index (DCFI), as suggested by Little (1997), and the significance of the $\Delta\chi^2$ (Reise et al., 1993).

A second step necessary to proceed to hypothesis testing LCMs, was to make sure the study variables showed significant variance in the level and change parameters. We therefore estimated univariate LCMs for all the study variables. Significant variance would be indicative of sufficient variation in the baseline levels and degree of intra-individual change across time.

After establishing an adequate measurement model, we estimated an univariate LCM for every outcome, with each model describing the mean-level change from baseline to post-intervention (i.e., T1-to-T2) and from post-intervention to follow-up (i.e., T2-to-T3), with participation in the intervention or control group serving as the dummy coded predictor (i.e., 0 = control condition; 1 = experimental condition) (i.e., Hypothesis 1).

To test the explanatory role of need crafting (i.e., Hypothesis 2), we built a structural model involving a chain of variables, going from condition assignment to need crafting, from need crafting to need-based experiences (i.e., need satisfaction and need frustration) and from need-based experiences to mental health (i.e., well-being and ill-being). To examine whether additional direct effects would reach significance in this mediational model, we proceeded in a stepwise fashion, thereby adding a single direct path from a predictor to another variable in the sequence (i.e., condition to need-based experiences and mental health, and need crafting to mental health). If these paths did not improve model fit and were not significant, they were left out from the final model. In a last step, we also entered indirect paths from condition assignment to outcomes further in the sequence to examine whether condition effects could be accounted for by the proposed chain of mediating mechanisms.

To shed light on the factors that may moderate the effectiveness of the intervention (i.e., Hypothesis 3), a series of dummy variables was created in a similar manner across moderators. As for program engagement, a first dummy variable contrasted the control group ($N=162$) with the low engagement group ($N=126$, 64.3% of the experimental group), whereas the second dummy variable contrasted the control group with the high engagement group ($N=70$; 35.7% of the experimental group). A similar procedure was used to create two dummies for quality of motivation, depending on participants' score below (i.e., low quality motivation) and above (i.e., high quality motivation) the median (= 4) on the composite score for motivation. The first dummy contrasted the high quality motivation group ($N=89$, 47.6% of the experimental group) with the control group. The second dummy contrasted the low quality group ($N=98$, 52.4% of the experimental group) with the control group. As for *pacing* of the program, two dummy variables were created to compare participants that chose the fast pace (i.e., receiving a module every day) with those who chose the slower pace (i.e., receiving a module every other day). The first dummy variable contrasted the fast group ($N=109$, 56.5%) with the control group and the

second dummy variable contrasted the slow group ($N=84$, 43.5%) with the control group. The last moderator we included in the LCMs was *WhatsApp-use*. A dummy variable was created to compare participants who engaged in WhatsApp with participants who did not engage in WhatsApp. Again, the first dummy variable contrasted the group that made use of WhatsApp use ($N=104$, 53.89%) with the control group, whereas the second dummy variable contrasted the group who did not make use of WhatsApp ($N=89$, 46.11%) with the control group. These different moderators were separately considered in a series of LCMs, thereby thus inserting both contrasts for a given moderator simultaneously.

Drop-out analyses were performed using R version 4.3.1 via a series of logistic regression analyses with drop-out at post-intervention serving as the outcome (0 = not completing T2 assessment and 1 = completing T2 assessment) and type of motivation, self-chosen pacing and optional WhatsApp use serving as the predictors. Prior to the hypothesis testing, background variables (i.e. age, gender, physical complaints, psychological counselling and employment) and baseline differences in the study variables (i.e., need crafting, needs-based experiences, mental health) were examined as predictors in relation to drop-out. Materials and analysis code for this study are available at OSF or by emailing the corresponding author.

4 Results

4.1 Preliminary Analyses

4.1.1 Background Characteristics

A MANCOVA was performed with age, gender, employment, physical complaints, and psychological help serving as independent variables in the prediction of the outcome variables at baseline as dependent variables. A multivariate effect was found for psychological help (Wilks' $\lambda=0.85$, $F(6,346)=8.37$, $p<0.001$) and physical complaints (Wilks' $\lambda=0.93$, $F(6,346)=5;44$, $p<0.001$), but not for age (Wilks' $\lambda=1.00$, $F(6,346)=0.15$, $p=0.98$), gender (Wilks' $\lambda=0.98$, $F(6,346)=1.31$, $p=0.26$) or employment (Wilks' $\lambda=0.96$, $F(6,346)=1.30$, $p=0.23$). Subsequent univariate tests revealed that physical complaints were positively related to need frustration ($b=0.11$; $F(1,357)=12.16$; $p<0.001$) and ill-being ($b=0.16$; $F(1,351)=31.37$; $p<0.001$). Having received psychological help now and/or in the past was related to lower need crafting ($b=-0.38$; $F(1,357)=10.85$; $p<0.001$), lower need satisfaction ($b=-0.26$; $F(1,357)=12.45$; $p<0.001$), higher need frustration ($b=0.45$; $F(1,357)=34.42$; $p<0.001$), lower well-being ($b=-0.41$; $F(1,357)=21.30$; $p<0.001$) and higher ill-being ($b=-0.40$; $F(1,357)=33.84$; $p<0.001$). All primary analyses were therefore controlled for psychological help and physical complaints.

4.1.2 Correlations

Correlations between the study variables are presented in Table 2 and are consistent with theoretical assumptions. Need crafting correlated positively with need satisfaction and well-being and negatively with need frustration and ill-being within each measurement moment. These correlates were also observed across measurement waves, with rank-order stability coefficients of corresponding measures across time being all significant. As for the motivation to participate in the training, it was positively correlated with desirable

Table 2 Correlations between measured constructs

	M	SD	1	2	3	4a	5a	6a	7a	8a	9b	10b	11b	12b
*Moderators**														
1 Quality of motivation	−.10	1.54												
2 Engagement in days	2.58	1.86	.22**											
3 WhatsApp use in signs	269.52	467.64	.09	.30**										
T1 outcome variables														
4a Need crafting	4.66	.91	.33**	.31**	.08									
5a Need satisfaction	3.35	.59	.21**	.15*	.11	.65***								
6a Need frustration	2.92	.63	−.23**	−.13	.00	−.49***	−.71***							
7a Well-being	2.20	.71	.27**	.12	−.07	.55***	.65***	−.55***						
8a Ill-being	2.24	.56	−.28**	−.16*	−.02	−.44***	−.57***	.63***	−.52***					
T2 outcome variables														
9b Need crafting	4.88	.88	.20*	.44**	.10	.50***	.40***	−.33***	.38***	−.27***				
10b Need satisfaction	3.45	.53	.27**	.37***	.04	.50***	.61***	−.51***	.53***	−.45***	.65***			
11b Need frustration	2.74	.58	−.22*	−.36**	−.07	−.36***	−.56***	.57***	−.43***	.50***	−.50***	−.73***		
12b Well-being	2.32	.70	.24*	.34**	−.02	.41***	.56***	−.46***	.67***	−.43***	.49***	.66***	−.59***	
13b Ill-being	2.05	.58	−.26*	−.24*	−.02	−.33***	−.50***	.50***	−.41***	.75***	−.38***	−.61***	.65***	−.55***

*Moderators are only applied to the experimental condition; Correlations apply to the total sample and are therefore limited to T1 and T2

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

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outcomes (i.e., need crafting, need satisfaction, well-being) and negatively with undesirable outcomes (i.e., need frustration, ill-being) across the measurement moments. Program engagement yielded a similar pattern of correlates, although the associations were, as can be expected, strongest for the T2 assessments. In contrast, WhatsApp use did not correlate with any outcome across time.

4.1.3 Baseline Differences

A MANOVA was conducted to examine baseline differences between the experimental and control condition, with condition as fixed factor and the study variables at baseline and the continuous background characteristics (i.e., age and physical complaints) as dependent variables. The overall multivariate effect of condition was non-significant (Wilks's $\lambda = 0.99$, $F(7, 344) = 0.66$, $p = 0.70$). Next, chi-square tests indicated both sexes were equally spread over both conditions ($\chi^2(1) = 0.41$, $p = 0.52$), employment ($\chi^2{}^2(1) = 0.09$ $p = 0.96$) and that participants who received or still receive psychological help ($\chi^2(1) = 0.24$ $p = 0.63$). Taken together, these results suggest that the participants in the experimental and control group did not systematically differ from each other, suggesting that the randomization was successful.

4.1.4 Measurement Model

The measurement model yielded an adequate fit (CFI = 0.88; RMSEA = 0.06; SRMR = 0.08). With a DCFI of 0.001 and a non-significant χ^2 difference, the measurement model was found to be longitudinally invariant, suggesting that the meaning of the latent variables did not differ across the three measurement moments and that the latent variables were adequately represented by their respective indicators. Next, as shown in Table 3, both the level and change parameters show significant variance for the baseline levels and change parameters. This means that there was heterogeneity in participants' baseline scores and intra-individual change across time in all of the studied variables. The only exception was change in need crafting from T2 to T3, which did not indicate sufficient variance. As a result, this parameter cannot be interpreted.

4.2 Primary Analyses

As can be noticed in Table 4 and Fig. 2, the results of LCMs indicates that intervention predicted a significant change from T1 to T2 on all study variables, with this change being maintained in the transition from T2 to T3. Specifically, students in the intervention, relative to the control group, reported an increase in need crafting, need satisfaction, and well-being, and a decrease in need frustration and ill-being. These findings confirm Hypothesis 1.

To examine whether need crafting serves as the explanatory mechanism of the program (i.e., Hypothesis 2) we built a serial mediation model (RMSEA = 0.06, CFI = 0.88, SRMR = 0.07). As shown in Fig. 3, intervention participation related positively to change in need crafting, which, in turn, related to change in need satisfaction (positively) and change in need frustration (negatively). Changes in need-based experiences related to mental health, with need satisfaction being positively related to a change in well-being and need frustration being positively related to a change in ill-being. The stepwise insertion of direct effects did not improve model fit such that the fully mediated model in Fig. 3

Table 3 Parameter estimates and fit indices of the univariate latent change models

	Level		Change T1-to-T2		Change T2-to-T3		Fit Indices		
	M	s^2	M	s^2	M	s^2	RMSEA	CFI	SRMR
Need crafting	4.64 (.055)***	.42(.063)***	.18(.051)**	.26(.075)**	−.02(.057)	.11(.103)	.06	.95	.11
Need satisfaction	3.19 (.036)***	.18 (.025)***	.10 (.024)**	.10(.024)***	.02 (.034)	06 (.060)*	.02	1.00	.08
Need frustration	3.14(.045)***	.27(.036)***	−.17(.037)***	−.17(.037)***	−.03(.041)	.11(.040)**	.05	.96	.08
Well-being	2.39(.045)***	.46(.042)***	.14(.038)***	.22(.036)***	.05(.045)	.15(.042)***	.06	.99	.02
Ill-being	2.09(.031)***	.20(.022)***	−.16(.024)***	.09(.015)***	−.05(.029)	.07(.017)***	.02	1.00	.02

RMSEA = Root mean square error of approximation; CFI = Comparative fit index; SRMR = Standardized root mean square residual

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

Table 4 Univariate latent change models of program effects

	Exp	Controle	Change T1-to-T2		Change T2-to-T3		Fit Indices			Effect size
	T1 M (sd)	T1 M (sd)	Level	Condition	Level	Condition	RMSEA	CFI	SRMR	Unique R^2
			β(SE)	β(SE)	β(SE)	β(SE)				
Need crafting	4.70(.88)	4.80(.78)	−.40(.178)*	.57(.111)***	.35(.592)	−1.13(.478)	.06	.94	.12	.49
Need satisfaction	3.35(.58)	3.43(.56)	−.68(.099)***	.30(.080)**	.14(.420)	−.06(.229)	.04	.97	.11	.33
Need frustration	2.91(.64)	2.84(.60)	−.73(.136)***	−.30(.094)**	.66(.515)	.02(.212)	.04	.97	.08	.38
Well-being	2.20(.67)	2.24 .67	−.42(.125)**	.21(.105)*	.28(.155)*	−.03(.130)	.04	.99	.03	.14
Ill-being	2.22(.54)	2.25(.61)	−.26(.147)	−.34(.087)***	−.09(.174)	−.05 (.121)	.00	1.00	.03	.14

RMSEA = Root mean square error of approximation; CFI = Comparative fit index; SRMR = Standardized root mean square residual
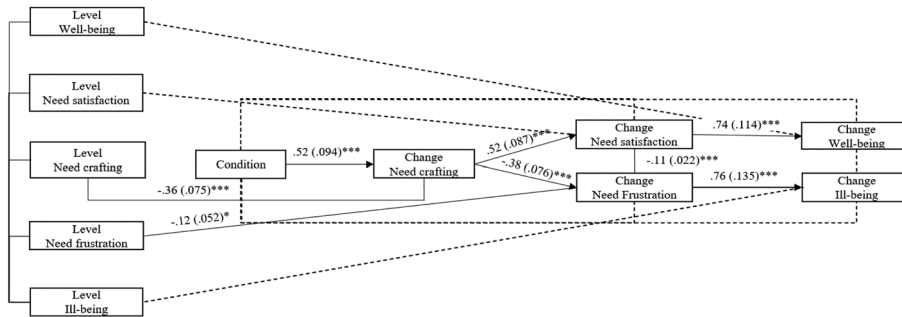
***$p < .001$, **$p < .01$, *$p < .05$
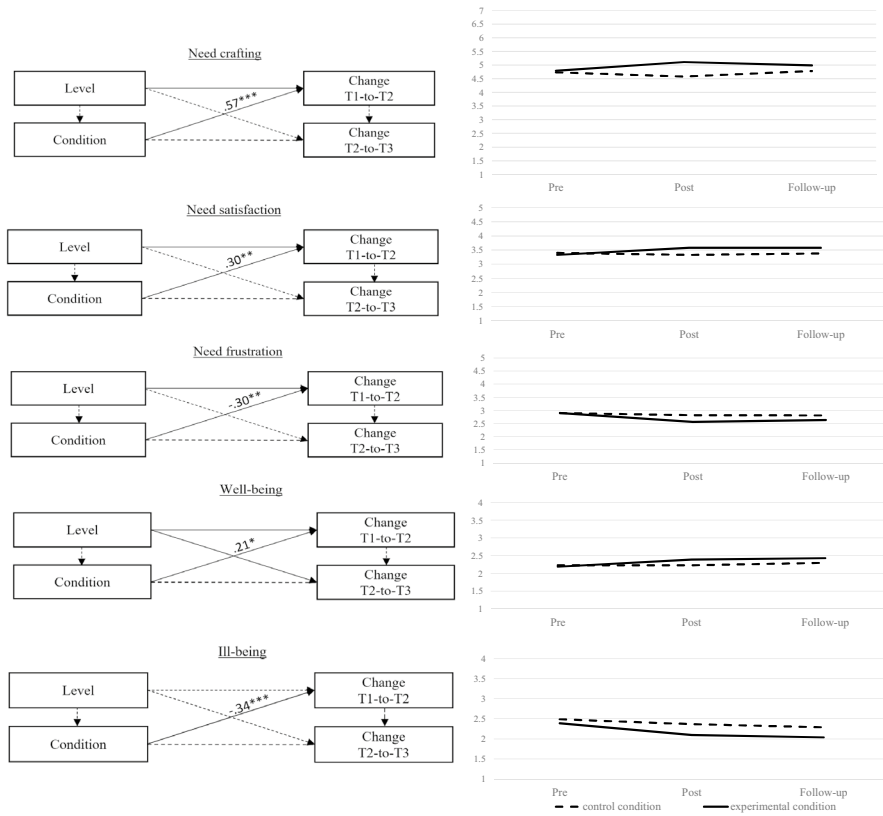
Fig. 2 Univariate Latent Change Models (Hypothesis 1)

Latent Change Mediation Model (Hypothesis 2)

provides the most parsimonious representation of the data. All indirect pathways of this model were significant. An increase in need crafting due to the program accounts for the association with increased need satisfaction ($b=0.27$, SE$=0.059$, $p<0.001$) and decreased need frustration ($b=-0.20$, $SE=0.050$, $p<0.001$). In addition, the indirect path from a

change in need crafting to a T1-to-T2 change in well-being is mediated by the T1-to-T2 change in need satisfaction ($b=0.39$, $SE=0.074$, $p<0.001$), just as the T1-to-T2 change in ill-being is mediated by the T1-to-T2 change in need frustration ($b=-0.29$, $SE=0.064$, $p<0.001$). Lastly, the complete sequence from condition to a change in well-being via a change in need crafting and a change in need satisfaction ($b=0.20$, $SE=0.045$, $p<0.001$) and from condition to a change in ill-being via a change in need crafting and need frustration were significant ($b=0.15$, $SE=0.041$, $p<0.001$).

The findings of the four factors that potentially moderate the intervention effects (i.e., Hypothesis 3) are presented in Table 5. Across all moderators and outcomes, fit indices of tested models were satisfactorily. Overall, there was little systematic evidence for moderation, except for the role of engagement. The intervention was found to be significant among both lowly and highly engaged participants in two of the five outcomes (i.e., need crafting and ill-being) and yielded an additional significant effect on the three other outcomes in the highly engaged group. Further, both highly and lowly autonomously motivated participants benefitted from the intervention in four of the five outcomes, with a non-significant effect being observed for well-being in both groups relative to the control group. As for pacing, participants in both tracks reported improved need crafting and need satisfaction and reduced ill-being compared to the control group. The effects for the two other outcomes were inconsistent, with the fast group additionally reporting a decrease in need frustration and the slow group additionally reporting an increase in well-being. Finally, WhatsApp use did not alter the effectiveness of the intervention in four of the five outcomes, except for well-being. Those not making use of WhatsApp reported additionally increased well-being compared to the control group. Apart from these moderation effects, a main effect for baseline differences in motivation was obtained, with highly autonomously motivated persons reporting higher well-being and lower ill-being compared to the control group across the intervention and lowly autonomously motivated persons reporting lower need crating and higher need frustration compared to the control group across the intervention.

Finally, an initial logistic regression analysis indicated that drop-out was not predicted by any of baseline variables, χ^2 (5, $N=192$) $=1.31$, $p=0.25$. Further, drop-out was unrelated to any of the background variables (i.e., gender, age, employment, physical complaints and received/receiving psychological help), χ^2 (5, $N=192$) $=4.47$, $p=0.49$. Yet, when introducing quality of motivation, optional WhatsApp use and self-chosen pacing an overall significant effect was observed, χ^2 (3, $N=192$) $=8.02$, $p<.$ 01. The chance to drop-out from the intervention was higher for less autonomous motivated participants (odds ratio [OR] $=0.51$, $p<0.05$), among those not making use of WhatsApp (OR $=0.26$, $p<0.001$) and those participants choosing the slow pace (OR) $=0.76$, $p<0.05$).

5 Discussion

Prior research within Self-Determination Theory (Ryan & Deci, 2017) has provided convincing evidence for the role of basic needs in the prediction of students' motivation, growth, and wellness and for the role of contextual need supports in the prediction of enhanced need satisfaction (e.g., Koestner et al., 2020). Yet, what has been under-examined is the question whether students themselves can steer their own need-based functioning, with resulting positive effects for their mental health. The aim of the present study was to test the effectiveness of an online intervention entitled 'LifeCraft' that aims to support students in their capacity for need crafting (Laporte et al., 2021a, 2021b, 2022). Apart from

Table 5 Latent change models with moderators

	High	Low	Level		Change T1-to-T2		Fit Indices		
	T1 M (sd)	T1 M (sd)	High	Low	High	Low	RMSEA	CFI	SRMR
			β(SE)	β(SE)	β(SE)	β(SE)			
Engagement									
Need crafting	4.92 (.94)	4.47 (.95)	.13(.077)	−.14(.074)	.37(.074)***	.37(.122)**	.04	.97	.08
Need satisfaction	3.40(.60)	3.32(.60)	.00(.074)	−.05(074)	.34(.104)***	.23(.128)	.03	.98	.07
Need frustration	2.88(.70)	2.94(.60)	−.00(.074)	.04(.066)	−.28(.079)***	−.13(.105)	.04	.97	.05
Well-being	2.32(.72)	2.19(.74)	.10(.062)	.03(.063)	.16(.070)*	.11 (.101)	.00	1.00	.02
Ill-being	2.15(.52)	2.24(.55)	−.07(.057)	−.01(.063)	−.23(.072)**	−.27(.090)**	.04	.99	.03
Quality of motivation									
Need crafting	4.83(.97)	4.50(.81)	.13(.079)	−.15(.072)*	.39(.082)***	.39(.117)**	.02	.99	.07
Need satisfaction	3.46(.61)	3.26(.55)	.10(.073)	−.01(.076)	.39(.113)**	.24(.122)*	.03	.98	.06
Need frustration	2.79(.62)	3.04(.61)	−.09(.067)	.16(.069)*	−.25(.082)**	−.21(.104)*	.03	.98	.05
Well-being	2.37(.73)	2.04(.66)	.17(.062)**	−.05(.062)	.14(.082)	.16(.088)	.00	1.00	.02
Ill-being	2.14(.51)	2.34(.60)	−.14(.053)**	.07(.067)	−.28(.067)***	−.23(.092)*	.04	.99	.03
	Fast	Slow	Fast	Slow	Fast	Slow	RMSEA	CFI	SRMR
	T1 M (sd)	T1 M (sd)	β(SE)	β(SE)	β(SE)	β(SE)			
Pace									
Need crafting	4.75(.84)	4.55(.98)	.03(.071)	−.10(.083)	.42(.093)***	.39(.106)***	.02	.99	.06
Need satisfaction	3.38(.57)	3.31(.62)	−.02(.073)	−.04(.077)	.32(.110)**	.31(.111)**	.04	.97	.07
Need frustration	2.88(.62)	2.96(.63)	.00(.070)	.05(.069)	−.27(.082)**	−.18(.106)	.04	.96	.05
Well-being	2.22(.57)	2.18(.76)	.04(.060)	.08(.067)	.12(.075)	.21(.097)*	.01	1.00	.03
Ill-being	2.23(.57)	2.24(.55)	−.05(.062)	−.02(.062)	−.24(.081)**	−.29(.074)***	.05	.99	.03

Table 5 (continued)

	Use T1 M (sd)	No use T1 M (sd)	Use β(SE)	No use β(SE)	Use β(SE)	No use β(SE)	RMSEA	CFI	SRMR
WhatsApp use									
Need crafting	4.70(.87)	4.62(.94)	.04(.074)	−.09(.080)	.40(.089)***	.38(.102)***	.02	1.00	.06
Need satisfaction	3.35(.61)	3.36(.59)	.01(.071)	−.08(.072)	.26(.09)**	.29(.090)**	.04	.97	.07
Need frustration	2.89(.60)	2.93(.67)	.02(.068)	.03(.072)	−.22(.085)**	−.23(.105)*	.05	.94	.06
Well-being	2.18(.72)	2.22(.71)	.05(.062)	.07(.064)	.07(.076)	.28(.092)**	.00	1.00	.02
Ill-being	2.23(.53)	2.25(.60)	−.03(.062)	−.03(.062)	−.24(.075)**	−.29(.091)**	.05	.99	.03

RMSEA = Root mean square error of approximation; CFI = Comparative fit index; SRMR = Standardized root mean square residual

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

examining whether students facing a stressful exam during the COVID-19 crisis would benefit from such an intervention, we also sought to shed light on diverse participant (i.e., motivation; engagement) and program characteristics (i.e., pacing; WhatsApp use) that can moderate the effectiveness of the intervention and that can account for participants' drop-out from the intervention. Several interesting findings emerged.

5.1 Key Findings

The current study provides promising evidence for the effectiveness of the student-adapted version of LifeCraft. As hypothesized, the online intervention yielded a beneficial effect across the different assessed outcomes, some being situated more proximally to the training content (e.g., need crafting, need-based experiences) and others being more distal to the content (i.e., well-being and ill-being). Process analyses further indicated that, as theoretically expected, an increase in need crafting accounted for the efficacy of the training and, hence, served as an explanatory or driving mechanism. Specifically, serial mediation analyses showed that improvements in need-based experiences due to enhanced need crafting accounted for a positive change in well-being and for a reduction in ill-being, thus confirming Hypothesis 2.

These findings are congruent with and extend prior work in a number of ways. First, while Laporte et al. (2022) reported that LifeCraft is effective in adults, the present study extends this work to university students, who were exposed to an exam period during COVID-19 restrictions. These more troubling circumstances may help to account for the effectiveness of LifeCraft as previous research shows that people at risk tend to benefit more of an intervention that aims to increase their mental health (Hoorelbeke et al., 2022; Stice et al., 2009). Indeed, different from Laporte et al. (2022), who reported that engagement fully qualified the intervention effect, with *only* highly engaged participants benefiting from the training (see also Sheldon et al., 2010), the present study suggests that even lowly engaged individuals benefit in terms of improved need crafting and reduced ill-being. As low engagement denotes only a minimal participation in the daily need crafting activities (i.e., less than 3 days a week), it suggests that even a minimal dose of need crafting could suffice to generate some benefits.

Second, whereas prior studies suggest that a momentary reactivation of need-satisfying memories, presumably primarily affecting the awareness component (Cantarero et al., 2021), and the daily engagement in need-conducive activities, presumably affecting the action component of need crafting (Behzadnia & FatahModares, 2020, 2023; Weinstein et al., 2016), yield immediate well-being effects, the present study indicates that the obtained benefits of need crafting lasted for at least one week. Said differently, the benefits of increased need crafting are not short-lived or fleeting. In future research, a longer time frame, ideally with booster activities built in between, needs to be considered to shed light on the long-term effects of the intervention.

Third, the present study addressed, for the first time, the role of motivational differences, both as moderators and as predictors of attrition. Motivational differences did not moderate the effectiveness of the intervention, suggesting that even lowly motivated individuals benefit from LifeCaft. It should be noted though that the difference between the two groups in terms of motivation was rather small, as both groups scored high on autonomous motivation, with one of both groups scoring additionally high on controlled motivation. Thus, differences reflected a difference in quality of motivation for intervention participation. At the same time, many students who seek help may display such a mixed motivational profile.

The fact that even those individuals benefit from an online training program that requires substantial energy to go through and persist independently is remarkable in its own right.

Although motivational differences did not qualify the intervention effects, they mattered in two other ways, with, first, more autonomously motivated participants reporting more adaptive functioning across the intervention and, second, being less likely to drop out of the program. Instead, participants with relatively lower autonomous motivation engaged in less need crafting and experienced higher need frustration throughout the intervention compared to control group participants. The premature attrition among individuals with low autonomous motivation is consistent with prior work in other life domains (e.g., education; Vansteenkiste et al., 2005) and *indirectly* suggests that LifeCraft is less effective for them. All in all, the findings underscore the claim that moving towards enhanced well-being involves not only a proper way but also the will to do so (Lyubomirsky et al., 2011).

Fourth, two other program characteristics were further, that is, the self-chosen pacing, with some participants going through the program in one week and others in two weeks time, and the offer of optional use of WhatsApp support. The findings are also nuanced in this case. None of these program characteristics had a main effect on the assessed outcome, nor did they impact the effectiveness of the intervention. Possibly, the lack of a moderating role for both program characteristics may be due to their self-chosen or volitional nature. Instead, both characteristics yielded an unique effect on premature drop-out from the training, with those who chose to go through the program in a single week and making use of WhatsApp being less likely to drop-out (Fast pace; 64,6%, WhatsApp use 68,1% retention) compared to those who spread program participation across 14 days and did not send any text message via WhatsApp (Slower pace; 35,4%, No WhatsApp use 31,9% retention).

Although the overall drop-out rate in the current study was lower (42%) than in the Life-Craft intervention among adults (Laporte et al., 2022; 76%), Behzadnia and FatahModares (2020, 2023) reported even lower drop-out rates in their self-support programs (i.e., respectively 22% and 13%). As the circumstances (i.e., exams and COVID-19) and the target group (i.e., students) were the same in the present study and the study by Behzadnia and FatahModares (2023), future research could concentrate on other factors that might impact the difference in drop-out rate, including cultural differences, the recruiting method (open i.e., subscription versus introduction by own teacher) and delivery method (i.e., e-mail links versus WhatsApp). Potentially, these factors may impact the motivation of participants to enroll in the training, which is precisely a factor impacting attrition, as shown herein.

5.2 Practical Implications

The present findings have important practical implications. As students have been observed to report increasing internalizing problems over the past few years (Booth et al., 2016) and find themselves in a life stage that entails both opportunities and threats to their basic needs (Ratelle & Guay, 2023; Soenens & Vansteenkiste, 2023), it seems useful to disseminate LifeCraft on a larger scale among student populations. To prevent students from dropping out prematurely, it seems critical to address their motivation prior to participation, perhaps in a separate module that precedes participation in LifeCraft. A psycho-educational component on the motivational differences in combination with an activity that fosters greater motivational awareness may help students in making more well-informed decisions to participate in the training, temporarily postpone the training or not participate at all. Although a slower pace came with a greater probability of dropping out, the question is whether

the pacing needs to be imposed or, alternatively, interested students can be informed on the present findings that a slower pace (although perhaps better fitting their schedule) also comes with a greater risk for premature drop-out. By building in a meaningful rationale for the faster rhythm, students may more easily and volitionally select this program, with resulting benefits for their retention.

5.3 Limitations and Future Directions

As the (intervention) research on need crafting is still in its infancy, the present study is in need of replication and extension to overcome some of its limitations. First, it is instructive to examine whether the effects observed herein would generalize to different periods in the academic year (e.g., teaching semester instead of exams), would hold across different age groups (e.g., secondary education) and to participants with different personalities (see Mabbe et al., 2018) and would be sustained across longer periods of time (e.g., 6 month follow-up).

Second, as a passive control group was included only, the question needs to be addressed whether LifeCraft comes with higher benefits when compared with an active control condition. An active control group could for instance focus on the improvement of students' executive functioning, which was found to enhance resilience and decrease depressive symptoms (e.g. Hoorelbeke et al., 2021, 2022; for a review see Diamond & Ling, 2016). The inclusion of such an active control group helps to address the shortcomings of a waiting list condition. Although waiting lists eventually enable the provision of care and therefore have ethical advantages (Cunningham et al., 2013), they may overestimate intervention effects as participants in the waiting list condition may compliantly 'wait' to change (Miller & Rollnick, 2002).

Third, by building in choice around pacing and WhatsApp use, we could not disentangle the role of choice on the one hand and the role of pacing and WhatsApp differences on the other hand. As both variables get confounded, future research could manipulate the effects of pacing (slow vs. fast) and choice (i.e., optional vs. imposed) in a 2×2 design, with participants thus selecting themselves or randomly assigned to a fast versus slow pace. A similar method could be used for WhatsApp use. Perhaps even more promising is the development of a hybrid version of LifeCraft, with participants being guided, either individually or in group, by a counselor during the first and last session but following the other sessions via e-health trajectory (as was the case herein). Such hybrid versions may form a more feasible alternative to the support via WhatsApp, which required the researcher to be ongoingly available during the intervention to provide support and address questions.

Finally, the present study made use of self-reported data only, which may be subject to response biases and socially desirable responding. Although the key variables in this study require a subjective appraisal, outcomes could also be assessed via ratings (e.g., best friend or parents; Ahmad et al., 2013) or objective markers, including cortisol secretion (Reeve & Tseng, 2011).

6 Conclusion

Student life is a developmental period replete with opportunities for increasing autonomy, relatedness, and competence satisfaction, as diverse developmental tasks center around these need dynamics (Soenens & Vansteenkiste, 2023). Although students are not merely

recipients of contextual need supports, they may also need some guidance to craft their own life in the service of improved need satisfaction. The present study indicates that a short online training program (LifeCraft) targeting the skill of need crafting, is a promising e-health tool that can aid students to enhance need satisfaction and well-being during a stressful period. To maximize its benefits, students do well to consider their motivation, as especially autonomously motivated individuals are likely to persist their efforts to engage in need crafting and, hence, are more likely to benefit from the program. At the organizational level, universities can optimize training persistence by offering the short track (i.e., one week) of the training and implementing some form of interactive support as students go through the program.

Declarations

Conflict of interest We have no known conflict of interest to disclosure.

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