

ARTICLE

# Subjective wellbeing and emotion regulation strategies: How are they associated with student engagement in online learning during Covid-19?

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**Abstract**

**Background:** The COVID-19 pandemic has brought unprecedented challenges to the world, creating significant impact on people's lives and subjective wellbeing. While previous studies have shown that students' wellbeing and how they manage their emotions are critical to students' learning, less research has considered their specific impacts on student engagement in online learning.

**Aims:** The aim of this study is to examine how students' subjective wellbeing and emotion regulation strategies (viz cognitive reappraisal and expressive suppression) are associated with student engagement in online learning during the pandemic.

**Sample:** A total of 965 students from a university in China participated in the study.

**Methods:** The data were collected online during the COVID-19 from March to July 2020, which included measures of wellbeing, emotion regulation strategies, and online learning engagement.

**Results:** Structural equation modelling results showed that wellbeing was positively associated with both the use of reappraisal and suppression. Moreover, mediation analysis showed that reappraisal partially mediated the relationship between wellbeing and all types of online learning engagement (including cognitive, emotional and behavioural engagements). Conversely, suppression was found to have a

small mediating effect between wellbeing and behavioural engagement of online learning only. No such effect was found on cognitive and emotional engagements.

**Conclusions:** The findings provide evidence on the positive relationship between wellbeing and both the strategies of suppression and reappraisal during the pandemic. However, only reappraisal has positive impact on learning, suggesting the importance of effective regulation strategies on students' online engagement. Theoretical and practical implications of the findings are discussed.

#### KEYWORDS

COVID-19, emotion regulation, online learning, student engagement, wellbeing

## INTRODUCTION

The COVID-19 pandemic has brought unprecedented challenges to the world, creating a drastic impact on people's lives and subjective wellbeing. Amid the changes of social distancing, isolation, and financial uncertainty, there is also a heightened degree of stress, uncertainty, and anxiety aroused (Qiu et al., 2020; Zacher & Rudolph, 2020). In the education landscape, the pandemic has also created tremendous changes to students' learning, giving rise to online learning at home due to the forced closure of schools and universities. While previous studies have shown that students' wellbeing and how they manage their emotions are critical to students' learning (Brady et al., 2018; Datu & King, 2018), less research has considered their specific impacts on student engagement in online learning, which is believed to be the future trend of learning. Hence, the aim of this study is to examine how students' subjective wellbeing and their emotion regulation strategies (viz. cognitive reappraisal and expressive suppression) are associated with their online learning engagement at home during this unprecedented time of COVID-19.

### Subjective wellbeing and student engagement in online learning

Subjective wellbeing is a broad term, which refers to the subjective evaluation of one's life and emotional experiences (Diener et al., 2017). Hence, it includes both the cognitive and affective dimensions. The cognitive dimension pertains to one's evaluation of contentment with life (e.g., life satisfaction), while the affective dimension is related to the emotional experiences that reflect an individual's overall evaluation of life [including positive affect (e.g., enjoyment and gratitude) and negative affect (e.g., worry and sadness)] (Diener et al., 2018).

As to student engagement, it is widely agreed as crucial for student success (Zhoc et al., 2020; Boulton et al., 2019). Notwithstanding its varied definitions, the student engagement model proposed by Fredricks et al. (2004) is one of the models that has received the most attention. According to Fredricks et al. (2004), student engagement is comprised of (i) behavioural engagement (i.e., active participation in academic-related tasks), (ii) emotional engagement (i.e., positive feelings experienced when performing academic-related tasks) and (iii) cognitive engagement (i.e., investment of mental energy and effort in thinking and learning).

The relationship between wellbeing and student engagement in online learning is still an underexplored area. Having said that emotions experienced in the learning process were found to account for

37% of the variance in student achievement in online courses (Chan et al., 2014). Indeed, wellbeing is central to learning. Many studies have shown that students' wellbeing and engagement, as well as academic success, are closely intertwined (Heffner & Antaramian, 2016; Pipere & Mierina, 2017; Plominski & Burns, 2018). More specifically, there is accumulative research evidence showing that individuals' wellbeing affects not only their academic performance but also their attitudes, behavior, and level of engagement (Boulton et al., 2019; Roberts, 2010). For example, individuals with high wellbeing and low psychopathology were found to have the highest levels of engagement and GPA (Antaramian et al., 2010). Moreover, subjective wellbeing was found to have a positive relationship with cognitive engagement and academic engagement in schools (Datu & King, 2018; Lewis et al., 2011). Conversely, negative wellbeing factors were found to have a substantial adverse effect on students' learning performance and engagement (Thorley, 2017).

## Emotion regulation strategies mediate wellbeing and student engagement in online learning

### Emotion regulation strategies and wellbeing

Emotion regulation refers to the various ways that “we influence which emotions we have, when we have them, and how we experience and express them” (Gross, 2002, p. 282). The ability to regulate emotions is positively associated with wellbeing (Cote et al., 2010; Gross, 2015; Korpela et al., 2018). Through the emotion regulation mechanism of reducing, strengthening, or maintaining the experience of positive or negative emotions, it, indeed, helps individuals to better cope with environmental demands or meet their current needs or goals (Gross, 2014; Kobylnska & Kusev, 2019).

There are varied ways of emotion regulation, with cognitive reappraisal and expressive suppression as the two most commonly used emotion regulation strategies. While cognitive reappraisal regulates emotions by changing the meaning of a situation so as to modify its emotional impact, expressive suppression aims at modifying emotional responses by consciously inhibiting emotional expression (Gross, 2002).

Many studies have shown that the use of cognitive reappraisal is positively associated with wellbeing as reflected in its related indicators, such as life satisfaction, mental health, and social functioning (Aldao et al., 2010; Gross, 2015; Guassi Moreira et al., 2020). In contrast, the use of suppression is associated with negative wellbeing outcomes, such as lower life satisfaction, mental health problems (e.g., depression and anxiety), decreased experience of positive emotions, and problems in social interactions (Beblo et al., 2012; Chervonsky & Hunt, 2017, 2019; Hu et al., 2014).

Although research findings generally support cognitive reappraisal as more adaptive and “healthier” than suppression, it is not a complete picture, as the use and effect of emotion regulation strategies are subject to the social context and cultural factors (English et al., 2017; Kobylnska & Kusev, 2019). Indeed, in Asian collectivist culture, which values interpersonal harmony, suppression was found to be more frequently used by people than in other cultural groups, as emotional control and restraint are the social norms that are encouraged (Butler & Gross, 2009; Soto et al., 2011). Moreover, suppression was found to be used more often in the presence of others, which may be related to the social motives of self-presentation to be emotionally controlled and behaved to meet the social goals of maintaining social harmony (English et al., 2017). In this relation, suppression was not found to be associated with poorer psychological functioning and negative consequences in the collectivist cultures (Soto et al., 2011). As explained by Niedenthal et al. (2006), suppression may have functional values that serve to facilitate social interaction by avoiding interpersonal conflicts and the spread of negative emotions as well as protecting one from criticism and negative judgment of others. It is noteworthy that while the cultural difference was found to exist regarding expression and suppression of emotions, no such difference was found for cognitive reappraisal (Soto et al., 2011).

In view of the above, we hypothesize that subjective wellbeing would be positively associated with cognitive reappraisal and also with suppression. It is having regard to the consideration that the study was conducted in the context of COVID-19 and among samples with the Chinese culture. Indeed, owing to the lockdown, individuals experience higher levels of stress due to the extended confinement and lack of personal space, which increase interpersonal pressure at home. It, to a certain extent, could be reflected in the increasing rates of divorce and domestic violence since the outbreak of COVID-19, as reported in many places, including China (Flies, 2020; Miltimore, 2020; Wray, 2020). Hence, it is likely that individuals would adopt multiple strategies to help emotion regulation, including suppression. Moreover, the use of suppression is driven more by the social concern to avoid conflicts and maintain interpersonal harmony, which in turn, promotes wellbeing.

## Emotion regulation strategies and student engagement in online learning

The emotion regulation strategies of cognitive reappraisal and suppression are with major differences in their psychological and cognitive impacts, which in turn, affect learning differently. As explained by Gross's (1998) process model of emotion regulation, emotion regulation strategies that intervene earlier in the emotion-generative process are more effective than strategies that occur later. In short, intervention works the best before the elicitation of emotions.

More specifically, suppression is a response-focused strategy, which primarily modifies the behavioural expression of the emotional response, but not the experiential component of the emotion. Since this strategy only occurs after the elicitation of emotion, it is not effective in decreasing the negative emotion experienced, which may remain lingered and accumulated in an individual that requires conscious effort to manage the unresolved emotions that keep arising. The continual consumption of cognitive resources for self-monitoring and controlling emotion inevitably reduces the cognitive resources available for optimal performance in other areas, such as learning (Gross, 2002, 2014). On the contrary, cognitive reappraisal is an antecedent-focused strategy, which intervenes before the elicitation of the emotional response by reconstructing the meaning of the emotion-elicited situation. It, thus, helps to change the subsequent emotion experienced without consuming much cognitive energy, leaving more cognitive resources for the downstream performance of other cognitive activities.

There is supporting evidence that the use of cognitive reappraisal was associated with higher engagement and academic performance (Brady et al., 2018; Leroy et al., 2012). For example, Jamieson et al. (2016) found that students who used reappraisal had better exam performance and perceived ability in coping with the demands of the exam. Aside from this, students who used reappraisal were found to have lower levels of school burnout, whereas those who used suppression were found to have higher levels of school burnout. School burnout was related to lower GPA and increased absenteeism, an indicator of disengagement (Seibert et al., 2017). Indeed, so far, few studies have examined how suppression is related to learning, which is a research gap that would also be addressed in this study.

Given the theoretical and empirical ground set out above, we hypothesize that the use of reappraisal will be associated with better engagement in online learning. No such effect will be observed for the use of suppression. Altogether, subjective wellbeing will be positively associated with both the use of suppression and reappraisal. However, only the use of reappraisal will be positively related to student engagement in online learning. In other words, reappraisal will mediate between wellbeing and online learning engagement, but not suppression.

## The present study

The aim of the present study was to examine how students' subjective wellbeing and emotion regulation strategies (viz. cognitive reappraisal and expressive suppression) are associated with their engagement in online learning during COVID-19.

Taking into account the literature as well as the contextual and cultural factors, our conceptual model is devised as follows. While wellbeing is posited to be positively associated with student engagement in online learning, emotion regulation is assumed to partially mediate the relationship between wellbeing and student engagement in online learning. More specifically, we posited the following hypotheses:

**H1:** Subjective wellbeing would be positively associated with student engagement in on-line learning (including cognitive, behavioural, and emotional engagement).

**H2:** Subjective wellbeing would be positively associated with both the use of the emotion regulation strategies of suppression and cognitive appraisal.

**H3:** The use of cognitive reappraisal, but not suppression, would partially mediate the relationship between wellbeing and student engagement in online learning.

## METHOD

### Participants

A total of 965 students from a university featuring in international business and economics studies in China participated in the study. Among them, students were distributed in the following programmes: international financial management (40%), international economics (17%), statistics (10%), and others (such as accounting, international laws, foreign languages, and communication) (33%). The ratio of females to males was 72.2% to 27.8%. There were 499 (46.5%) freshmen, 503 (52.1%) sophomores and 13 (1.3%) junior students. Their mean age was 19.5 ( $SD = .94$ ). About 53.9% of the students reported their parents' highest education level was a bachelor's degree, while the remaining reported senior high middle school (24.6%), junior middle school (12.7%), and primary school (1%), or a doctoral degree (1%).

### Procedures

Approval of data collection was obtained from the participating university. Consent was obtained from both the teachers and students concerned. Each participant responded to an online questionnaire measuring wellbeing, emotion regulation strategies, and online English learning engagement during the COVID-19 from March to July 2020.

### Measures

#### Wellbeing

Students' wellbeing was measured by the WHO-Five Well-Being Index (WHO-5) ( $\alpha = .95$ ), which was devised by the World Health Organization (WHO) to measure individuals' current wellbeing with the timeframe of the previous 2 weeks (WHO, 1998). The WHO-5 measures subjective wellbeing based on positive mood, vitality, and general interest. The scale consists of five items on a 6-point Likert scale from 0 (At no time) to 5 (All of the time). Examples of the items include: '*I have felt cheerful and in good spirits*', and '*I have felt calm and relaxed*'. According to the WHO, a sum-up score of 13 or below represents poor well-being, whereas a score of 14 to 25 represents good well-being.

## Emotion regulation

Emotion Regulation Questionnaire (ERQ) (Gross & John, 2003) was used to measure individuals' tendency in the use of the two main emotion regulation strategies in emotion management: (1) cognitive reappraisal (6 items,  $\alpha = .90$ ) (e.g., *'When I want to feel less negative emotion, I change the way I'm thinking about the situation'*) and (2) suppression (4 items,  $\alpha = .81$ ) (e.g., *'I control my emotions by not expressing them'*). The items are rated on a 6-point Likert scale.

## Engagement

Engagement was measured using the scale developed by Reeve and Tseng (2011). We adapted their scale to focus specifically on student engagement in online learning of English courses. In our adapted scale, students were asked to rate their cognitive engagement (e.g., *'I try to make all the different ideas fit together and make sense when I study in online English class'*;  $\alpha = .93$ ), behavioural engagement (e.g., *'When I'm in my online English class, I listen very carefully'*;  $\alpha = .93$ ), and emotional engagement (e.g., *'I enjoy learning new things in online English class'*;  $\alpha = .95$ ). The items are on a 6-point Likert scale from 0 (*strongly disagree*) to 5 (*strongly agree*).

## Data analysis

Primary data analysis involved two steps: (1) confirmatory factor analyses (CFA) to assess the measurement validity of the constructs of wellbeing, emotion regulation strategies of cognitive reappraisal and suppression, as well as student engagement in online learning; (2) structural equation modeling (SEM) with covariates (gender, grade, and parents' education level) to examine the mediated effect of emotion regulation strategies (i.e. reappraisal and suppression) on different types of online learning engagement (i.e., cognitive, behavioural, and emotional engagements). Mplus Version 8.3 (Muthén & Muthén, 1998–2018) with maximum likelihood robust (MLR) was used for these analyses.

Model-data fit was evaluated by referring to comparative fit index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). CFI and TLI values no smaller than .95 and RMSEA and SRMR no larger than .05 were considered excellent fit criteria (Mueller & Hancock, 2010).

## RESULTS

### Preliminary analysis

The mean of the wellbeing sum-up score was 21.76 ( $SD = 5.00$ ). However, 55 students out of the sample (5.7%) produced a score below 13 (including 44 females), which indicates poor wellbeing. As to emotion regulation, the mean for reappraisal ( $M = 4.65$ ,  $SD = .79$ ) was higher than suppression ( $M = 4.15$ ,  $SD = .96$ ). In respect of engagement, it ranged from  $M = 4.52$  ( $SD = .97$ ) for cognitive engagement to  $M = 4.67$  ( $SD = .89$ ) for behavioural engagement.

Table 1 shows the bivariate correlations among key study variables and covariates. All engagement variables are positively associated with each other ( $r = .76$  to  $.86$ ,  $p < .01$ ), wellbeing ( $r = .53$  to  $.56$ ,  $p < .01$ ), suppression ( $r = .35$  to  $.39$ ,  $p < .01$ ) and reappraisal ( $r = .51$  to  $.54$ ,  $p < .01$ ), and parents' education level ( $r = .14$  to  $.16$ ,  $p < .01$ ). Besides, wellbeing was positively associated with suppression ( $r = .43$ ,  $p < .01$ ) and reappraisal ( $r = .56$ ,  $p < .01$ ).

TABLE 1 Bivariate correlations (N = 956)

	V1	V2	V3	V4	V5	V6	V7	V8	V9
V1. Cognitive engagement	–	.760**	.762**	.562**	.384**	.538**	.157**	.026	.018
V2. Behavioural engagement		–	.856**	.527**	.387**	.528**	.161**	.027	-.043
V3. Emotional engagement			–	.535**	.353**	.506**	.143**	.002	-.036
V4. Wellbeing				–	.426**	.556**	.083*	.063	.095**
V5. Suppression					–	.549**	.014	.074*	.206**
V6. Reappraisal						–	.025	.057	.062
V7. Parents' education							–	-.026	-.002
V8. Grade									-.008
V9. Gender									–
Mean	4.53	4.67	4.63	4.35	4.15	4.65	3.55	–	–
SD	.97	.89	.96	1.00	.96	.79	.88	–	–

Note. \*\* $p < .01$ ; \* $p < .05$ .

TABLE 2 Model fit statistics for CFAs and SEM

	$\chi^2$	<i>df</i>	<i>p</i>	RMSEA (90% CI)	SRMR	CFI	TLI
Model 1. Wellbeing(1&2; 3&4)	8.043	3	.045	.042 (.006, .078)	.004	.999	.996
Model 2. Suppression (7&11)	.944	1	.331	.000 (.000, .084)	.009	1.000	1.000
Model 3. Reappraisal (6 &10, 12)	4.297	3	.231	.021 (.000, .06)	.006	1.000	.998
Model 4. Behavioural engagement (25&26)	1.259	1	.262	.016 (.000, .089)	.002	1.000	1.000
Model 5. Emotional engagement	.847	2	.655	.000 (.000, .050)	.001	1.000	1.000
Model 6. Full measurement model	844.028	231	<.001	.053 (.049, .056)	.032	.972	.966
Model 7. Structural equation model	929.456	285	<.001	.048 (.045, .052)	.031	.970	.964

## Model-fit results

Prior to primary structural analyses, we conducted a series of CFA with the multiple-indicator variables. As shown in Table 2, all measurement models fit the data excellently, originally (Model 5) or after minor modification (with the addition of correlated errors) (Model 1 to Model 4). Finally, the structural model that also included the covariates (i.e., study grade, gender, and parents' education level) fit the data excellently: RMSEA (95% CI) = .048 (.045, .052), SRMR = .031, CFI = .970, TLI = .964.

## Estimates of structural equation modelling

Estimates of SEM are shown in Figure 1.

Regarding the relation between wellbeing and engagement, the total effect of wellbeing on cognitive engagement, emotional engagement, and behavioural engagement were  $\beta = .60$ ,  $\beta = .57$ , and  $\beta = .57$ , respectively, all at  $p < .001$ .

As to the relationship between wellbeing and emotional regulation strategies, the direct effect of wellbeing on reappraisal was  $\beta = .58$ ,  $p < .001$ , while its effect on suppression was  $\beta = .45$ ,  $p < .001$ .

In relation to the emotion regulation strategy of reappraisal, while it had a direct effect on all engagement factors, including cognitive engagement ( $\beta = .30$ ), behavioural engagement ( $\beta = .31$ ), and emotional engagement ( $\beta = .29$ ), all at  $p < .001$ , it played a mediating role between wellbeing and online learning engagement. More specifically, the direct effect of wellbeing on cognitive engagement was  $\beta = .39$ ,  $p < .001$ , and the indirect effect by way of reappraisal was  $\beta = .17$ ,  $p < .001$ . That said, reappraisal mediated 29% of the total effect of wellbeing on cognitive engagement. Similarly, while the direct effect of wellbeing on emotional engagement was  $\beta = .38$ ,  $p < .001$ , the indirect effect by way of reappraisal was  $\beta = .17$ ,  $p < .001$ . Accordingly, reappraisal mediated 30% of the total effect of wellbeing on emotional engagement. Finally, the direct effect of wellbeing on behavioural engagement was  $\beta = .34$ ,  $p < .001$ . The indirect effect by way of reappraisal was  $\beta = .18$ ,  $p < .001$ . Hence, reappraisal mediated 32% of the total effect of wellbeing on behavioural engagement.

For the emotion regulation strategy of suppression, it was found to have a direct effect only on behavioural engagement ( $\beta = .10$ ,  $p = .025$ ), but not on cognitive or emotional engagement. Aside from this, suppression was found to mediate 8% of the total effect of wellbeing on behavioural engagement. The indirect effect by way of suppression was  $\beta = .04$ ,  $p = .026$ .



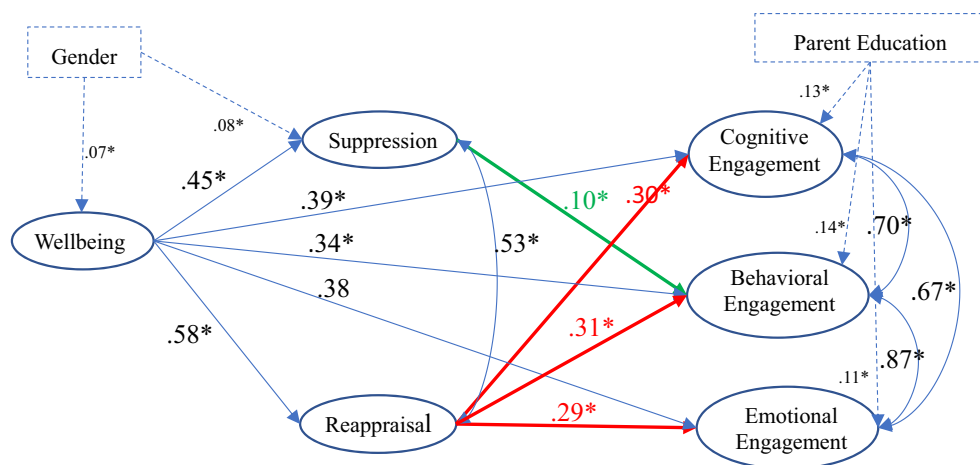


FIGURE 1 Results of structural equation modelling with estimates standardized. \* $p < .01$

Concerning covariate effects, gender only positively predicted wellbeing ( $\beta = .57, p = .02$ ) and suppression ( $\beta = .08, p = .007$ ), while parents' education only positively predicted all engagement factors: cognitive engagement ( $\beta = .13, p < .001$ ), behavioural engagement ( $\beta = .14, p < .001$ ) and emotional engagement ( $\beta = .11, p < .001$ ). The grade was not significantly associated with any of the other key variables.

## DISCUSSION

The current study examined the relationship between wellbeing and student engagement in online learning and whether and how emotion regulation strategies of suppression and reappraisal mediate the relationship between wellbeing and student engagement in online learning during the unprecedented time of COVID-19. The study confirmed our hypotheses that while wellbeing is positively associated with online learning engagement, the use of emotion regulation strategies mediates the relationship between wellbeing and online learning engagement, although the effects are different for suppression and cognitive reappraisal. These results remained significant with the control of gender, grade, and parental education.

Consistent with previous literature, our findings support that wellbeing is positively associated with student engagement in online learning (Boulton et al., 2019; Roberts, 2010). However, previous studies on engagement have been confined to the traditional mode of learning that involves in-person teaching and learning in physical classrooms, this study extends the literature by supporting that the positive association between the two remains valid even with the change to the mode of online learning. Compared to the traditional mode of learning, online learning needs to deal with different challenges, which may lower students' engagement, e.g., environmental distractions, technical difficulties, feelings of isolation, and lack of peer and teacher support (Chan et al., 2014; Kahn et al., 2017).

The second major finding of the study is that wellbeing is positively associated not only with the use of reappraisal but also with suppression. As suggested by English et al. (2017), it is not necessary that individuals would employ strategies that are the best for controlling or improving their emotional experience. Instead, they may make use of multiple strategies to help them with emotional regulation. Moreover, the use of emotion regulation strategies may be driven more by contextual factors and social concerns. Given that this study was conducted in the context of lockdown and the Chinese culture that values family, filial piety, and interpersonal harmony (Chen et al., 2018), it is, therefore, understandable that even individuals with good wellbeing also reported to have higher use of suppression. As discussed in the literature, suppression serves to avoid escalating conflicts and negative emotions, thereby helping

to maintain social harmony. As such, while Soto et al. (2011) found that suppression is not related to negative psychological functioning in cultures in which its use is considered normative, we, as a step further, found that the use of suppression is positively associated with wellbeing. Further research is needed to examine whether this finding arises from the cultural or lockdown situation. For reappraisal, it was found to be positively associated with wellbeing, which is consistent with the previous literature and found no cultural differences (Gross, 2015; Guassi Moreira et al., 2020; Soto et al., 2011).

Furthermore, our mediational analyses show that the use of reappraisal plays a considerable role in mediating the relationship between wellbeing and all types of online learning engagement (including cognitive, emotional, and behavioural engagement), but suppression was found to have a small mediating effect between wellbeing and behavioural engagement of online learning only. The major difference between the two is that reappraisal involves reinterpreting the meaning of a situation that helps to change the emotion experienced before its elicitation, thereby leaving effective cognitive functioning and resources for learning (such as memory, concentration, and problem-solving), which are crucial especially for cognitive and emotional engagement in online learning (Perera & DiGiacomo, 2013). In contrast, although suppression also works to enhance individuals' overall wellbeing, it does not help to modify the emotion experienced, leaving negative emotions to be unresolved and even accumulated that require the continual expenditure of cognitive effort and resources to keep monitoring and controlling the emotions. It, thus, impairs cognitive functioning for optimal performance of learning. Hence, the results show that the use of suppression could only help to slightly modify the behavioural responses in learning, but not cognitive and emotional engagements. This study has extended our understanding of the merits of reappraisal on learning, which so far has been limited to the domain of mathematics learning only (Brady et al., 2018).

The importance of wellbeing for learning has been increasingly recognized in the educational context. While schools and universities have been putting their focus on the use of diverse technologies to enhance student engagement in online learning, our study suggests that students' wellbeing and their use of different emotion regulation strategies are influential to their engagement in online learning. Students' wellbeing, however, may easily be overlooked due to self-isolation and social distancing during the pandemic. Hence, more measures, including reappraisal intervention and training in adaptive emotion regulation strategies, would be useful to support not only the wellbeing of students but also their engagement in learning.

## Limitations and directions for future research

There are several limitations of the study that should be noted. First, the samples of this study were limited to undergraduate students from a university only. Hence, future studies would be needed to examine whether the findings could be generalized to different age groups and education levels of students. Similarly, given that the study was conducted in the context of China, it would be worthwhile for future studies to be conducted across different cultures. Moreover, our study relied on self-report data, which might be prone to response biases. To accurately reflect a complete picture, future studies should consider the use of other sources of data and behavioural measures, such as biological assessments (e.g., EEG, fMRI) and peer reports. Finally, our findings on mediation are based on cross-sectional data. Future studies are encouraged to replicate our findings through a longitudinal study design.

## CONCLUSION

Wellbeing has been recognized as crucial for learning. Our study shows that wellbeing is positively associated with student engagement even in the context of the online learning environment. Moreover, wellbeing is positively associated not only with the use of reappraisal but also with suppression during the pandemic. Having said that, students who are able to make use of reappraisal are more engaged in

their online learning than students who try to suppress their emotions, suggesting that intervention to promote students' effective regulation strategies, particularly cognitive reappraisal, could promote not only students' wellbeing but also their engagement in online learning.

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## CONFLICT OF INTEREST

All authors declare no conflict of interest.

## AUTHOR CONTRIBUTIONS

**Karen C. H. Zhoc:** Conceptualization, Writing—Original draft preparation, Editing. **Yuyang Cai:** Conceptualization, Methodology, Formal analysis, Writing—Original draft preparation, Funding acquisition, Supervision. **S. S. Yeung:** Writing—review & editing. **Jianguo Shan:** Investigation.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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