

RESEARCH

Open Access



# The relationship between meaning in life and self-regulated learning among college students: the mediating effect of psychological capital and the moderating effect of phubbing

Wenjing Feng<sup>1</sup>, Peibo Wu<sup>1,2\*</sup>, Shuai Lv<sup>3</sup> and Zhaoyuan Fan<sup>1</sup>

## Abstract

**Background** Previous research on college students' learning problems has investigated the notion of self-regulated learning. However, relatively little research has explored the mechanism underlying the relationship between meaning in life and self-regulated learning on the basis of the self-regulated learning framework. Additionally, relatively few studies have examined the impact of phubbing behavior on the traits exhibited by the source of the behavior in question, particularly from the perspective of nonpersonal perception. Therefore, in this study, Pintrich's Self-Regulated Learning model is used as a theoretical framework; in addition, this study draws on conservation of resources theory, among other theories, to explain the relationships among relevant variables. It thus aims to develop a moderated mediation model that can be used to systematically examine the relationship between meaning in life and self-regulated learning as well as the mechanism underlying this relationship. On this basis, this study provides effective recommendations that can be used to enhance self-regulated learning among college students and promote high-quality learning outcomes.

**Methods** In this study, the Chinese Meaning in Life Questionnaire, the Youth Psychological Capital Questionnaire, the Youth Phubbing Scale-Chinese Version, and the Self-Regulated Learning Scale for College Students were used to survey 488 college students who were recruited from an undergraduate college in a province in central China.

**Results** (1) Meaning in life had a positive predictive effect on self-regulated learning ( $r_2 = 0.51, p < 0.001$ ). (2) Psychological capital mediated the relationship between meaning in life and self-regulated learning (indirect effects = 0.31,  $SE = 0.04$ , 95%  $CI = [0.23-0.38]$ ). (3) The first half of the mediating path "meaning in life → psychological capital → self-regulated learning" and the direct path "meaning in life → self-regulated learning" were moderated by phubbing ( $\beta = 0.07, p < 0.01, \beta = 0.10, p < 0.001$ ).

\*Correspondence:  
Peibo Wu  
wupeibo1986@163.com

Full list of author information is available at the end of the article



© The Author(s) 2025. **Open Access** This article is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License, which permits any non-commercial use, sharing, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if you modified the licensed material. You do not have permission under this licence to share adapted material derived from this article or parts of it. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by-nc-nd/4.0/>.

**Conclusion** Meaning in life not only predicts self-regulated learning among college students directly and positively; it also influences self-regulated learning indirectly via the mediation of psychological capital. The effects of meaning in life on psychological capital and self-regulated learning are moderated by phubbing. Specifically, as the frequency of phubbing increases, the positive predictive effects of meaning in life on psychological capital and self-regulated learning become stronger.

**Keywords** Meaning in life, Psychological capital, Phubbing, Self-regulated learning, College students

## Introduction

The learning problems faced by college students have been a hot topic in the research on higher education [1]. Self-regulated learning, on the other hand, is a key tool that can be used to address college students' learning problems and promote high-quality learning [2]. Through self-regulated learning, students can enhance their learning proactivity, promote holistic development, and adapt to the rapidly changing social environment more effectively. Studies have also reported that self-regulated learning can promote holistic development among college students [3–6]. Specifically, self-regulated learning not only promotes deep learning among college students [5], thereby improving their academic achievement, self-efficacy, and problem-solving ability, but also helps promote their career development [6]. Therefore, self-regulated learning plays a key role in the holistic development of college students. An in-depth understanding of the characteristics of and mechanisms underlying self-regulated learning among college students is essential with respect to efforts to address their learning challenges effectively and provide them with high-quality learning activities.

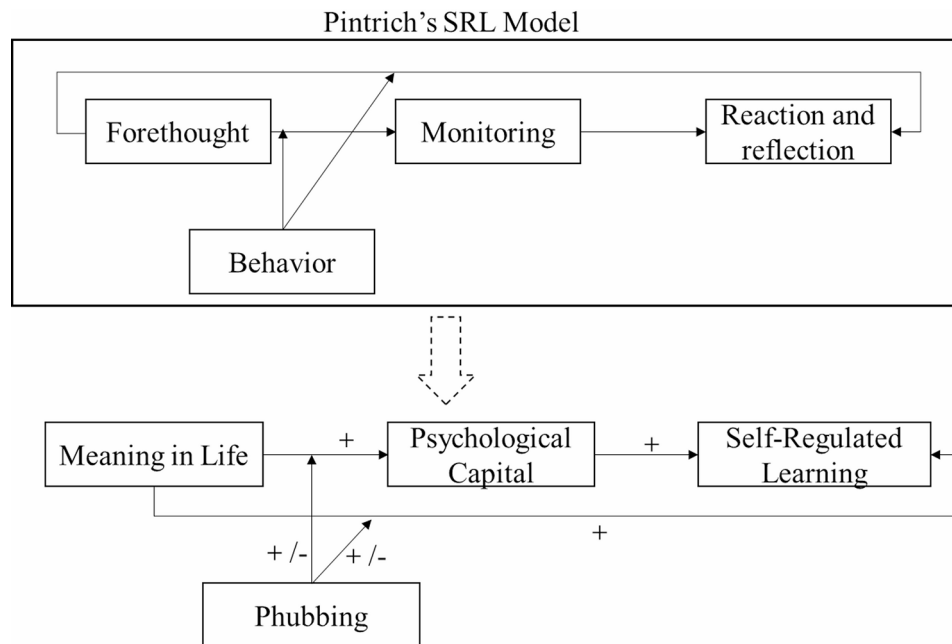
Previous studies on this topic have explored the process, strategies, actions and influencing factors associated with self-regulated learning [4–8]; however, these studies have mostly been limited to explorations of the relationships among some of the relevant variables, and no researchers have yet systematically examined the internal and external factors associated with self-regulated learning or the associated mechanisms of action, thus limiting efforts to improve the self-regulated learning ability of college students and solve their learning problems to a certain extent. Therefore, this study relies on Pintrich's definition of self-directed learning, which defines self-regulated learning as an active, constructive process that can enable learners to set goals for their learning and subsequently to attempt to monitor, regulate, and control their cognition, motivation, and behavior under the guidance and constraints of their goals as well as contextual features of the environment [9]. These self-regulatory activities can mediate the relationships among individuals, the surrounding context, and their overall achievements [9].

Pintrich's SRL model divides self-regulated learning into four stages: forethought, monitoring, control, and

reaction and reflection. Each of these stages involves cognition. Furthermore, each stage involves the regulation of multiple factors, such as cognition, motivation/emotion, behavior, and context. On the basis of this model, this study constructs a research framework that can be used to investigate self-regulated learning among college students and systematically explores the associated internal and external mechanisms (see Fig. 1).

During the anticipation stage, the notion of meaning in life is introduced; this concept is closely related to self-regulated learning [10–11], and it can provide learners with a sense of direction and motivation and help them set appropriate learning goals, thus initiating the process of self-regulated learning. The introduction of psychological capital during the monitoring stage reveals that meaning in life enhances an individual's level of psychological capital, including in terms of psychological resilience and self-efficacy [12]; furthermore, positive psychological capital has been identified as an important intrinsic type of motivation that drives self-regulated learning among college students [13], thus helping them exhibit positive self-monitoring and emotional regulation. In terms of external behavioral factors, the notion of phubbing is then introduced. Previous research has reported that the proportion of Chinese internet users who use cell phones to access the internet has reached 99.9%, and college students, as a new group of internet users, include a higher proportion of cell phone users [14]. In addition, the 2018 report, "How Teens and Parents Cope with Screen Time and Device Interruptions," which was issued by the Pew Research Center, indicated that 72% of parents believe that their children's cell phone use interferes with communication, thereby leading to distraction and phubbing [15]. Such phubbing behavior may affect various stages of self-regulated learning. During the stage of reaction and reflection, self-regulated learning, which represents a manifestation of learning outcomes, refers to the final performance that can be achieved through the effective regulation of the aforementioned stages as well as external behavioral factors (see Fig. 1).

In summary, this study uses Pintrich's SRL model as a theoretical framework to explore the internal and external role mechanisms underlying self-regulated learning among college students. In particular, it aims to provide effective strategies that can be used to solve the learning



**Fig. 1** Hypothetical model of the influence of internal and external mechanisms on self-regulated learning among college students

problems faced by college students and promote high-quality learning activities.

#### Meaning in life and self-regulated learning among college students

Meaning in life refers to an individual's perception of the value and significance of their current life as well as their pursuit of purpose and meaning in their future life [16]. This sense of meaning not only enhances an individual's understanding of deeper values but also plays a crucial role in the process of motivating individuals to engage in positive learning behaviors [17–18]. Specifically, goals are an integral component of meaning in life. College students who experience a strong sense of meaning in life tend to have a clearer sense of purpose and a greater desire to learn as a result of this sense of meaning [19]. This motivation encourages them to focus more closely on areas of interest, thus fostering more self-regulated learning [20].

Moreover, goal-setting theory (GST) posits that goals that are both specific and challenging can increase an individual's effort and persistence, thereby enhancing their performance [21–22]. In summary, when college students experience a strong sense of meaning in life, they are more likely to define their direction in life clearly and to internalize their personal values and long-term vision into specific and challenging goals [23]. To achieve these goals, such students actively adjust their learning strategies to meet their changing needs, thereby enhancing their self-regulated learning ability [24]. On the basis of the theoretical and empirical studies mentioned above,

this study proposes the following hypothesis: **Hypothesis 1:** Meaning in life among college students can positively predict their self-regulated learning behaviors (H1).

#### The mediating effect of psychological capital

Psychological capital plays a crucial role in the relationship between meaning in life and self-regulated learning. This notion encompasses various positive psychological states or resources—namely, optimism, hope, confidence, and resilience—that individuals exhibit during their growth and development [25]. According to conservation of resources theory, resources refer to various material or psychological conditions that help individuals achieve goals, reduce stress, or meet their needs [26–27]. Meaning in life can serve as an important resource that can facilitate goal setting and achievement, thus eliciting a sense of control over the external world; this process can ultimately promote personal development [20].

Hobfoll et al. (2018) extended conservation of resources theory by introducing the concept of resource gain spirals (RGS); namely, the initial resources possessed by individuals can trigger the acquisition of further resources, thus leading to the emergence of a positive feedback loop [27]. This dynamic ultimately contributes to individual growth. Therefore, as an initial psychological resource, meaning in life not only motivates college students to actively pursue their learning goals and directly enhances their self-regulated learning capacity; it also helps them accumulate various forms of psychological capital—such as self-efficacy, resilience, hope, and optimism. In turn, this accumulation strengthens their ability to cope with

challenges and increases the flexibility of the learning strategies that they use, thereby indirectly promoting the sustainable development of their self-regulated learning abilities.

Meaning in life can significantly enhance individuals' psychological capital [12], a claim which is supported by the following three points. First, meaning in life can enhance self-efficacy among college students. Research has revealed that when college students perceive the meaning and purpose of their lives clearly, they are more likely to believe that they are capable of meeting both academic and social challenges, thus increasing their self-efficacy [28]. This enhanced sense of self-efficacy provides a solid psychological foundation to support their independent learning. Second, meaning in life can enhance the psychological resilience of college students. Research has reported that when individuals actively explore and commit themselves to the task of realizing their life goals, they are more persistent and courageous in response to setbacks and challenges, and they exhibit greater resilience and endurance, thus enhancing their psychological resilience [29]. Psychological resilience further helps such individuals overcome difficulties and maintain a positive learning attitude during the learning process. Third, meaning in life helps college students develop a positive mindset of optimism and hope. Clarifying the value and meaning of life can help individuals remain optimistic in response to difficulties, identify the positive aspects of such situations more easily, and maintain hope and confidence in the future [30]. This optimism and hope drive them to become more actively engaged in learning, thus enhancing their learning outcomes.

Meaning in life provides colleges students with sufficient motivation to engage in self-regulated learning by stimulating positive psychological capital. As noted, meaning in life can enhance individuals' psychological capital, thereby stimulating students' interest in learning and helping them develop self-regulation skills; in turn, this process enhances self-regulated learning [13]. Specifically, positive psychological capital contributes significantly to the intrinsic motivation of college students. For example, studies have reported that the stronger the sense of self-efficacy that college students experience, the more they believe in their ability to master new knowledge and respond actively to challenges that emerge during the learning process; accordingly, such students engage in more self-regulated learning behaviors [31]. Additionally, mental toughness plays a key role in students' ability to overcome learning difficulties, particularly by enabling individuals to maintain focus and endurance in response stress and frustration and thus to respond effectively to various learning challenges; this process thus also promotes self-regulated learning [32]. In addition, optimism and hope, which represent

important forms of psychological capital, can help college students actively set goals and take actions to pursue academic progress despite the learning challenges that they face [33]. Therefore, psychological capital is an important predictor of self-regulated learning. In light of the preceding arguments, this study proposes Hypothesis 2: Psychological capital plays a mediating role in the relationship between meaning in life and self-regulated learning among college students (H2).

### The moderating effect of phubbing

According to the 54th Statistical Report on the Development of the Internet in China, college students constitute the newest group of mobile internet users [14]. A reliance on "mobile phones" has come to represent the main lifestyle of college students. Studies have reported that 15–35-year-olds in China constitute the world's largest group of smartphone users; furthermore, phubbing has been identified as the most common behavior in this context [34]. Phubbing refers to the act of snubbing someone in a social setting by looking at one's smartphone instead of paying attention to the other person [35]. Researchers have argued that phubbing behavior is not inherently positive or negative but rather ambiguous [36].

Phubbing has been reported to have significant negative effects on individuals' mental health and learning behaviors [37–38], including by weakening their social skills and affective ties [39] as well as by decreasing their sense of direction in life [40]; however, such behavior can also be positively associated with life satisfaction, thereby temporarily strengthening emotional comfort [41].

Conservation of resources theory offers a comprehensive framework that can be used to explain the dual role of phubbing behavior, including in terms of both resource losses and resource gains. According to this theory, when an individual's resources are depleted or threatened, this phenomenon triggers stress and may initiate a negative cycle of resource loss. Conversely, when an individual acquires or utilizes resources, this phenomenon leads to the emergence of a positive cycle, which results in the accumulation of resources and the generation of a virtuous cycle of resource gain [26].

On the one hand, college students who engage in phubbing may also be phubbed by others. This behavior may lead to a loss of social resources, such as interpersonal support, as well as time resources, thus preventing meaningful exchanges of individuals' inner thoughts and life values [42]. As a result, meaning in life experienced by such students may grow weaker, thereby potentially leading to a vicious cycle of loneliness and distraction, which can reduce their psychological capital and their capacity for self-regulated learning [43]. On the other hand, despite the corresponding reduction face-to-face communication, mobile phones can provide academic

information, entertainment, and relaxation in a timely manner, thus promoting the accumulation of academic and psychological resources and enhancing individuals' psychological capital [44]. Additionally, mobile phones can optimize individuals' fragmented time, improve their learning efficiency, and stimulate their intrinsic motivation, thereby leading to the emergence of a virtuous circle that can enhance self-regulated learning [45]. Therefore, the hypotheses proposed in this study posited that phubbing may moderate the relationship between meaning in life and psychological capital (H3a) and the relationship between meaning in life and self-regulated learning (H3b).

In summary, the literature on this topic has focused primarily on the relationships among four key variables: meaning in life, psychological capital, phubbing, and self-regulated learning. However, relatively few studies have examined the mechanism underlying the relationship between meaning in life and self-regulated learning within the framework of a self-regulated learning model. Additionally, studies on the impacts of phubbing on the traits of phubbers themselves, particularly from the perspective of noninterpersonal perceptions, remain limited. Therefore, this study uses Pintrich's SRL model as a theoretical framework and incorporates conservation of resources theory and other relevant theories to explain the relationships among these variables. It aims to develop a moderated mediation model (see Fig. 1) that can be used to systematically explore the relationship between meaning in life and self-regulated learning as well as the underlying mechanism. On the basis of this model, the study seeks to provide practical recommendations that can be used to enhance self-regulated learning abilities among college students and promote high-quality learning.

## Methods

### Participants

As part of this study, convenience sampling was used to conduct a classroom-based survey of college students who were recruited from an undergraduate institution in a province in central China. This survey aimed to examine the relationships among meaning in life, psychological capital, phubbing, and self-regulated learning. The participants in this research were recruited from various academic disciplines, including education, management, and engineering. Their coursework covered subjects such as mental health education for college students and career planning and employment guidance. A total of 500 questionnaires were distributed via the Wenjuanxing platform. To ensure data quality, Mandata, a plugin in SPSS 26.0 software, was used to screen the responses for consistency. Specifically, the system automatically identified questionnaires in which multiple consecutive items

received identical responses, which suggested that the respondent may not have carefully read the questionnaire items. The results indicated that 12 out of the 500 questionnaires exhibited a clear pattern of response inconsistency; these questionnaires were thus deemed invalid for further analysis. Consequently, the final sample consisted of 488 valid responses (97.60%). The investigator, who was a full-time psychology teacher at the college under investigation, explained the instructions in detail and then allowed the participants to complete the questionnaire, which took approximately 30 min. The mean age of the participants ranged between 16 and 23 years ( $19.64 \pm 1.16$ ); furthermore, 155 (31.80%) participants were from urban areas, and 333 (68.20%) were from rural areas.

To ensure the scientific rigor and representativeness of this study, participation in this research was entirely voluntary. All participants provided informed consent and were explicitly informed oral form of the study's objectives and procedures as well as their right to withdraw from this research at any time. The research team adhered to strict ethical standards during the process of data collection. The study was conducted in accordance with the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Zhong yuan Institute of Science and Technology. The design of and procedures used in this study were approved by the relevant authorities and reviewed by the institutional ethics committee under approval number 2,024,051,823.

### Measures

#### *Chinese meaning in life questionnaire (C-MLQ)*

The Chinese Meaning in Life Questionnaire was developed by Steger and revised by Mengcheng Wang et al. [17, 46]. This questionnaire consists of 10 items that cover two dimensions: the experience of meaning in life and the search for meaning in life. The items included in this questionnaire are scored on a 7-point Likert scale, in which context 1 indicates "strongly disagree" and 7 indicates "strongly agree." Higher total scores indicate a stronger sense of meaning in life. An example item is "I am searching for something that makes my life meaningful." In the current study, the Cronbach's alpha coefficient for the total questionnaire was 0.87, and the Cronbach's alpha coefficients for the two dimensions were 0.81 and 0.90.

#### *Youth psychological capital questionnaire*

The Youth Psychological Capital Questionnaire was developed by Yidu Ye et al. [47]. This questionnaire consists of 22 items that cover four dimensions: hope, optimism, self-efficacy, and psychological resilience. The items included in this questionnaire are scored on a 6-point Likert scale, in which context 1 indicates

“completely disagree” and 6 indicates “completely agree.” Higher scores indicate higher levels of psychological capital. For example, “Even when I encounter bad outcomes, I can accept them calmly.” In the current study, the Cronbach’s alpha coefficient for the questionnaire as a whole was 0.93, and the Cronbach’s alpha coefficients for the four dimensions ranged from 0.76 to 0.93.

Phubbing scale-chinese version

The Phubbing Scale-Chinese Version was developed by Karadag et al. and revised by Hui Qiuping et al. [48–49]. This scale consists of 10 items that cover two dimensions: communication barriers and smartphone addiction. The items included in this measure are scored on a 5-point Likert scale, in which context higher total scores indicate more frequent phubbing behavior. An example item is “When I am with friends, I am busy playing with my phone.” In the current study, the Cronbach’s alpha coefficient for the scale was 0.82, and the Cronbach’s alpha coefficients for the two dimensions were 0.83 and 0.80.

Self-regulated learning scale for college students

The Self-Regulated Learning Scale for College Students used in this study was adapted from the scale developed by Zhu Zude et al. [50]. This scale consists of 40 items, which are divided into a motivation subscale and a strategy subscale, each of which contains six dimensions. The motivation subscale includes the dimensions of intrinsic goal of learning, sense of control over learning, extrinsic goal of learning, among others, whereas the strategy subscale includes the dimensions of general approach, learning help, and study plan arrangement, among others. The learning management dimension contains reverse-scored items. The items included in this measure are scored on a 6-point Likert scale, in which context higher total scores indicate stronger independent learning ability. An example item is “At the beginning of each semester, I have a rough study plan.” In the current study, the Cronbach’s alpha coefficient for the overall scale was 0.96, and the coefficients for the individual dimensions ranged from 0.77 to 0.89.

Statistical analysis

IBM SPSS 27.0 was used to conduct descriptive, reliability, correlation, and regression analyses. A

regression-based path approach was employed, and the PROCESS macro was used to examine conditional indirect relationships [51]. In this study, we employed Models 4 and 8 from the PROCESS macro. A moderated mediation model was tested on the basis of a conditional process model via the bootstrap procedure. In all effect analyses, we computed 95% confidence intervals on the basis of five-thousand bootstrap resamples. P values less than 0.05 were considered to indicate statistical significance.

Results

Common method variance

In this study, to control for potential common method variance (CMV), several measures were taken. First, some items included in the questionnaire were reverse-scored with the aim of reducing measurement error and response bias. Additionally, we employed Harman’s single-factor test to statistically examine CMV. This method involves analyzing whether all variables load primarily onto a single factor with the goal of identifying the presence of CMV. According to Harman’s single-factor test, the explained variance of the first extracted factor was 29.42%, which was well below the critical threshold of 40%. According to Podsakoff et al., if the explained variance of the first factor is less than 40%, this finding suggests that CMV does not pose a serious problem in a given study [52]. Therefore, the results of this study indicate no significant CMV, thus ensuring the validity and reliability of the data analysis.

Description and correlation analysis

Table 1 provides a detailed list of the descriptive statistics and results of the correlation analysis pertaining to each variable. Specifically, meaning in life was significantly positively correlated with psychological capital and self-regulated learning ( $r_1 = 0.68, p < 0.001$ ;  $r_2 = 0.51, p < 0.001$ ). Psychological capital was significantly positively correlated with self-regulated learning ( $r_3 = 0.59, p < 0.001$ ). Conversely, phubbing was significantly negatively correlated with meaning in life, psychological capital, and self-regulated learning ( $r_4 = -0.21, p < 0.001$ ;  $r_5 = -0.35, p < 0.001$ ;  $r_6 = -0.12, p < 0.001$ ).

Test of the mediating effects

To test the simple mediation model, in this study, the PROCESS plugin in SPSS 27.0 was used, in line with the method proposed by Hayes et al. [51]. The analysis involved using a bias-corrected percentile bootstrap method to assess the significance of the mediating effect. The results are presented in Table 2. The results revealed that, when the mediator was not included, the total effect of meaning in life on self-regulated learning was 0.51,

Table 1 Descriptive statistics and correlation analysis results pertaining to each variable

Variable	M	SD	1	2	3	4
1. Meaning in life	47.84	8.40	1			
2. Psychological capital	91.67	14.27	0.68***	1		
3. Phubbing	31.16	6.67	-0.21***	-0.35***	1	
4. Self-regulated learning	169.48	25.14	0.51***	0.59***	-0.12***	1

Note: \*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ . These indications also apply below

**Table 2** Total, direct and indirect effects

	Effect	Bootstrap SE	95% CI	Percentage
Direct	0.20	0.05	[0.11–0.30]	39.22%
Indirect	0.31	0.04	[0.23–0.38]	60.78%
Total	0.51	0.04	[0.43–0.58]	

Note: All variables included in the model were standardized before they were entered into the regression equations. The same point also applies below

with a 95% confidence interval of [0.43–0.58]. Since this interval did not include 0, the total effect was significant.

Furthermore, Model 4 in the PROCESS plugin was used to test the mediation model of psychological capital. When psychological capital was added as a mediator, the direct effect of meaning in life on self-regulated learning decreased to 0.20, with a 95% confidence interval of [0.11–0.30], which still did not include 0, thus indicating that the direct effect remained significant. The mediating effect of psychological capital was 0.31, with a 95% confidence interval of [0.23–0.38], which also did not include 0, thus indicating a significant mediating effect. This analysis revealed that the mediating effect of psychological capital accounted for 60.78% of the total effect.

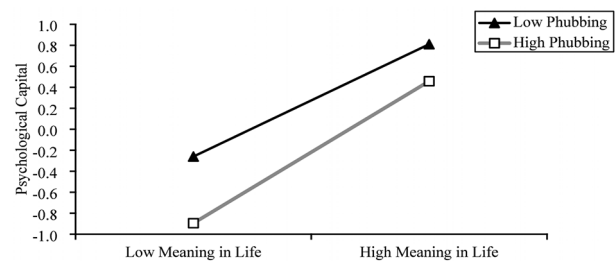
### Test of moderated mediation

Because the theory on which this research relies hypothesizes only that the moderator affects the direct path and the first half of the mediation path, the moderating effect on the second half of the mediation path was not tested. Therefore, the interaction term UW (i.e., b2) was not included in Eq. 3 [52]. Consequently, Model 8 in the PROCESS plugin was used to test the moderated mediation model of phubbing. As part of this analysis, a bias-corrected percentile bootstrap method was employed to determine the significance of the moderating effects. The results are presented in Table 3.

The results of Eq. 1 indicated that meaning in life significantly positively predicted self-regulated learning ( $\beta=0.68$ ,  $p<0.001$ ). The results of Eq. 2 indicated that meaning in life significantly positively predicted psychological capital ( $\beta=0.64$ ,  $p<0.001$ ), and the interaction term between meaning in life and phubbing significantly positively predicted psychological capital ( $\beta=0.07$ ,  $p<0.01$ ). The results of Eq. 3 indicated that psychological

**Table 4** The mediating effects of psychological capital at different levels of phubbing

Mediator	Phubbing	Conditional indirect effect	BootSE	95% CI
Psychological Capital	24.49(M–1SD)	0.26	0.04	[0.18–0.35]
	31.16(M)	0.30	0.04	[0.22–0.37]
	37.83 (M+1SD)	0.33	0.04	[0.25–0.42]

**Fig. 2** The Moderating Effect of Phubbing on the Relationship between Meaning in Life and Psychological Capital

capital significantly positively predicted self-regulated learning ( $\beta=0.47$ ,  $p<0.001$ ), and the interaction term between meaning in life and phubbing significantly positively predicted self-regulated learning ( $\beta=0.10$ ,  $p<0.001$ ). In light of these findings, the moderated mediation model of phubbing was supported, thus indicating that phubbing moderates both the direct path and the first half of the mediation path.

The mediating effects of psychological capital on the relationship between meaning in life and self-regulated learning at three levels of phubbing (M–1SD, M, and M+1SD) are presented in (Table 4) alongside the corresponding 95% bootstrap confidence intervals.

To explore the moderating effects in further detail, simple slope tests were conducted, and simple effects plots were created (see Fig. 2). The results revealed that when the level of phubbing was low (M–1SD), meaning in life had a significant positive predictive effect on psychological capital ( $B_{\text{simple}}=0.56$ ,  $SE=0.04$ ,  $t=13.27$ ,  $p<0.001$ ). When the level of phubbing was high (M+1SD), the

**Table 3** Results of the test of the moderated mediation model of phubbing

Predictors	(Eq. 1) Self-regulated learning			(Eq. 2) Psychological capital			(Eq. 3) Self-regulated learning		
	$\beta$	$t$	95% CI	$\beta$	$t$	95% CI	$\beta$	$t$	95% CI
Meaning in life	0.68	20.21***	[0.61–0.74]	0.64	19.47***	[0.57–0.70]	0.22	4.43***	[0.12–0.31]
Phubbing				-0.24	-7.04***	[-0.31–0.17]	0.05	1.37	[-0.02–0.13]
Psychological capital							0.47	9.22***	[0.37–0.57]
Meaning in life * Phubbing				0.07	2.57*	[0.02–0.13]	0.10	3.07***	[0.03–0.16]
$R^2$	0.46			0.51			0.37		
$F$	408.54***			166.22***			76.16***		

positive predictive effect of meaning in life on psychological capital was stronger ( $B_{\text{simple}}=0.71$ , increasing from 0.56 to 0.71,  $SE=0.04$ ,  $t=15.82$ ,  $p<0.001$ ). These findings indicating that as the frequency of phubbing among college students increases, the positive predictive effect of meaning in life on psychological capital becomes stronger. In other words, the developmental advantages of meaning in life on psychological capital among college students can be activated more easily when the frequency of phubbing is greater.

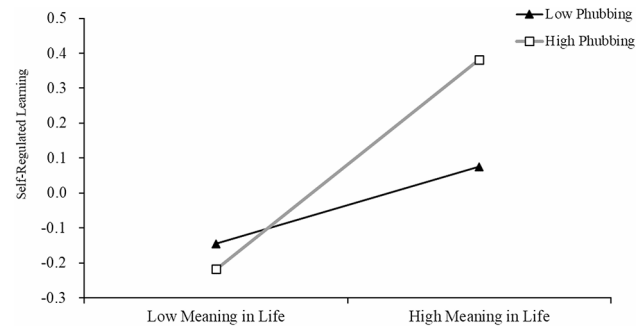
To explore the moderating effects in further detail, simple slope tests were conducted, and simple effects plots were created (see Fig. 3). The results revealed that when the level of phubbing was low ( $M-1SD$ ), meaning in life had a significant positive predictive effect on self-regulated learning ( $B_{\text{simple}}=0.12$ ,  $SE=0.06$ ,  $t=2.09$ ,  $p<0.05$ ). When the level of phubbing was high ( $M+1SD$ ), the positive predictive effect of meaning in life on self-regulated learning was stronger ( $B_{\text{simple}}=0.32$ , increased from 0.12 to 0.32,  $SE=0.06$ ,  $t=5.10$ ,  $p<0.001$ ). These findings reveal that as the frequency of phubbing among college students increases, the positive predictive effect of meaning in life on self-regulated learning becomes stronger. In other words, the developmental advantages of meaning in life with respect to self-regulated learning among college students can be activated more easily when the frequency of phubbing is greater.

## Discussion

The present study explored the relationship between meaning in life and self-regulated learning among college students as well as the intrinsic mechanism of action underlying this relationship. The results indicated that meaning in life indirectly influences self-regulated learning via psychological capital and that the first half of the path of this mediating effect as well as the direct path between meaning in life and self-regulated learning were moderated by phubbing. The results of this study indicate that Pintrich's self-regulated learning model can help explain how meaning in life and psychological capital function at different stages of self-regulated learning, particularly with respect to the pathway in which meaning in life influences self-regulated learning via psychological capital [9]. These findings provide empirical evidence and practical insights that can be used in efforts to promote self-regulated learning among college students alongside high-quality learning.

### Meaning in life and self-regulated learning among college students

Meaning in life was identified as a significant positive predictor of self-regulated learning among college students, a result that is consistent with the findings of previous research [53–54]. According to [53–54], an



**Fig. 3** The moderating effect of phubbing on the relationship between meaning in life and self-regulated learning

individual's perspective on life is a key influence on their habits and behaviors. According to goal-setting theory, college students who experience a strong sense of meaning in life tend to have a clearer sense of direction and life goals [21]. To achieve these goals, they proactively adjust their motivation and learning strategies, thus indicating a stronger desire for knowledge and a clearer sense of purpose [19]. In turn, these traits increase their capacity to engage in self-regulated learning in response to changing needs [20, 24].

One possible explanation for this finding is that meaning in life enhances students' expectations and value identification, thus motivating them to face and overcome learning challenges. This deep-seated value identity drives students to adapt proactively and optimize their learning strategies [55]. Such intrinsic motivation and persistence become even more pronounced when students encounter difficulties, particularly by enabling them to maintain high levels of enthusiasm and effort in the context of learning despite the challenges they face; in turn, this process can effectively enhance their self-regulated learning ability. In this way, students not only achieve better academic outcomes but also make significant progress in terms of their personal growth and development.

### The mediating effect of psychological capital

This study revealed that psychological capital partially mediates the relationship between meaning in life and self-regulated learning. This finding validated the application of conservation of resources theory, particularly in light of the spiral effect on resource acquisition that it posits [26–27]. According to this theory, initial resources (e.g., meaning in life) not only enhance an individual's psychological state directly but also contribute to the accumulation of various forms of psychological capital (e.g., hope, optimism, self-confidence, and resilience), thereby leading to the emergence of a positive cycle of resource gain. According to [28–30], the positive relationship between meaning in life and psychological capital is in line with this theory. College students who experience

a strong sense of meaning in life are more likely to focus on certain areas of interest during the learning process. When such students encounter challenges, they experience greater enthusiasm and initiative and focus on positive aspects, thus eliciting a sense of hope and optimism [30]. Moreover, these students often have clear plans for the future and a strong sense of purpose, thereby enhancing their psychological resilience and self-efficacy when they encounter academic challenges [28–29].

The positive relationship between psychological capital and self-regulated learning revealed in this research is consistent with the findings reported by Paloş et al. [13]. Psychological capital (e.g., self-efficacy, hope, resilience, and optimism) serves as a crucial resource that can help enhance students' intrinsic motivation and psychological resilience [32]. Students who possess high levels of psychological capital are better equipped to maintain a positive attitude when they encounter learning difficulties; furthermore, they set goals proactively, solve problems, and persist in their learning. In turn, these benefits promote the continuity and effectiveness of self-regulated learning. By using their psychological capital, such students are able to cope with academic challenges more effectively, explore a variety of self-regulated learning strategies, and ultimately attain enhanced learning outcomes.

### The moderating effect of phubbing

This study also revealed that phubbing moderated the first half of the “meaning in life → psychological capital → self-regulated learning” path as well as the direct path “meaning in life → self-regulated learning.” As the frequency of phubbing increased, the positive predictive effect of meaning in life on psychological capital and self-regulated learning became stronger. In other words, among students who experienced a stronger sense of meaning, the positive effect on their learning and psychological resources was more significant in high-frequency phubbing situations. This finding stands in contrast to the results of most previous studies on this topic, which have highlighted the negative effects of phubbing behavior [39, 40, 48]. According to [39, 40], the smartphone is primarily a tool that can facilitate social communication. Phubbing behavior is often associated with reduced social interaction, thus presenting individuals with the illusion of engagement with the world around them. The fact that phubbing can affect offline real-time interactions negatively is undeniable [56–57].

The positive moderating effect of phubbing observed in this study differs from the findings of previous research on this topic. This discrepancy may be due to the fact that prior studies have focused primarily on the passive negative effects of phubbing on the recipient of such behavior. In contrast, this study adopted a perspective

rooted in noninterpersonal perception, thus emphasizing the interaction between phubbing and the psychological processes experienced by phubbers themselves. One possible explanation for these findings is that during phubbing, individuals not only disengage from social interactions but also gain the ability to process information efficiently, access relevant resources quickly, and thereby complete learning tasks more effectively [41, 58]. As a result, phubbing can facilitate emotional regulation, thus allowing college students to temporarily reduce their social distractions, enhance their focus and motivation in their pursuit of meaning in life, and cope with external pressures or anxieties more effectively, thereby ultimately strengthening their psychological capital as well as related psychological resources. Additionally, frequent phubbing may provide college students with a self-regulation strategy that they can employ within a digital environment, thus expanding the ways in which they can achieve meaning in life. In turn, this process enables them to complete specific tasks more effectively, thereby enhancing their self-regulated learning ability.

The results of this study are consistent with previous research [48], which has suggested that the communicator, as the source of the behavior in question, takes the initiative in the process of phubbing [59]. This study revealed that phubbing, to some extent, protects the psychological resources and self-regulated learning abilities of college students who exhibit a strong sense of meaning in life. This process has two key implications: first, it helps avoid unnecessary social distractions, thereby reducing the depletion of psychological resources, and second, it enhances the individual's focus and control over learning activities. These findings are in line with conservation of resources theory [26], which posits that by avoiding unnecessary social demands, individuals can accumulate and optimize psychological resources, such as self-efficacy and learning resilience, thereby ultimately supporting self-regulated learning. In summary, this study provides new empirical evidence in support of the positive effects of phubbing on the basis of the dual-effect framework. However, importantly, while the interaction between phubbing and meaning in life has positive effects on psychological capital and self-regulated learning, phubbing alone continues to have negative effects on psychological capital and self-regulated learning.

### Research limitations

The present study revealed in meaningful findings but was subject to several limitations. First, the cross-sectional design of this research limits our ability to determine temporal sequences and causality among the variables; thus, future researchers should employ experimental or longitudinal designs to draw conclusions regarding temporal precedence and causality. Second, the

size of the sample investigated in this study was relatively small and limited to college students from regular undergraduate institutions. This limitation may affect the generalizability of the findings of this research, as different educational environments and student backgrounds may influence the process of developing self-regulated learning abilities. Therefore, future researchers should recruit larger samples by including students from various types of universities, thereby increasing the heterogeneity of the target population. In particular, comparisons of students from regular universities and top-tier institutions in terms of their self-regulated learning behaviors could enhance the comprehensiveness of the findings of this research. Third, this study identified phubbing as a moderating variable; however, students' self-regulated learning behavior may also be related to many other factors. For example, family capital, as an external resource, is closely related to students' self-regulated learning. Future researchers should investigate these additional moderators with the goal of obtaining a more comprehensive understanding of the factors that affect self-regulated learning. Furthermore, future researchers could explore the implications of phubbing in different cultural contexts and social environments in further depth and investigate its long-term effects on student learning.

## Implications

### Theoretical implications

In this study, which is based on Pintrich's SRL model, a moderated mediation model is used to examine the internal and external mechanisms that influence self-regulated learning among college students. The key theoretical implications of this research are as follows:

First, this study provides empirical support to support Pintrich's SRL model. The findings indicate that meaning in life, which is a key factor during the forethought stage, enhances self-regulated learning not only directly but also indirectly by strengthening psychological capital during the monitoring stage [9]. Additionally, phubbing, as an external behavioral factor, influences these early stages, thereby impacting self-regulated learning. These empirical results confirm the applicability of Pintrich's SRL model and extend its relevance to digital learning environments.

Second, this study validates the conservation of resources (COR) theory and its resource gain perspective. According to COR theory, individuals strive to acquire, protect, and accumulate resources with the aim of coping with the stress and challenges that they experience [26]. This study reveals that psychological capital, as a secondary type of resource gain that is derived from meaning in life, not only enhances self-regulated learning but also contributes to continuous resource accumulation, thus leading to the emergence of a positive cycle.

Furthermore, under specific conditions, phubbing serves as a positive moderator in this context, thereby supporting the resource gain perspective by revealing that individuals can optimize resource management by engaging in strategic behaviors. These findings suggest that in digital environments, phubbing may function as a self-regulation strategy, which can enable college students to explore meaning in life and improve their self-regulated learning abilities more effectively.

### Practical implications

This study provides practical recommendations that can be used to enhance self-regulated learning among college students effectively, particularly in terms of three key aspects.

First, families and educators can support self-regulated learning among students by encouraging them to experience meaning in life. Parents play a crucial role in the process of shaping their children's perceptions and appreciation of the meaning of life through subtle, everyday influences. Furthermore, educators should consciously integrate life education into their teaching practices, thereby embedding self-regulated learning strategies within curricular activities with the goal of helping students develop more effective self-learning habits [60]. This interdisciplinary educational interaction is particularly beneficial in the context of efforts to promote students' comprehensive self-regulated learning abilities [61].

Second, the mediating role of psychological capital in this context suggests that educators should focus on cultivating students' psychological resources with the aims of helping them overcome learning difficulties and enhancing their self-regulated learning outcomes. Educators can be effective in this context in several ways: (1) it can strengthen students' academic self-efficacy by providing them with positive feedback that can increase their confidence; (2) it can promote students' academic resilience by helping them maintain a positive mindset and improve their ability to cope with challenges; (3) it can guide students to discover the intrinsic value of learning, thereby enhancing their sense of engagement and commitment; and (4) it can facilitate the design of self-regulated learning activities that can improve students' independent thinking and self-management skills. By employing these strategies, educators can enhance students' self-regulated learning abilities while also providing them with the psychological support that is necessary to promote their overall development.

Third, the positive moderating effect of phubbing in this context suggests that educators should adopt a balanced perspective on the dual impacts of this factor and develop intervention strategies that can be used to improve students' psychological capital and self-regulated

learning in the digital age. Understanding both the positive and negative effects of phubbing can help relevant actors develop more targeted educational interventions. (1) Universities should raise awareness of the negative effects of phubbing, such as social isolation and procrastination, by providing mental health education and time management training. (2) Educators can encourage students to use mobile devices as effective learning tools, thereby employing educational apps, online courses, and digital time-management tools to transform smartphones into resources that can support self-regulated learning. (3) Relevant actors can elicit a sense of meaning in life among students and improve their psychological capital, thus helping them make goal-oriented decisions regarding phone use; this process can ultimately enhance students' self-regulated learning abilities.

## Conclusions

Meaning in life not only predicts self-regulated learning among college students directly and positively but also influences self-regulated learning indirectly via the mediating role of psychological capital. The effects of meaning in life on psychological capital and self-regulated learning are moderated by phubbing. Specifically, as the frequency of phubbing increases, the positive predictive effect of meaning in life on psychological capital and self-regulated learning becomes stronger.

## Abbreviations

SRL	Self-Regulated Learning
GST	Goal-setting theory
CMV	Common method variance
RGS	Resource gain spirals
COR	Conservation of resources

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s40359-025-02859-x>.

Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

## Acknowledgements

We are grateful to the school administrators, teachers and students who actively cooperated with the researchers in the data collection. We also thank the peer reviewers who helped us review the manuscript.

## Author contributions

Wenjing Feng: Writing – review & editing. Peibo Wu: Methodology, formal analysis, investigation, writing – original draft, visualization. Shuai Lv: Methodology, provision of computing resources or other analytical tools. Zhaoyuan Fan: Conceptualization, supervision, project administration.

## Funding

Henan Province Soft Science Research Program Project: "Research on the Influencing Mechanism and Cultivation Path of College Students' Innovative Vitality in Henan Province from the Perspective of High-Quality Development", Project Number: 242400410553. Key Project of Henan Provincial Educational

Science Planning: "The Impact Mechanism and Cultivation Pathways of Social and Emotional Competencies of College Students in Henan under the Background of Artificial Intelligence", Project Number: 2025JKZD38. The University-level Scientific Research and Innovation Team of Zhongyuan University of Technology: "Teacher Education and Teacher-Student Symbiosis Research Team", Project Number: ZYKJCXTD202404.

## Data availability

This study adheres to the principles of openness and transparency. All original data is available to readers as supplementary materials to the article and are open for download, further analysis, and utilization by interested researchers.

## Declarations

### Ethical approval and consent to participate

To ensure the scientific rigor and representativeness of this study, participation in this research was entirely voluntary. All participants provided informed consent and were explicitly informed orally of the study's objectives and procedures as well as their right to withdraw from this research at any time. The research team adhered to strict ethical standards during the process of data collection. The study was conducted in accordance with the guidelines of the Declaration of Helsinki and was approved by the Ethics Committee of Zhongyuan Institute of Science and Technology. The design of and procedures used in this study were approved by the relevant authorities and reviewed by the institutional ethics committee under approval number 2024051823.

### Consent for publication

Not applicable.

### Competing interests

The authors declare no competing interests.

### Author details

<sup>1</sup>Zhong Yuan Institute of Science and Technology, Zhengzhou, People's Republic of China

<sup>2</sup>Institute of Education, Xiamen University, Xiamen, People's Republic of China

<sup>3</sup>School of Modern Logistics, Qingdao Harbour Vocational and Technical College, Qingdao, People's Republic of China

Received: 15 October 2024 / Accepted: 9 May 2025

Published online: 27 May 2025

## References

- Guo JP, Yang LY, Zhang J, Gan YJ. Academic self-concept, perceptions of the learning environment, engagement, and learning outcomes of university students: relationships and causal ordering. *High Educ.* 2022;1–20. <https://doi.org/10.1007/s10734-021-00705-8>.
- SUN M. & CHEN D. A new model of autonomous learning for high school students and its new demands for the reform of the current college entrance examination system. *Mod Educational Manage.* 2024;1–9. <https://doi.org/10.16697/j.1674-5485.2024.08.001>.
- Follmer DJ, Hut M, Spitznogle R, Baker AC. First-generation student pathways to persistence and degree attainment: the roles of deeper learning and self-regulated learning beliefs. *Learn Individual Differences.* 2024;113:102471. <http://doi.org/10.1016/j.lindif.2024.102471>.
- Arianto F, Hanif M. Evaluating metacognitive strategies and self-regulated learning to predict primary school students' self-efficacy and problem-solving skills in science learning. *J Pedagogical Res.* 2024;8(3):301–19. <https://doi.org/10.33902/JPR.202428575>.
- Puustinen M, Pulkkinen L. Models of self-regulated learning: A review. *Scandinavian J Educational Res.* 2001;45(3):269–86. <https://doi.org/10.1080/00313830120074206>.
- Efklides A, Schwartz BL. Revisiting the metacognitive and affective model of Self-Regulated learning: origins, development, and future directions. *Educational Psychol Rev.* 2024;36:61. <https://doi.org/10.1007/s10648-024-09896-9>.
- Radović S, Seidel N, Menze D, Kasakowski R. Investigating the effects of different levels of students' regulation support on learning process and

- outcome: in search of the optimal level of support for self-regulated learning. *Computers Educ.* 2024;215:105041. <https://doi.org/10.1016/j.compedu.2024.105041>.
8. Panadero E. A review of self-regulated learning: six models and four directions for research. *Front Psychol.* 2017;8:422. <https://doi.org/10.3389/fpsyg.2017.00422>.
  9. Pintrich PR. The role of goal orientation in self-regulated learning. In: Boekaerts M, Pintrich PR, Zeidner M, editors. *Handbook of Self-Regulation*. San Diego, CA: Academic; 2000. pp. 452–502. <https://doi.org/10.1016/B978-0-12109890-2/50043-3>.
  10. Conde Gafaro B. First steps towards self-regulated learning: setting goals in MOOCs. *Setting Goals MOOCs.* 2022;63–75. <https://doi.org/10.4324/9781003177098-6>.
  11. Alonso-Mencia ME, Alario-Hoyos C, Maldonado-Mahauad J, Estévez-Ayres I, Pérez-Sanagustín M, Delgado Kloos C. Self-regulated learning in MOOCs: lessons learned from a literature review. *Educational Rev.* 2020;72(3):319–45. <https://doi.org/10.1080/00131911.2019.1566208>.
  12. Zhang S, Fu YN, Liu Q, Turel O, He Q. Psychological capital mediates the influence of meaning in life on prosocial behavior of university students: A longitudinal study. *Child Youth Serv Rev.* 2022;140:106600. <https://doi.org/10.1016/j.childyouth.2022.106600>.
  13. Paloş R, Sava SL, Virgă D. The role of teacher support, students' need satisfaction, and their psychological capital in enhancing students' self-regulated learning. *Studia Psychol.* 2020;62(1):44–57. <https://doi.org/10.31577/sp.2020.01.790>.
  14. China Internet Center. The 54th Statistical Report on the Development of the Internet in China. 2024-08 Retrieved from.
  15. Pew Research Center. Teens, social media & technology. 2018. Retrieved from <http://publicservicesalliance.org/wpcontent/uploads/2018/06/Teens-Social-Media-Technology2018-PEW.pdf>.
  16. Steger MF, Kawabata Y, Shimai S, Otake K. The meaningful life in Japan and the United States: levels and correlates of meaning in life. *J Res Pers.* 2008;42(3):660–78. <https://doi.org/10.1016/j.jrp.2007.09.003>.
  17. Steger MF, Frazier P, Oishi S, Kaler M. The meaning in life questionnaire: assessing the presence of and search for meaning in life. *J Couns Psychol.* 2006;53(1):80–93. <https://doi.org/10.1037/0022-0167.53.1.80>.
  18. King LA, Hicks JA. The science of meaning in life. *Ann Rev Psychol.* 2012;72(1):561–84.
  19. Liu Y, Di S, Zhang Y, Ma C. Self-concept clarity and learning engagement: the sequence-mediating role of the sense of life meaning and future orientation. *Int J Environ Res Public Health.* 2023;20(6):4808. <https://doi.org/10.3390/ijerph20064808>.
  20. Lotfi Amiri Z, Qorbanpur Lafmejani A, Pursafar A. The mediatory role of Self-Control and meaning of life in the relationship between Islamic lifestyle and marital conflicts. *J Lifestyle.* 2023;8(2):33–60.
  21. Locke EA, Latham GP. A theory of goal setting & task performance. Prentice-Hall, Inc; 1990.
  22. Locke EA, Latham GP. Building a practically useful theory of goal setting and task motivation: A 35-year odyssey. *Am Psychol.* 2002;57(9):705. <https://doi.org/10.1037/0003-066X.57.9.705>.
  23. Zhu M, Zhao J, Zhu X, Cheng Q, Zhang S, Kong L. Effects of Health-Promoting lifestyle on Late-Onset depression in older adults: mediating effect of meaning in life and Interleukin-6 (IL-6). *Psychol Res Behav Manage.* 2023;5159–5168. <https://doi.org/10.2147/PRBM.S441277>.
  24. An F, Xi L, Yu J. The relationship between technology acceptance and self-regulated learning: the mediation roles of intrinsic motivation and learning engagement. *Educ Inform Technol.* 2024;29(3):2605–23.
  25. Luthans F, Avolio BJ, Avey JB, Norman SM. Positive psychological capital: measurement and relationship with performance and satisfaction. *Pers Psychol.* 2007;60(3):541–72. <https://doi.org/10.1111/j.1744-6570.2007.00083.x>.
  26. Hobfoll SE. Conservation of resources: a new attempt at conceptualizing stress. *Am Psychol.* 1989;44(3):513–24.
  27. Hobfoll SE, Halbesleben J, Neveu JP, Westman M. Conservation of resources in the organizational context: the reality of resources and their consequences. *Annual Rev Organizational Psychol Organizational Behav.* 2018;5(1):103–28. <https://doi.org/10.1146/annurev-orgpsych-032117-104640>.
  28. Wang X, Zhang J, Wu SW, Wang Z, Li F, Miao D. Effects of meaning in life on subjective well-being: the mediating role of self-efficacy. *Social Behav Personality: Int J.* 2021;49(4):1–11. <https://doi.org/10.2224/sbp.9975>.
  29. Zhang Y, Ding X, Liu Y, Han Y, Wang G, Cai M, Hu DY. The relationship between social support and suicide resilience in Chinese cancer patients: a serial multiple mediation model through self-care self-efficacy and meaning in life. *Cancer Nurs.* 2024;47(4):E236–44. <https://doi.org/10.1097/NCC.0000000000001202>.
  30. Murphy ER. Hope and well-being. *Curr Opin Psychol.* 2023;50:101558. <https://doi.org/10.1016/j.copsyc.2023.101558>.
  31. Teng LS. Individual differences in self-regulated learning: exploring the nexus of motivational beliefs, self-efficacy, and SRL strategies in EFL writing. *Lang Teach Res.* 2024;28(2):366–88. <https://doi.org/10.1177/13621688211006881>.
  32. Li Y. The mechanism of self-regulated learning among rural primary middle school students: academic delay of gratification and resilience. *Learn Motiv.* 2024;87:102013. <https://doi.org/10.1016/j.lmot.2024.102013>.
  33. Huang C. Self-regulation of learning and EFL learners' hope and joy: A review of literature. *Front Psychol.* 2022;13:833279.
  34. Olson JA, Sandra DA, Colucci ÉS, Bikaii A, Chmoulevitch A, Nahas D, Veissière J, S. P. Smartphone addiction is increasing across the world: A meta-analysis of 24 countries. *Comput Hum Behav.* 2022;129:107138. <https://doi.org/10.1016/j.chb.2021.107138>.
  35. Chotpitayasonondh V, Douglas KM. The effects of phubbing on social interaction. *J Appl Soc Psychol.* 2018;48(6):304–16. <https://doi.org/10.1111/jasp.12506>.
  36. Miller-Ott A, Kelly L. The presence of cell phones in romantic partner face-to-face interactions: an expectancy violation theory approach. *South Communication J.* 2015;80(4):253–70.
  37. Bakır V, Dilmaç B. Examining the relationship between phubbing and mental health among university students: A mixed study. *Res Educ Psychol.* 2023;7(3):602–21.
  38. Musdalifah M, Qamariah Z. The effect of phubbing in group learning. *Atmosfer: Jurnal Pendidikan, Bahasa, Sastra, Seni, Budaya, dan Sosial Humaniora.* 2023;1(3):98–108. <https://doi.org/10.59024/atmosfer.v1i3.215>.
  39. Anderl C, Hofer MK, Chen FS. Directly-measured smartphone screen time predicts well-being and feelings of social connectedness. *J Social Personal Relationships.* 2024;41(5):1073–90. <https://doi.org/10.1177/02654075231158300>.
  40. Garrido EC, Delgado SC, Esteban PG. Phubbing and its impact on the individual's psychological well-being. *Acta Psychol.* 2024;248:104388. <https://doi.org/10.1016/j.actpsy.2024.104388>.
  41. Ergün N, Göksu İ, Sakız H. Effects of phubbing: relationships with psychodemographic variables. *Psychol Rep.* 2020;123(5):1578–613. <https://doi.org/10.1016/j.heliyon.2021.e07037>.
  42. Maftai E, Mäirean C. Put your phone down! Perceived phubbing, life satisfaction, and psychological distress: the mediating role of loneliness. *BMC Psychol.* 2023;11(1):332. <https://doi.org/10.1186/s40359-023-01359-0>.
  43. Tong W, Jia J, Wang P, He W. The associations between parental phubbing, adolescent phubbing, and adolescents' adjustments: a cross-lagged panel network analysis. *J Youth Adolesc.* 2024;53(7):1529–41.
  44. He AM, Xu WQ, Hui QP. The relationship between adolescents' psychological capital and motivation for cell phone use: a cross-sectional lagged study. *Chin J Clin Psychol.* 2020;28(5):995–1001. <https://doi.org/10.16128/j.cnki.1005-3611.2020.05.028>.
  45. Estefanía C, Garrido, Issa TP, Gutiérrez E, Delgado SC. A descriptive literature review of phubbing behaviors. *Heliyon.* 2021;7(5):e07037.
  46. Mengcheng W, Xiaoyang Dai. Chinese meaning in life questionnaire revised in college students and its reliability and validity test. *Chin J Clin Psychol.* 2008;16(5):459–61.
  47. Ye Y, Fang B. Compilation of the psychological capital questionnaire for adolescent students. F. Fujian Normal University (Philosophy Social Sci Edition). 2015;2:135–41. 171.
  48. Karadağ E, Tosuntaş ŞB, Erzen E, Duru P, Bostan N, Şahin BM, Babadağ B. Determinants of phubbing, which is the sum of many virtual addictions: A structural equation model. *J Behav Addictions.* 2015;4(2):60–74.
  49. Hui Q, Wang Z, He A. Reliability and validity of phubbing Scale—Chinese version in Chinese adolescents. *Chin J Clin Psychol.* 2022;30(5):1179–82. <https://doi.org/10.16128/j.cnki.1005-3611.2022.05.034>.
  50. Zhu Z, Wang J, Zhang W, Ye Q. Construction of Self-Regulated learning scale for college students. *Psychol Dev Educ.* 2005;360–5. <https://doi.org/10.16187/j.cnki:issn1001-4918.2005.03.012>.
  51. Hayes AF, Scharlow M. The relative trustworthiness of Inferential tests of the indirect effect in statistical mediation analysis: does method really matter? *Psychol Sci.* 2013;24(10):1918–27.
  52. Podsakoff PM, MacKenzie SB, Lee JY, Podsakoff NP. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J Appl Psychol.* 2003;88(5):879–903.

53. Feraco T, Casali N, Ganzit E, Meneghetti C. Adaptability and emotional, behavioural and cognitive aspects of self-regulated learning: direct and indirect relations with academic achievement and life satisfaction. *Br J Educ Psychol*. 2023;93(1):353–67. <https://doi.org/10.1111/bjep.12560>.
54. Tezci E, Sezer F, Aktan S, Gurgan U. Do lifestyles shape self-regulated learning strategies? *Eurasian J Educational Res*. 2016;16(65):239–58. <https://doi.org/10.14689/ejer.2016.65.14>.
55. Syahrial M. Psychoeducation based on meaning life learning values to increase students' Self-Awareness in studying in junior high school. *Manajia: J Educ Manage*. 2024;2(2):49–53.
56. Wang X, Zhao F, Lei L. Partner phubbing and relationship satisfaction: Self-esteem and marital status as moderators. *Curr Psychol*. 2021;40:3365–75.
57. HE A., ZHAI P., & HUI Q.(2024). The Impact and Its Mechanism of College Students' Phubbing on Social Mentality. *Chin J Clin Psychol*, 32(1), 177–81. <https://doi.org/10.16128/j.cnki.1005-3611.2024.01.032>.
58. Su W, Lin F, Luo W, Li T, Hang X. A social trend or a personal Temptation?——An interview study on causes and consequences of smartphone addicts among college students. *J Fuzhou University(Philosophy Social Sciences)*. 2022;2:107–16.
59. Gong Y, Chen Z, XIE X. Phubbing: antecedents, consequences and functioning mechanisms. *Adv Psychol Sci*. 2019;27(7):1258–67.
60. Zhang T. Effects of self-regulation strategies on EFL learners' Language learning motivation, willingness to communication, self-efficacy, and creativity. *BMC Psychol*. 2024;12(1):75. <https://doi.org/10.1186/s40359-024-01567-2>.
61. Žerak U, Jurišević M, Pečjak S. Parenting and teaching styles in relation to student characteristics and self-regulated learning. *Eur J Psychol Educ*. 2024;39(2):1327–51. <https://doi.org/10.1007/s10212-023-00742-0>.

## Publisher's note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.