

ORIGINAL PAPER

## EXPLORING THE ROLE OF LOCUS OF CONTROL AND FLOURISHING IN SUICIDAL IDEATION AMONG INDIAN ENGINEERING STUDENTS

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## Summary

**Background.** Suicide remains a significant public health concern, particularly among young adults, with engineering students facing elevated risks due to academic pressures. This study investigates the protective role of locus of control and flourishing in mitigating suicidal ideation among adolescent engineering students in an Indian technical institute.

**Material and methods.** Drawing upon a sample of 796 participants, data was collected via an online questionnaire assessing locus of control, flourishing, and suicidal ideation.

**Results.** Findings revealed a significant indirect effect of locus of control on suicidal ideation through flourishing, supporting the hypothesized mediation model. While no direct association was found between locus of control and suicidal ideation, flourishing emerged as a significant mediator, indicating that higher levels of flourishing were associated with reduced suicidal ideation. Additionally, an inverse relationship was observed between locus of control and flourishing, suggesting that an internal locus of control is conducive to higher levels of flourishing.

**Conclusions.** These findings contribute to the understanding of protective factors against suicidal ideation and highlight the importance of fostering flourishing and internalized modes of thinking in suicide prevention efforts among college students. Limitations and implications for future research are discussed.

**Keywords:** engineering students, locus of control, suicidal ideation, protective factors, flourishing

## Introduction

Suicide claims the lives of approximately 720,000 individuals annually and stands as the third leading cause of mortality among those aged 15 to 29 years [1]. When referencing “suicide”, the term generally encompasses a wide range of behaviors rather than a specific act. Individuals contemplate suicide when grappling with a persistent, atypical inner desire to terminate their lives, leading them to perceive death as the sole source of solace. Suicidal thoughts, intentions, gestures, attempts, and completions represent various manifestations of such behavior. It is imperative to view suicide as a complex public health and mental health concern intricately linked to the biological, psychological, social, cultural, and economic dimensions of both individual and societal existence.

Despite the advancements of the modern age, suicide remains a stigmatized topic, and individuals experiencing suicidal ideation often receive inadequate support. Research reveals that men with lower perceived need for help did not seek any support for their suicidal ideation [2]. Suicidal ideation serves as a crucial initial indicator of suicidal risk and warrants a thorough risk assessment [3]. This ideation spans a spectrum from passive contemplation of ending one's life to well-defined, organized suicidal thoughts and plans. The term “suicidal ideation” encompasses a diverse array of thoughts, inclinations, and preoccupations with suicide and death. The presence of suicidal ideation and the occurrence of suicide attempts demonstrate a robust correlation with casualties due to suicide, often leading to detrimental consequences such as injuries, hospitalization, and a loss of autonomy.

Suicidal ideation and behaviors manifest with notable frequency among college students. Despite the implementation of various preventive strategies in universities and colleges worldwide, suicide rates continue to be a significant concern, particularly in India, where suicide has seen a rising trend over the last 26 years, with late adolescents being highly

vulnerable [4]. Over the past two decades, the incidence of Indian student suicides has more than doubled, as reported by the Accidental Deaths and Suicide in India [5]. Furthermore, despite suicide ranking as one of the primary causes of death in collegiate settings, only a limited number of students report receiving information on suicide from their educational institutions. This discrepancy is underscored by a study wherein 65.9% of participants indicated a lack of information on suicide prevention provided by their academic institutions [6].

Within the academic sphere, engineering students contend with formidable challenges such as elevated expectations, protracted study sessions, and demanding coursework, leading to a pronounced prevalence of heightened stress [7]. Research demonstrates that academic perfectionism correlates negatively with different dimensions of psychological well-being, with the level of demand of the degree serving as a mediating variable between perfectionism and psychological well-being [8]. The competitive nature of this academic environment exacerbates the imperative to excel, consequently exerting a deleterious impact on mental health and heightening the susceptibility to suicidal ideation. The intricate matter of suicidal ideation within the engineering student population is intricately linked to societal pressures, mental health concerns, and the stressors inherent in academic pursuits. Longitudinal research has revealed that perceived stress can significantly and negatively predict subsequent general self-efficacy, while general self-efficacy can significantly and negatively predict subsequent perceived stress [9]. Consequently, it becomes imperative to discern and address the specific factors posing a threat to the holistic well-being of this distinct academic demographic.

Upon exposure to the suicidal behaviors of their peers, adolescents may exhibit an increased susceptibility to suicidal tendencies, a phenomenon denoted as “suicide clusters” by researchers [10]. It should be noted that suicidal ideation is distinct from suicidal behavior. Suicidal ideation refers to thoughts and preoccupations with suicide, whereas suicidal behavior

encompasses planning, attempts, and enactment. Although related, ideation does not inevitably lead to behavior, but it remains one of the strongest predictors [11]. Furthermore, the fluctuating nature of suicidal ideation [11] poses challenges in its accurate measurement, with short-term longitudinal research finding that higher morning hopelessness predicted increased suicidal ideation later the same day [12]. Researchers underscore the pivotal role of suicidal ideation as a crucial intervention target in suicide prevention efforts, emphasizing the need to recognize and address it without diminishing its inherent significance [3].

Research conducted in India has primarily concentrated on evaluating the prevalence and societal influences contributing to suicidal ideation among college students [13]. However, there exists a notable gap in exploring the psychological factors associated with suicidal ideation within this demographic. Previous studies have delved into the examination of suicidal ideation among Indian medical students [14]. Despite these efforts, there remains a dearth of assessment and documentation regarding the risk of suicide among engineering students. Therefore, the present study endeavors to investigate the protective roles of locus of control and flourishing in mitigating suicidal ideation among this population.

### ***Suicidal ideation and locus of control***

The concept of locus of control pertains to the extent to which individuals perceive the outcomes of their actions to be contingent upon their own efforts [15]. Individuals characterized by an external locus of control attribute the consequences of their actions to external factors such as fate or the influence of others. Conversely, those with an internal locus of control maintain a belief that they have control over their own destiny, attributing the impact of their actions to personal agency. Meta-analytic evidence demonstrates that decreased perceived control is consistently associated with suicide attempts [16], while lower levels of perceived

control are strongly associated with greater suicidal ideation [17]. Previous research has established a correlation between suicidal ideation and an external locus of control [14]. Additionally, it has been found that individuals who attempted suicide were more externally oriented than individuals who did not [18].

Researchers have presented a model of suicidal ideation proposing that the confluence of three factors significantly heightens the risk of suicide in youth: (a) an overwhelming absence of meaningful connections due to persistent attachment breakdowns; (b) a sense of powerlessness in resolving interpersonal conflicts; and (c) a distinctly bleak and pessimistic outlook on the future [19]. Individuals characterized by an external locus of control may perceive an inability to alter their circumstances, rendering them more susceptible to suicidal ideation. Research reveals that individuals with high perceived control of internal states tend to have higher resilience, leading to lower suicidality [20].

### ***Suicidal ideation and flourishing***

Flourishing stands as a fundamental concept within positive psychology, encompassing traditional dimensions of well-being [21]. This construct integrates both hedonic well-being, which involves positive emotions and perceptions of life satisfaction, and eudaimonic well-being, encompassing both interpersonal and intrapersonal aspects [22]. Furthermore, flourishing extends to positive social functioning. Research indicates that eudaimonic subjective well-being may be protective at the individual level, whereas hedonic subjective well-being may be protective at the group level against suicidal ideation [23].

Consistent with preceding research, flourishing has demonstrated associations with a diminished likelihood of suicidal ideation [24]. Research demonstrates that flourishing, along with other resilience-related protective factors, is negatively associated with suicidal ideation

[25]. Additionally, students who were depressed and languishing had the greatest odds of suicidal thoughts and behavior [26]. Significantly lower resilience levels have been noted among participants who reported suicidal ideation or attempts [27].

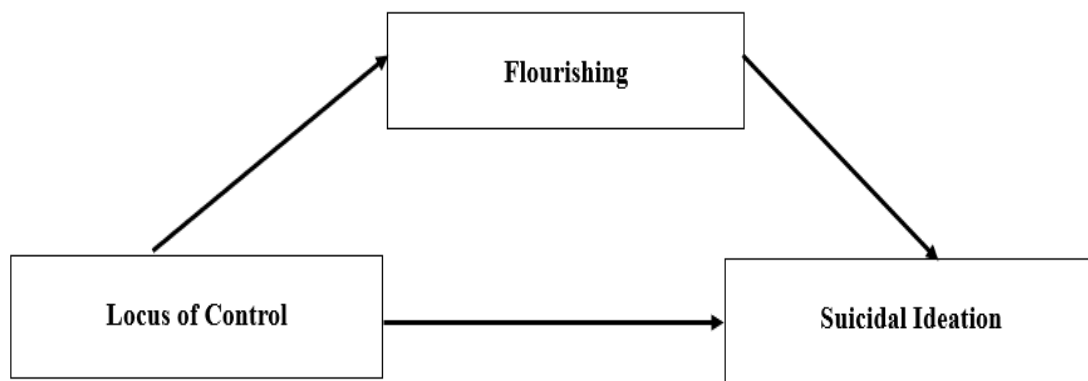
Prior investigations have examined the correlation between locus of control and various aspects of flourishing, such as well-being and happiness, with recent research showing that individuals who feel greater control over their lives report higher life satisfaction and happiness [28]. However, the broader association between locus of control and overall flourishing remains relatively unexplored, especially in the context of suicide risk. The conceptual intersection of flourishing and mental health presents an opportunity for the development of innovative strategies aimed at mitigating suicidal ideation. To assess the efficacy of novel suicide prevention approaches that bolster flourishing in vulnerable individuals, it is imperative for healthcare providers and policymakers to comprehend the causal relationship between flourishing and suicidal ideation. The crucial interplay between suicidal ideation, locus of control, and flourishing must be understood to inform the creation of effective suicide prevention strategies. By addressing the multifaceted nature of suicidal behavior, collaborative efforts among researchers, healthcare providers, and policymakers can strive to diminish the prevalence of suicidal ideation and elevate overall well-being.

### **Aim of the work**

This research aims to investigate the extent to which locus of control and flourishing serve as protective factors against suicidal ideation among engineering students. By delving into these factors, we hope to contribute insights toward the development of comprehensive and effective suicide prevention measures. Instead of identifying the risk factors that might enhance suicidal ideation, the present study concentrates on protective factors that foster well-

being and enhance resilience. More specifically, we aim to discover how locus of control and flourishing impact suicidal ideation. Drawing upon a previous investigation [29], which explored the interplay among locus of control, the meaning of life, and suicidal tendency, we posit that flourishing acts as a mediator between locus of control and suicidal ideation. Figure 1 presents the proposed conceptual model of the study. Thus, the following hypotheses were formed:

- **H1a:** Locus of control has a direct effect on suicidal ideation.
- **H1b:** Flourishing serves as a mediator between locus of control and suicidal ideation.
- **H2a:** Locus of control is negatively associated with flourishing.
- **H2b:** Locus of control is positively associated with suicidal ideation.
- **H2c:** Flourishing is negatively associated with suicidal ideation.



**Figure 1.** Proposed relationship between locus of control, flourishing and suicidal ideation

## **Material and methods**

### ***Participants and procedure***

Data was gathered through an online questionnaire distributed among engineering students, in exchange for course credit, enrolled in an Indian technical institute. The questionnaire also encompassed demographic variables such as age, gender, and educational background. Participants failing any of the attentional checks were excluded from the sample. The final sample comprised 796 engineering students. Among them, 182 identified as female (22.82%), 612 as male (76.88%), with one participant preferring “they/them” pronouns and another identifying as “non-binary”. Prior to participation, informed consent was obtained from all participants.

### ***Measures***

#### *Rotter's Locus of Control Scale*

The Locus of Control Scale comprises 29 items designed to assess an individual's perception of the extent to which reinforcements are contingent upon their own actions [15]. This scale utilizes a forced-choice format, wherein respondents must select between two statements provided for each item. To obscure the true intent of the assessment, six filler items are included in the 29-item version. Scores on the scale range from 0 to 23. A *higher* score suggests an *external* locus of control, indicating that the individual attributes outcomes to external factors such as fate or the actions of others. Conversely, a *lower* score reflects an *internal* locus of control, signifying the belief that one's actions significantly influence their own destiny. In this study, the internal consistency of the scale was deemed acceptable ( $\alpha = 0.603$ ).

### *Flourishing Scale*

The Flourishing Scale assesses an individual's level of flourishing through eight positively framed items [30]. These items cover various significant aspects of human functioning, including self-acceptance, competence, engagement, interest, meaning and purpose, optimism, supportive relationships, perception of contribution to the well-being of others, and being respected. Each item employs a 7-point Likert scale ranging from 1 ("strongly disagree") to 7 ("strongly agree"). Higher scores indicate a more positive self-perception across key domains of well-being. In this study, the scale demonstrated high internal consistency ( $\alpha = 0.885$ ) within the sample.

### *Suicidal Ideation Scale*

Suicidal Ideation was assessed utilizing a subset of 39 items selected from the Suicidal Ideation Scale [31], specifically chosen for their relevance to the current study. This scale aims to identify individuals potentially harboring suicidal thoughts and inclinations. Responses to the statements are rated on a 4-point scale, ranging from Never (0) to Often (3). The cumulative total score was then categorized into levels of severity: Mild Suicidal Ideation (1 to 39), Moderate Suicidal Ideation (40 to 78), and Severe Suicidal Ideation (79 to 117), with a score of 0 indicating No Suicidal Ideation. Within the present sample, the scale demonstrated good internal consistency ( $\alpha = 0.982$ ).

## Data analysis

All analyses were done using Pandas, Statsmodel, and Scipy libraries from Python 3.9.13. A bivariate analysis was conducted to assess the associations between locus of control, flourishing, suicidal ideation, and age. A mediation analysis was performed to assess the direct and indirect effect of locus of control, via flourishing, on suicidal ideation among the students.

## Results

### Descriptive summary and bivariate relationships

The participants had a mean age of 20.76 years (SD = 1.27). The total score on the Locus of Control Scale ranged from 2 to 23 (M = 12.47; SD = 3.59). The scores on the Flourishing Scale ranged from 8 to 56 (M = 41.92; SD = 8.78). The total score of the Suicidal Ideation Scale ranged from 0 to 117 (M = 31.29; SD = 29.17). Table 1 presents a descriptive summary of the variables.

**Table 1.** Descriptive statistics and characteristics of the sample (N = 796)

Locus of control		Flourishing		Suicidal ideation	
M = 12.47	SD = 3.59	M = 41.92	SD = 8.78	M = 31.29	SD = 29.17
Internal locus of control (51.38%)		High flourishing (92.34%)		No suicidal ideation (4.90%)	
External locus of control (48.62%)		Low flourishing (7.66%)		Mild suicidal ideation (63.82%)	
				Moderate suicidal ideation (24.75%)	
				Severe suicidal ideation (6.53%)	

Notes: M – Mean, SD – Standard deviation.

The bivariate relationships between the variables and with age were also assessed. Only flourishing ( $r = 0.12, p < 0.001$ ) and suicidal ideation ( $r = -0.12, p = 0.001$ ) were significantly associated with age, indicating that as age increases, suicidal ideation decreases and flourishing

increases. Locus of control was negatively associated with flourishing ( $r = -0.15, p < 0.001$ ), indicating that higher scores on the scale, i.e. an external orientation, was associated with lower levels of flourishing. The association between locus of control and suicidal ideation was not significant ( $r = 0.03, p = 0.27$ ). Flourishing was significantly negatively associated with suicidal ideation ( $r = -0.21, p < 0.001$ ), indicating that higher levels of flourishing are associated with lower levels of suicidal ideation. Table 2 presents the bivariate linear associations between the variables.

**Table 2.** Correlations between age, locus of control, flourishing, and suicidal ideation

Variables	Age	Locus of control	Flourishing	Suicidal ideation
Age	1	-0.099	0.124**	-0.121*
Locus of control	-0.099	1	-0.150**	0.039
Flourishing	0.124**	-0.150**	1	-0.216**
Suicidal ideation	-0.121*	0.039	-0.216**	1

Notes: \* $p < 0.01$ , \*\* $p < 0.001$ .

### **Mediation analysis**

The locus of control was encoded as the independent variable (X), flourishing as the mediating variable (M), and suicidal ideation as the dependent variable (Y). The mediation analysis was carried out by the ordinary least squares method to check the direct and indirect effect of locus of control on suicidal ideation. Locus of control (X) had a positive impact on suicidal ideation, but the result was not statistically significant ( $\beta = 0.06, SE = 0.28, p = 0.84$ ), hence indicating that locus of control has no direct effect on suicidal ideation. Flourishing (M) had a significant negative impact on suicidal ideation ( $\beta = -0.71, SE = 0.12, p < 0.001$ ), thus suggesting a significant indirect effect of locus of control on suicidal ideation via flourishing. The result of the mediation analysis is given in Table 3.

**Table 3.** Direct and indirect effects of locus of control on suicidal ideation

Variables	$\beta$	SE	t	95% CI
Constant	60.51*	6.54	9.26	47.68 – 73.34
Locus of control (X)	0.06	0.28	0.20	-0.50 – 0.61
Flourishing (M)	-0.71*	0.12	-6.13	-0.943 – -0.485

Notes: SE – Standard Error, CI – Confidence Interval, \* $p < 0.001$ .

The model yielded a  $R^2$  value of 0.047, implying that the predictors together explain about 4.7% of the variance in suicidal ideation. The adjusted  $R^2$  value (0.044) was consistent with the initial value. The overall model proved to be statistically significant ( $F(2, 793) = 19.42$ ,  $p < 0.001$ ), suggesting the significant mediating effect of flourishing on suicidal ideation.

## Discussion

The primary objective of this investigation was to explore the mechanism by which locus of control and flourishing influence suicidal ideation. Rather than solely examining risk factors associated with heightened suicidal ideation, this study shifts its focus towards protective factors conducive to well-being and resilience development. Instead of evaluating the influence of externally oriented thinking on susceptibility to suicide, our focus lies in exploring the protective factors of internal locus of control and flourishing against suicidal ideation. Two pivotal variables are outlined herein: locus of control as the independent variable and flourishing as the mediating variable between locus of control and suicidal ideation. Given the significant escalation in suicide rates among Indian students, particularly highlighted by recent evidence showing that suicide in India has seen a rising trend over the last 26 years, with late adolescents being highly vulnerable [4], engineering students were selected as the focal

population for our research investigation. This choice is further supported by research demonstrating that engineering culture acts as a barrier to help-seeking for mental health [32].

Although the explained variance of the model was slight ( $R^2 = 4.7\%$ ), this finding is consistent with the broader literature on suicide research, where small effect sizes are common given the multifactorial nature of suicidal thoughts and behaviors. A meta-analysis of 50 years of suicide research emphasizes that even small predictors can hold substantial theoretical and clinical relevance because suicide risk arises from numerous interacting biological, psychological, and social determinants [33]. Similarly, researchers argue that small effect sizes in psychology should not be dismissed, as they often accumulate to produce meaningful outcomes at the population level [34]. In this light, the present findings highlight flourishing as a valuable protective factor that, despite explaining limited variance individually, may play a critical role in broader suicide-prevention frameworks.

The first hypothesis posited a direct influence of locus of control on suicidal ideation. However, analysis of observed variables indicated a non-significant relationship between the two directly. Contrary to previous research [6], this study did not find locus of control to be a significant predictor of suicidal ideation. This outcome suggests that locus of control, in isolation, may not suffice as a reliable predictor of suicidal ideation. Its predictive utility may necessitate concurrent assessment with other variables. Nonetheless, when considering flourishing as a mediator, a significant indirect effect of locus of control on suicidal ideation emerged. This finding aligns with the discovery of a negative correlation between internal locus of control and suicidal tendencies [29].

Moving to the subsequent hypothesis, it was postulated that flourishing would serve as a mediator between locus of control and suicidal ideation. Examination of the study data revealed a statistically significant mediating role of flourishing on suicidal ideation, affirming the hypothesis. Additionally, it was conjectured that flourishing would display a negative

correlation with suicidal ideation, a proposition corroborated by the findings. This consistency aligns with recent literature indicating that flourishing, along with other resilience-related protective factors, is negatively associated with suicidal ideation [25]. As highlighted in meta-analytic findings [35], a negative correlation exists between the meaning of life and suicidal ideation, with a diminished sense of meaning fostering helplessness and despair that strongly contribute to suicidal ideation among adolescents [36]. Consequently, heightened levels of flourishing were associated with diminished levels of suicidal ideation.

Furthermore, an inverse relationship was observed between locus of control and flourishing, indicating that individuals with an external locus of control tend to exhibit lower levels of flourishing. An external locus of control denotes a belief that the outcomes of one's actions are contingent upon external forces such as fate or societal influences, thereby diminishing the experience of flourishing. Conversely, individuals with an internal locus of control perceive their lives as meaningful and actively seek out avenues for imbuing their lives with significance, thus fostering flourishing. Scholarly discourse suggests that individuals with an internal locus of control demonstrate greater perseverance in pursuit of goals [37], assuming responsibility for their actions and consequently minimizing reliance on external sources for their well-being. Contemporary research has expanded the understanding of control mechanisms, revealing that individuals with high perceived control of internal states tend to have higher resilience, leading to lower suicidality regardless of depression levels [20]. Additionally, agency – the sense of control over one's actions and outcomes – is diminished in individuals with depressive symptoms but can be strengthened when effort leads to successful outcomes [38]. Our study aligns with previous findings in that internal locus of control was associated with higher flourishing, which subsequently related to lower suicidal ideation among the students.

Internally oriented people have been found to be happier [28] and have better levels of mental health as compared to externally oriented individuals. Flourishing has also been associated with improved emotional stability [39]. However, studies have yet to explore the association between internal locus of control and the holistic concept of flourishing, which encompasses eudemonic as well as hedonic well-being. Meaning of life served as a mediator between internal locus of control and suicidal tendencies in a previous study [29]. We extended this model by incorporating the role of flourishing, which includes meaning of life as a component, in predicting suicidal ideation. Our study is, to the best of our knowledge, one of the first to examine the impact of internal locus of control and flourishing, as protective factors, on suicidal ideation in college students.

The examination of bivariate associations among the variables, including age, was also conducted. Notably, flourishing and suicidal ideation displayed significant correlations with age, indicating a pattern wherein advancing age corresponds to reduced suicidal ideation and heightened levels of flourishing. This observation aligns with the longitudinal findings of a study [40] where happiness was linked to an internal locus of control, a relationship that was noted to strengthen over time. With age, individuals tend to acquire experiences, fostering the development of resilience and coping mechanisms, potentially serving as protective factors against suicidal ideation. However, while a negative association between age and external locus of control was observed, it did not attain statistical significance in our study. This outcome may be attributed to the homogeneity of the sample; broader age range assessments of locus of control might yield divergent findings.

Demographic characteristics of the sample warrant further discussion. The predominance of male students reflects the gender distribution in engineering programs in India. Prior research has shown that men are less likely to seek psychological help [2], and having a predominantly male sample in the present study provides valuable insights into this

underrepresented group. Age also appeared relevant, with older students reporting slightly lower suicidal ideation and higher flourishing levels. This aligns with evidence that resilience and coping resources accumulate with age, reducing vulnerability to suicidality [40]. Additionally, the engineering context itself introduces unique pressures, including perfectionistic expectations, long study hours, and stigma toward help-seeking, all of which exacerbate mental health challenges [32]. Taken together, these contextual factors reinforce the need for targeted preventive interventions within technical institutes.

## Conclusions

Despite the inconclusive findings regarding the direct impact of locus of control on suicidal ideation and its association with the latter, our model was deemed valid for the targeted population. It was observed that flourishing serves as a mediator in the relationship between locus of control and suicidal ideation, a conclusion supported by previous literature indicating that an internal locus of control [37] and a sense of meaning in life diminish the propensity for engaging in risky behaviors.

Our study holds significant theoretical and practical implications. Locus of control, as a facet of personality structure [15], is typically considered stable and enduring, yet, akin to other personality traits, it remains amenable to developmental changes. Individuals necessitate exposure to achievements and positive experiences to gradually cultivate an internal locus of control [37]. Thus, individuals experiencing heightened flourishing may gradually cultivate self-reliance, shifting away from attributing outcomes solely to external factors or others. However, it is noteworthy that an individual's levels of flourishing may vary over time, presenting a potential caveat. Consequently, researchers and practitioners are encouraged to devise interventions focused on fostering flourishing and internalized modes of thinking. A

comprehensive meta-analysis of 99 studies on youth suicide prevention reported that interventions implemented in clinical and educational settings effectively reduce self-harm and suicidal ideation, though evidence remains limited for low and middle-income countries and high-risk groups [41]. Recent evidence suggests that structured psychoeducational programs can enhance self-efficacy and reduce stress among university students, highlighting the value of integrating such interventions with flourishing and control-oriented training [42]. More evidence is needed to examine how the internal locus of control and flourishing relate to each other so that practitioners can devise interventions and policies accordingly. If heightened levels of flourishing can develop an internally oriented cognition among individuals, or an internal locus of control leads to higher flourishing, it needs to be studied in greater depth to help vulnerable individuals.

The limitations of the present study underscore avenues for future research exploration. Firstly, the exclusive focus on engineering students limits the generalizability of the findings to broader populations. Diversifying the sample to encompass various demographics could enrich our understanding of the phenomenon under investigation. Secondly, the internal consistency of Rotter's Locus of Control Scale was modest ( $\alpha = 0.603$ ). This limitation may have attenuated the observed associations. Future research should consider employing alternative measures to capture locus of control with higher psychometric precision. Thirdly, while internal locus of control and flourishing were identified as significant protective factors, the inclusion of additional variables is imperative to construct a more comprehensive framework of resilience against suicidal ideation. Exploring multifaceted protective mechanisms may yield nuanced insights into preventive interventions. Fourthly, reliance on self-reported measures may introduce response biases and limit the depth of understanding regarding the interrelations among the studied variables. Employing diverse methodological approaches, including observational and experimental designs, could enhance the robustness

of future investigations. In conclusion, addressing these limitations offers promising pathways for advancing our knowledge of preventive strategies aimed at mitigating suicidal ideation and promoting mental well-being across diverse populations.

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Artificial intelligence (AI) was not used in the creation of the manuscript.

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