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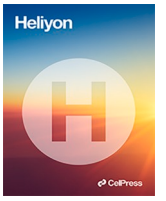

Research article

Analyzing psychological resilience in college students: A decision tree model

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A B S T R A C T

In the evolving landscape of higher education, particularly in the post-pandemic era, it is crucial for college students to face societal challenges and achieve success by understanding and predicting psychological resilience. To deepen our understanding of psychological resilience, this study used a decision tree model to explore influencing factors. We surveyed 776 college students and collected data on demographic information, self-esteem, sense of school belonging, pro-environmental behavior, subjective well-being, internet game addiction, life autonomy, and academic procrastination using several scales. The decision tree model identified eight key predictors of psychological resilience, which are as follows in order of importance: self-esteem, sense of school belonging, pro-environmental behavior, subjective well-being, academic procrastination, life autonomy, internet game addiction, and academic achievement. This model's accuracy reached 73.985 %, emphasizing its potential utility in educational settings. The findings not only provide a novel and data-driven perspective to understand psychological resilience in college students compared to existing research but also provide practical guidance for educational practitioners and policymakers on how to develop psychological resilience in college students.

1. Introduction

The emergence of the global public crisis, represented by the COVID-19 pandemic, has not only reshaped the social and economic structure but has also profoundly affected the learning style, life, and mental health of college students. In the context of multi-aspect challenges, research has revealed the impact of social media on learning behavior and highlighted how the digital environment changes students' adaptive strategies [1]. Scholars have further emphasized the changes in mental health during COVID-19 and pointed out the importance of psychological resilience during crises [2]. Psychological resilience is crucial for college students, as it encompasses separate (biological and psychological) qualities of well-being and mental health that enable successful adaptation or swift recovery from adversity in life [3]. From the perspective of educational intervention and adolescents' health needs, the study emphasized the influence of individual developmental stages on mental health [4,5]. These studies have collectively highlighted the

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importance of college students' mental health in coping with external crises and changes, which introduces the topic of this study: What are the key factors of psychological resilience in college students, and how important are they?

In previous studies related to psychological resilience, it was generally believed that psychological resilience is influenced by individual and environmental factors, such as self-efficacy, natural environment, educational level, and trauma experience [6–9]. However, these studies have not fully explored the influence of individual consciousness on psychological resilience, which includes internal self-awareness and external perceived behavior, especially in a situation of collective pressure, such as a public crisis [10,11]. It has been proved that individual consciousness has great significance for psychological resilience. On one hand, according to the Broaden-and-Build Theory of Positive Psychology, positive emotions, such as self-esteem, life autonomy, and subjective well-being, can broaden individuals' thought and behavior patterns [11,12], and enhance psychological resilience by creating lasting resources to manage challenges [13]. These internal elements of self-consciousness are regarded as subjective, showing the uniqueness of an individual's self-thinking and self-experience [14]. For example, individuals with higher self-esteem tend to have stronger psychological resilience. Life autonomy and subjective well-being can enhance individual self-efficacy and self-regulation and strengthen psychological resilience [15]. Furthermore, external perceived behavior toward the environment, such as a sense of school belonging and pro-environmental behavior, can lead to conscious discovery of oneself in the surrounding environment and comfortably situating oneself in the right place, which reflects strong psychological resilience [16,17]. Moreover, in the post-pandemic era, COVID-19 resulted in academic procrastination, academic performance and internet game addiction, etc., which are important factors affecting psychological resilience [18,19]. These variables can be explained by the Stress Adaptation Theory, which illustrates how these factors predict psychological resilience. This highlights adaptability to challenges and the importance of management strategies [20]. Therefore, under the collective stress of a public crisis, it is crucial to consider the impact of these factors on higher-order thinking, which is helpful in identifying the key predictors of individual psychological resilience and understanding the influencing mechanism of psychological resilience from a multidimensional perspective.

However, previous research has rarely applied the decision tree model to explore the factors influencing psychological resilience from the following aspects: self-esteem, life autonomy, pro-environmental behavior, sense of school belonging, subjective well-being, academic procrastination, academic achievement, and internet game addiction. It has been shown that the decision tree model is an appropriate algorithm for data mining in machine learning because it can be used to identify and analyze the complex relationships between various factors and outcomes [21]. Specifically, the decision tree model can predict outcomes based on a set of input variables. This approach can help psychologists better understand the factors that influence behavioral and mental health in a better way [22]. At the same time, the decision tree model can also identify key factors that contribute to mental problems or other psychological issues. By analyzing large datasets, the decision tree model can help psychologists determine which variables can predict outcomes.

To clarify the key predictors of psychological resilience, this study applied a decision tree model to understand the relationships between different factors and psychological resilience. Therefore, this study used a decision tree model to determine the predictors of psychological resilience from the variables. The results of this study can provide a reference for psychologists and educators when designing and implementing intervention measures. In the following sections, we review the relevant literature. Then, we present the research data and methods and put forward the predictors of psychological resilience in order of importance. Finally, we report the predictive factors of psychological resilience using a decision tree model and suggest further research directions.

2. Literature review

2.1. Psychological resilience

Psychological resilience, introduced by Anthony in the 1970s, has become a crucial area of study, particularly in the post-pandemic era. Werner [23] defined it as the capacity to recover from trauma, whereas Dryden and Bruce [24] viewed it as a dynamic process that enables adaptation to stress and setbacks. Psychological resilience, as a protective factor against stress [25,26], is closely related to mental health and is influenced by a variety of factors. This study highlights its correlation with factors such as self-esteem, sense of school belonging, subjective well-being, and internet game addiction. For instance, self-esteem showed a significant positive correlation with psychological resilience, especially among college students with left-behind experiences [27], whereas low self-esteem was linked to increased vulnerability [28]. Similarly, a strong sense of school belonging can foster psychological well-being and resilience [29]. Subjective well-being was positively correlated with psychological resilience [30]. Students with high psychological resilience are more optimistic about their futures and lives [31]. Conversely, internet game addiction was negatively associated with psychological resilience, often leading to decreased life satisfaction and increased negative emotions [32].

However, gaps in the literature exist regarding our understanding of the intricate dynamics of these factors in the post-epidemic landscape. The pandemic has altered social interactions and educational experiences, potentially influencing these correlations. Further research is needed to explore these changes and to identify additional variables or conditions that can predict psychological resilience in this new context. This exploration is vital for educators and policymakers aiming to cultivate psychological resilience among college students by allowing them to adapt to the unique challenges posed by the pandemic and its aftermath.

2.2. Psychological resilience measurement and common models

In the field of psychological resilience, measurement methods primarily revolve around scales and case studies tailored to specific contexts. Various definitions of psychological resilience have led to the development of various tools to measure it. For instance, the Connor-Davidson Resilience Scale (CD-RISC) aligns with an ability-based definition [33], the Mental Toughness Scale for Adolescents

with a process-based definition, and the Resilience Scale with an outcome-based approach. Additionally, prevalent models such as Garmezy's theoretical model [34], Rutter's developmental model [35], Kumpfer's integrate "individual-process-context" framework [36], and Richardson's resilience model [37] each offer unique perspectives on resilience formation and manifestation.

However, in the wake of the pandemic, research has not sufficiently explored the impact of multivariate predictors on psychological resilience, particularly in college students. This gap highlights the need for greater focus on positive psychology constructivist theories and the stress-resilience model, both of which are highly relevant to the pandemic context and college student demographics. For example, case studies on the interplay between psychological resilience and cognitive reappraisal strategies have been insightful [38], as has research on high school students' resilience during critical periods, such as college entrance exam preparations [39]. The pandemic has resulted in unique stressors, underscoring the importance of understanding how stressful daily events interact with psychological resilience. This understanding is crucial for adapting to high-risk sociotechnical systems and effectively managing recurrent stressors effectively [40]. Therefore, our study aimed to fill these gaps in the literature by considering various factors such as sample size, location, research methods, and specific conditions in our analysis, providing new insights into the field of psychological resilience, particularly under the unique challenges posed by the COVID-19 pandemic.

2.3. Predictive analysis methods

A range of analytical methods have been employed to predict psychological resilience, each contributing unique insights. Common techniques include exploratory potential category analysis, confirmatory factor analysis (CFA), meta-analysis, multilayer linear modeling, and rooted theoretical information analysis. For instance, Pang et al. [41] used t-tests, one-way ANOVA, correlation analysis, and multivariate regression to investigate teachers' perceived social support and its predictive relationship with psychological resilience. Khaksar et al. [42] employed structural equation modeling to examine the role of social capital in enhancing employees' psychological resilience. Meta-analyses have been instrumental in exploring the impact of psychological resilience on posttraumatic growth (PTG) and its relationship with depression among older adults [43]. Longitudinal studies such as those assessing the trajectory of resilience in gastric cancer patients [44] provided valuable insights into resilience over time. Similarly, rooted theoretical data analysis was used to understand the protective factors of orphans' psychological resilience [45].

Despite these various approaches, the application of the decision tree model, particularly in the context of college student populations, remains underexplored. This study aimed to address this gap by employing a decision-tree model to analyze a comprehensive range of factors affecting psychological resilience in college students. Such an approach is particularly pertinent in the evolving landscape of higher education, especially in the post-epidemic era, in which traditional predictors of resilience may interact differently owing to unique stressors and challenges. Our methodological selection, highlighted by the model's predictive precision of 73.985 %, underscores its effectiveness. Additionally, traditional methods do not prioritize the importance of predictive factors, whereas decision tree models can effectively prioritize predictive factors and are more interpretable and robust [46]. This method not only contributes a novel perspective to the existing literature but also highlights the potential of decision tree models in educational settings. Therefore, this study offers a new approach to understanding and predicting psychological resilience in college students, a demographic that has been significantly impacted by recent societal changes.

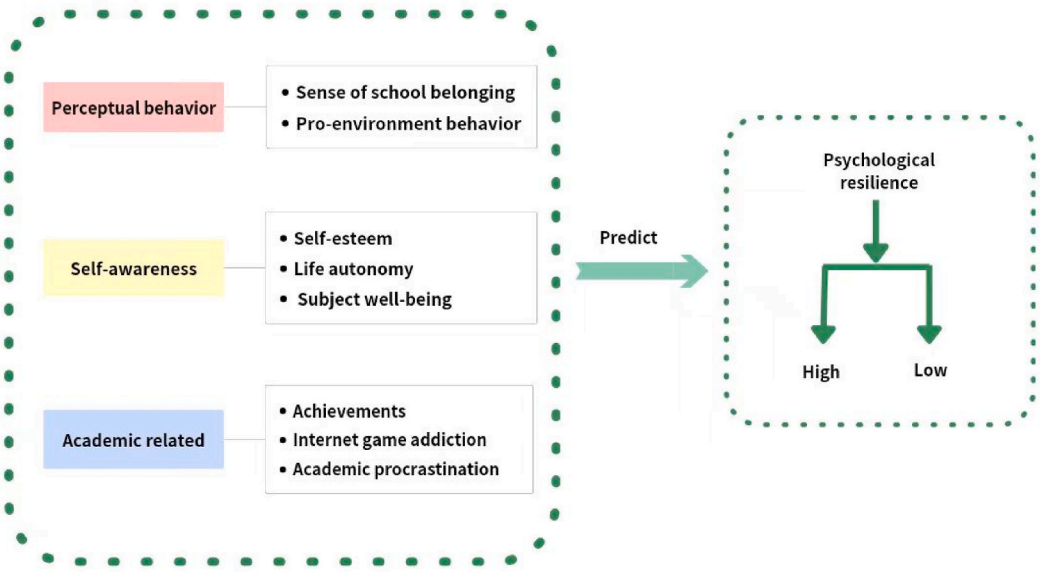


Fig. 1. Hypothetical predictors of psychological resilience.

2.4. Predicting psychological resilience

Earlier scholars suggested that psychological resilience is influenced by both individual factors, such as emotion regulation ability and self-efficacy, and environmental factors, including natural and social environments [47,48]. However, this dichotomy is not sufficient to explain the complex societal influences on individual psychological resilience, especially among college students. Grounded in the existing literature and relevant theories, this study categorizes the factors affecting college students' psychological resilience into three groups: self-awareness, extrinsic perceived behavior, and academic-related factors. First, according to the Broaden-and-Build Theory of Positive Psychology, self-awareness factors (i.e., self-esteem and subjective well-being) (see Fig. 1) enhance psychological resilience by promoting positive emotional experiences and expanding cognitive and behavioral patterns, thus building personal resources for resilience [49,50]. Additionally, based on positive constructivist theory, extrinsic perceived behavioral factors (i.e., pro-environmental behavior and sense of school belonging) predict psychological resilience by fostering positive cognitive construction, emotional experiences, and social connections [51]. Moreover, Stress Adaptation Theory provides a framework for understanding how college students face academic challenges (i.e., academic procrastination, internet game addiction, and academic achievement) by evaluating, choosing, and implementing coping strategies as well as learning and growing from these processes to predict and enhance psychological resilience [52,53].

Studies have found that intrinsic individual consciousness predicts psychological resilience. Individual consciousness refers to individual perceptions and attitudes about what one does, including awareness of one's own existence and relationship with people or objects around oneself [10]. Individual consciousness consists of intrinsic self-awareness and extrinsic perceived behaviors [11]. For example, self-esteem, life autonomy, and subjective well-being are all related to self-awareness and belong to internal self-consciousness, which is often described as subjectivity-that is, the uniqueness of individual thinking and self-experience. Scholars have found a significant positive correlation between self-esteem and psychological resilience among college students with left-behind experiences [54]. Moreover, research has shown that self-esteem can influence psychological resilience by affecting how individuals use emotional regulation strategies such as cognitive reappraisal and expressive suppression [55]. Thus, in this study, we hypothesized that self-esteem could predict psychological resilience [56]. Furthermore, people with higher levels of life autonomy tend to maintain better self-control [57], which is an important factor influencing psychological resilience [58]. At the same time, people who lack autonomy in life, such as those who feel trapped in their environment or controlled by others, tend to have lower levels of psychological resilience and more difficulty coping with stress and adversity. Therefore, we hypothesized that psychological resilience would be predicted by life autonomy (H2). Moreover, it has been shown that all dimensions of subjective well-being are significantly and positively correlated with psychological resilience [30,59]. People with higher levels of subjective well-being also tend to have stronger psychological resilience because positive emotions and a positive outlook on life help people cope better with stress and challenges as well as recover more quickly from negative experiences. Therefore, we hypothesized that psychological resilience can be predicted by subjective well-being (H3).

Second, scholars have identified the predictive role of external perceived behavior toward the environment in psychological resilience, a sense often described as objectivity, in which an individual's perception and behavior of the external environment is similar to that of others. Studies have proven that students' sense of self-worth improves according to the improvement of sense of school belonging, as does their psychological resilience [29]. Sense of school belonging is an important factor promoting psychological resilience [60]. Therefore, we hypothesized that sense of school belonging would predict psychological resilience (H4). However, one study found that junior high school students with a higher tendency to engage in pro-environmental behaviors could face academic or life events alone, stabilize their own adaptation to the environment, and maintain their dissatisfaction with life after being separated from their parents [61]. Therefore, there is a positive correlation between pro-environmental behavior and psychological resilience. People who engage in environmental behavior may be more resilient because they are actively stepping forward to solve environmental problems and make the planet healthier, which brings more feelings of control, competence, and hope. Thus, pro-environmental behavior is a key predictor of psychological resilience (H5).

Third, in the context of COVID-19, academic variables such as academic procrastination, academic achievement, and internet game addiction may affect individual psychological resilience. Particularly in the digital age of the Internet and social media, people have relied on the Internet more than ever during COVID-19 [62], particularly teenagers and college students. Activities such as online learning, social media interaction, and internet games have become part of their daily lives and have a significant impact on their psychological health and resilience. Academic achievement, internet game addiction, and academic procrastination can predict psychological resilience. First, improvements in academic achievement promote psychological well-being and enhance students' psychological resilience [63]. Students with good academic performance tended to have higher psychological resilience, better coping skills, problem-solving abilities, and the ability to recover from challenges and adversity. Therefore, we hypothesized that academic achievement would predict psychological resilience (H6). Second, internet game addiction is extremely damaging to society and personal mentality and affects psychological resilience [32]. Studies have indicated that the more people become addicted to internet games, the worse they maintain psychological resilience [64]. Internet game addiction has many negative effects on individual life, including social isolation, physical weakness, and a decreased ability to cope with stress and adversity. These negative effects can reduce individuals' recovery abilities and make it more difficult for them to recover from challenges and adversity. Therefore, we hypothesized that internet game addiction could predict psychological resilience (H7). Moreover, academic procrastination in college students acts as a coping mechanism to avoid emotional discomfort caused by challenging tasks [65,66]. Some studies have found a positive correlation between low academic procrastination and psychological resilience [67]. Therefore, we hypothesized that academic procrastination would predict psychological resilience (H8).

3. Methods

3.1. Participants

Using a network questionnaire method, our study was conducted to collect data from university students from September 7 to 15, 2022, from three universities in the Guangxi Zhuang Autonomous Region, China. The inclusion criteria were as follows: (1) students who, after the pandemic, were at an economic disadvantage, in psychological crisis, or had lost relatives and friends and students who had difficulty adapting to school according to the results of the university's psychological census and (2) students who were willing to participate in this study based on ethical considerations. (3) Students who were not from the three aforementioned universities were not included in the sample.

This study investigated the mental health status of university students in the Guangxi Zhuang Autonomous Region using a random sampling method. A sample of 800 students was selected from the three colleges. After the questionnaires were distributed and collected, the data were organized and analyzed. Ultimately, 776 valid questionnaires were obtained from 219 (28.2 %) male and 557 (71.8 %) female students who were between 19 and 25 years old. Before finalizing the study design, the researchers conducted sample interviews with the students to assess their emotional and psychological states. The majority of respondents expressed that they felt low during the COVID-19 pandemic and could not study effectively due to a lack of concentration during online courses, which had an impact on their studies and exacerbated their academic stress and anxiety.

3.2. Materials

The questionnaire used in this study consisted of the following components: a demographic information scale that included gender, age, subjects, grades, and major. The questionnaire measured the following variables to predict psychological resilience: self-esteem, sense of school belonging, pro-environmental behavior, subjective well-being, internet game addiction, life autonomy, academic procrastination, and psychological resilience.

3.2.1. Rosenberg self-esteem scale

The Rosenberg Self-Esteem Scale (RSE), developed by Rosenberg, was designed to evaluate general feelings of self-worth and self-acceptance [54]. The scale consists of 10 items, and convenience of measurement is fully considered in the design. Participants directly reported whether these descriptions fit them. A four-point scale was used: 1 indicated complete conformity, 2 indicated conformity, 3 indicated non-conformity, and 4 indicated complete non-conformity. The total score ranges from 10 to 40, with higher scores indicating higher self-esteem. In this study, the Cronbach's alpha coefficient for the RSE was 0.714.

3.2.2. Psychological sense of school membership scale

The Psychological Sense of School Membership (PSSM) Scale used in this study was originally proposed by Goodenow [68] and has been widely used and translated into several languages. The Chinese version of the PSSM, which has 18 items, was revised by Chinese scholars Teo et al. [69]. A five-point scale was used to assess participants' feelings, reactions, and recognition. The criteria were "1″ for "never," "2″ for "slightly not," "3″ for "average," "4″ for "slightly so," and "5″ for "always so." In this study, the Cronbach's alpha coefficient for the PSSM was 0.838.

3.2.3. Pro-environmental behavior scale

This study used the self-rated pro-environmental behavior scale developed by Zhou et al. [61]. The scale comprises 11 items and two dimensions. Among these, there were six items for public domain behaviors and five items for private domain behaviors. Public domain behavior refers to the environmental protection behavior of participating in public organizations, such as donating money to environmental organizations. Private domain behavior refers to the environmental protection behavior of individuals in their daily lives, such as the purchase of environmental protection products. A five-point scale was used to assess participants' feelings, responses, and agreement with the indicators. The criteria were "1″ for strongly agree, "2″ for somewhat agree, "3″ for agree, "4″ for somewhat disagree, and "5″ for strongly disagree. In this study, the Cronbach's alpha coefficient for the psychological flexibility scale was 0.953.

3.2.4. Subjective well-being scale

The Chinese version of the subjective well-being scale (SWB) modified by Xing [70], with a total of 20 items, was used in this study. This scale was first proposed by Diener [71] to assess an individual's overall evaluation of life based on their own criteria, including two dimensions: emotional and cognitive. Together with the Psychological Well-Being Scale (PWBS), these are the most commonly used scales to measure happiness in China. A five-point scale was used to assess participants' feelings, reactions, and degrees of recognition. The criteria were "1″ strongly disagree, "2″ for disagree, "3″ for somewhat disagree, "4″ for somewhat agree, and "5″ for agree. In this study, the Cronbach's alpha coefficient for the subjective well-being scale was 0.860.

3.2.5. Internet game addiction scale

The Diagnostic and Statistical Manual of Mental Disorders, 5th edition (DSM-5) was used to assess participants' internet game addiction [64]. Internet game disorder was recommended to be classified as a mental disorder in the DSM-5 using a five-point scale rating method, with "1" indicating "strongly disagree," "2" indicating "disagree," "3" indicating "agree," "4" indicating "somewhat agree," and "5" indicating "strongly agree." The higher the score is, the greater the delay. In this study, the Cronbach's alpha coefficient

for this scale was 0.941.

3.2.6. Life autonomy scale

The Life Autonomy Scale was developed by Pan and Hsieh [57], and has 70 items under six sub-scales: ideals, life autonomy, sense of being, love and care, life experience, and attitude toward death. The Life Autonomy sub-scale was selected for this study (e.g., "I always play the role expected by others instead of me," "I can choose the life I want"). All items were scored on a five-point scale from "totally disagree" to "totally agree," with questions 1–6 being scored positively and questions 7–12 being scored negatively. The higher the score, the more positively the students felt about their autonomy. Conversely, this indicates negative life autonomy. In this study, the Cronbach's alpha coefficient for this scale was 0.946.

3.2.7. Academic procrastination scale

The Academic Procrastination Scale, developed by Tuckman [72] and consisting of 16 questions, was used to measure the level of academic procrastination. A five-point scale was used, where "1″ meant "strongly agree," "2″ meant "somewhat agree," "3″ meant "not sure," "4″ meant "somewhat disagree," and "5″ meant "strongly disagree." After conversion, the possible scores ranged from 16 to 96. In the present study, the Cronbach's alpha coefficient for this scale was 0.920.

3.2.8. Psychological resilience scale

This scale was designed by Hu et al. [73], who summarized the definitions of psychological resilience provided by domestic and international scholars. The scale consists of 25 questions divided into five dimensions, including goal focus, emotional control, positive cognition, family support, and interpersonal assistance [33]. The questionnaire adopted a five-point scale, using participants' feelings, reactions, and agreements as assessment indicators. The criteria were "1″ for "total inconformity," "2″ for "relative inconformity," "3″ for "not sure," "4″ for "relative conformity," and "5″ for "total conformity." In this study, the Cronbach's alpha coefficient for the psychological resilience scale was 0.958.

3.3. Design

A web-based questionnaire was used to collect the data. Students completed the survey using their free time by scanning QR codes, which are black and white graphic symbols on a two-dimensional plane [74]. This method is quite popular in China and is widely used in many activities such as online payments, daily travel, and data entry during the COVID-19 pandemic. According to relevant research, selecting data mining methods should involve consideration of several factors. Geospatial analysis emphasizing the importance of method design has been conducted, which introduced how to choose an appropriate method according to the research problem [75]. Scholars have emphasized the influence of management characteristics on the selection of data analysis methods in the process of exploring technology adoption [76], which inspired us to consider the applicability of the decision tree model for analyzing mental resilience data. One study highlighted the importance of data analysis in understanding consumer behavior [77,78], which further proved the potential validity of the decision tree model in analyzing students' mental resilience. Therefore, data-mining methods were chosen to process the data, which benefited from the discovery of patterns that could predict students' psychological resilience [79]. Among these data mining methods, the decision tree model, k-nearest neighbor, neural network, plain Bayes, and support vector machine are frequently used and considered suitable for predicting students' psychological resilience [80].

Decision trees were selected to predict the students' psychological resilience for several reasons. First, their wide application in studies involving students' academic achievement, psychological states, and behaviors demonstrates their relevance and effectiveness in educational contexts [81,82]. Some studies have used decision tree models to identify innovative behavior [83,84] and accurately predict the factors influencing the success and failure of innovation in the Korean manufacturing industry [85].

The second advantage lies in the interpretability of decision trees. They generated easy-to-understand rules from training samples, which could then be applied to new datasets [86]. The resulting top-down structure, comprising root, internal, and leaf nodes, presents a clear visual representation of the decision-making process [87]. This structure not only simplifies interpretation but also aids in inferring rules based on the nodes [88].

Third, the decision tree algorithm is particularly suitable for handling multicollinearity and complex predictor relationships. This robustness is crucial when dealing with diverse predictors, such as those in psychological resilience studies. Depending on the nature of the predictor variables, different types of decision trees can be employed; for instance, categorical decision trees are used for categorical predictors, whereas regression trees suit continuous variables [89]. In this study, we focused on students' psychological resilience, which was categorized as high or low, and thus opted for a categorical decision tree approach. This choice not only facilitated accurate prediction but also allowed for a detailed analysis of the factors influencing psychological resilience.

3.4. Data analysis

We used SPSS 26.0 to conduct descriptive statistical analysis and Modeler 18.0 to analyze the decision tree model. First, descriptive statistical analysis was used to analyze the frequency statistics and changes in correlation trends, and these indicators were used to measure the predictors and levels of students' pro-environmental behavior. Second, a decision tree analysis model was constructed using the C5.0 algorithm and was used to examine which variables could predict psychological resilience. We chose the C5.0 algorithm because it is an extension of the ID3 and C4.5 algorithms proposed by Quinlan [90,91] and Witten, Frank, and Hall [92], which is not only suitable for large data but also has a faster speed and better predictive ability [93].

In this study, SPSS 26.0 facilitated descriptive statistical analysis, and Modeler 18.0 was employed for decision tree modeling using the C5.0 algorithm. The selection of variables for the decision tree model was informed by the extensive literature on psychological resilience, particularly in the context of higher education and the post-pandemic era. Our study advances the understanding of psychological resilience among college students by employing a comprehensive survey covering variables such as demographic information, self-esteem, sense of school belonging, pro-environmental behavior, subjective well-being, internet game addiction, life autonomy, and academic procrastination.

The choice of these variables was underpinned by existing research that has highlighted their impact on psychological resilience. Studies have shown that individual factors, such as self-esteem, life autonomy, and subjective well-being, significantly influence psychological resilience. For instance, self-esteem has been linked to resilience in students with a history of being left behind in college, suggesting a positive correlation between self-esteem and psychological resilience [54,56,94]. Similarly, life autonomy, which indicates strong self-control, is a crucial factor in resilience [57,58]. Subjective well-being was positively correlated with resilience [30,59].

In addition to these internal factors, external perceptions of the environment, such as sense of school belonging and pro-environmental behavior, were also pivotal. Increased sense of school belonging has been linked to higher levels of psychological resilience [29,60]. Moreover, pro-environmental behavior has been associated with higher resilience in middle school students, particularly in adapting to environmental changes brought about by COVID-19 pandemic [61,95]. Furthermore, in the context of the COVID-19 pandemic, factors such as academic procrastination, academic achievement, and internet game addiction have emerged as significant influences of psychological resilience [96]. For example, academic achievement boosts psychological well-being, thereby enhancing resilience, whereas game addiction and procrastination have been shown to adversely impact resilience.

Therefore, our study incorporated these variables to construct a decision tree model to identify key predictors of psychological resilience among college students. This approach aligns with the Broaden-and-Build Theory of Positive Psychology, which suggests that positive emotions, such as self-esteem and life autonomy, can create enduring resources for coping with challenges, thereby enhancing psychological resilience. The decision tree model, constructed using the C5.0 algorithm—an extension of Quinlan's ID3 and C4.5 algorithms—was chosen for its suitability for big data, faster operation, and superior predictive power [90–93]. Our findings contribute to the existing literature by offering a multidimensional perspective on the factors influencing psychological resilience among college students, particularly in the challenging context of the global pandemic.

3.5. Data coding

In this study, the sample was divided into two groups, high psychological resilience and low psychological resilience. The questionnaire used a five-point Likert scale with 60 % as the middle node. Therefore, a code of less than or equal to 3 was assigned a value of 0, and a code of more than 3 was assigned a value of 1. The key variables predicting psychological resilience were coded according to the above principles (see Table 1).

3.6. The construction of the decision tree

When constructing a decision tree, the optimal branching variables and segmentation thresholds were determined using the decreased rate of information entropy. Information entropy represents the degree of impurity of the dataset, which is defined based on Mitchell [88] as shown in equation (1):

Table 1
Variable coding and their descriptive statistics.

Variable	Coding	Number	Proportion
Self-esteem	0 = low	282	36.34 %
	1 = high	494	63.66 %
Sense of school belonging	0 = low	341	43.94 %
	1 = high	435	56.06 %
Pro-environmental behavior	0 = low	252	32.47 %
	1 = high	524	67.53 %
Subjective well-being	0 = low	178	22.94 %
	1 = high	598	77.06 %
Internet game addiction	0 = low	749	96.52 %
	1 = high	27	3.48 %
Academic achievement	0 = low	478	61.60 %
	1 = high	298	38.40 %
Life autonomy	0 = low	217	27.96 %
	1 = high	559	72.04 %
Academic procrastination	0 = low	629	81.06 %
	1 = high	147	18.94 %
Psychological resilience	0 = low	369	47.55 %
	1 = high	407	52.45 %

$$\text{Entropy}(D) = -\sum_{k=1}^{m} P_k \log_2 P_k \quad (1)$$

D is the training dataset with sample size m, and Pk is the probability of each class of samples. The information gain ratio was used to measure the difference in information entropy among different classification methods. If we chose variable C to divide dataset D into n subsets, the information gain ratio was defined based on Quinlan [90] as shown in equation (2):

$$\text{Gain Ratio} = \frac{Entropy(D) - Entropy(D|C)}{Entropy(C)} \quad (2)$$

The C5.0 algorithm selected the attribute with the largest information gain ratio as the split point and built several branches based on the value of this property to obtain some subsets. This selection process was repeated until the final subset contained only the same class of data to perform an inductive classification of the data [97].

3.7. Pruning of the decision tree

The C5.0 algorithm used a post-pruning method to prune the leaves layer by layer, starting from the leaf nodes. After construction of the decision tree, the dataset was recursively attributed to each leaf node of the tree. The mean square errors of the datasets with and without leaves were calculated. If the mean square error decreased after pruning, the node was excised; otherwise, it was retained [98].

3.8. Evaluation of the decision tree

Seventy percent of the sample (n = 544) was selected as training data, and 30 % (n = 232) was selected as test data. The quality of the model was evaluated based on the accuracy, precision, and recall rate based on research by Han et al. [99]. Accuracy was defined as the ratio of correctly classified cases to the total sample size. Precision is the prediction result, indicating the number of positively predicted samples that were actually positive. The recall rate applied to the actual sample and showed the number of positive cases in the sample that were correctly predicted.

4. Results

4.1. Descriptive and correlation analysis

The mean and standard deviation of each variable are shown in Table 2.

4.2. Predictive analysis of psychological resilience

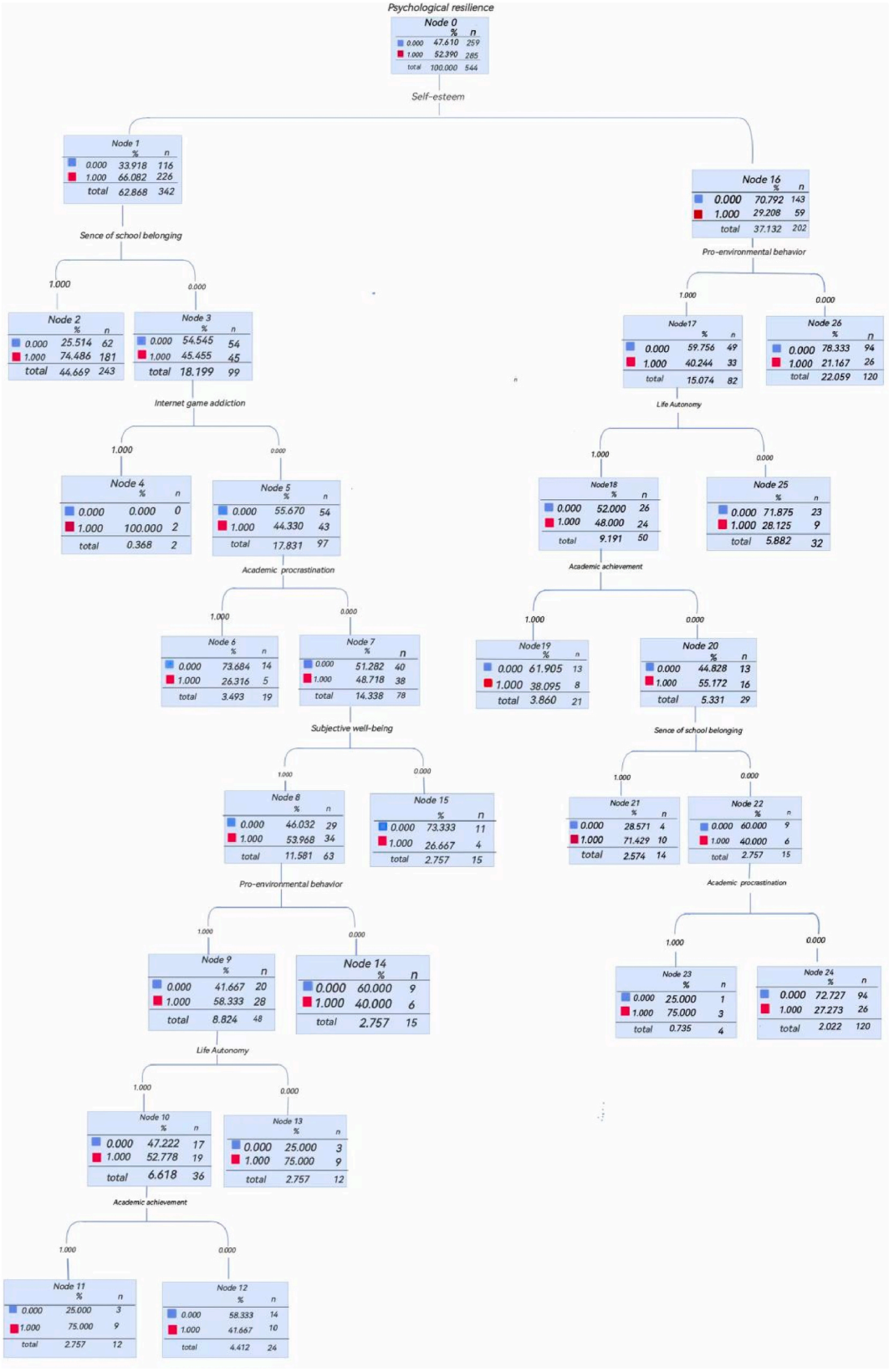
As shown in Fig. 2, the predictors of psychological resilience were self-esteem, sense of school belonging, pro-environmental behavior, subjective well-being, internet game addiction, life autonomy, academic procrastination, and academic achievement. Psychological resilience accounted for 52.39 % of the total. The root node is the topmost node in a decision tree model, and the branches below this top node represent the outcomes of decisions (see Fig. 2). The closer a predictive variable is to the root node, the higher its importance, indicating the degree of importance of the predictive variable. In addition, the importance of the predictors (see Fig. 3) showed that self-esteem was the most important predictor; sense of school belonging ranked second; pro-environmental behavior, subjective well-being, and internet game addiction ranked third, fourth, and fifth, respectively; and academic achievement, life autonomy, and academic procrastination were the least important.

4.3. Model evaluation

Tables 3 and 4 present the confusion matrices and classification accuracies of the models used in this study. The precision of the training and test samples were 73.53 % and 73.28 %, respectively. According to Table 5, the prediction accuracy for high pro-environmental behavior was 73.985 %, and the recall rate was 76.167 %.

Table 2
Descriptive statistics.

Variable	Full score	Mean value	Standard deviation	60 % of the full score
Self-esteem	5	3.430	0.665	3
Sense of school belonging	5	3.257	0.569	3
Pro-environmental behavior	5	3.478	0.748	3
Subjective well-being	5	3.380	0.522	3
Internet game addiction	5	1.711	0.784	3
Academic achievement	5	3.070	1.117	3
Life autonomy	5	3.543	0.601	3
Academic procrastination	5	2.593	0.635	3
Psychological resilience	5	3.204	0.703	3



(caption on next page)

Fig. 2. Predictive model of the psychological resilience model (The gray rectangle represents a node. The value inside a node indicate the quantity and distribution of samples. Blue and red squares represent the volume and proportion of samples within the node. The value 'n' denotes the number of samples in the node. The '%' value indicates the percentage of samples in the node relative to the total number of samples. 'Total' represents the cumulative total number of samples in the node.). (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

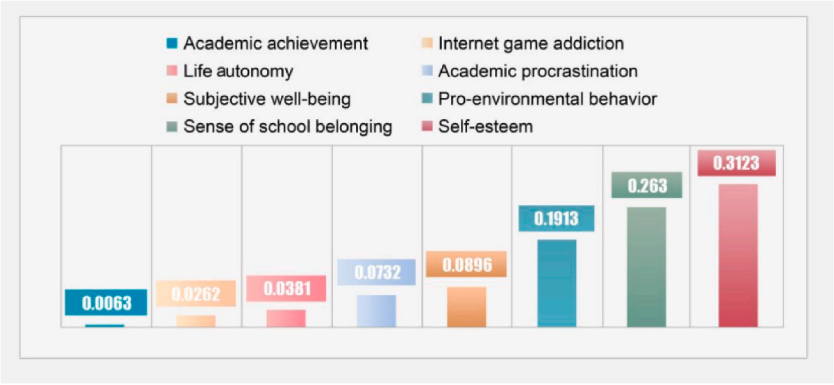


Fig. 3. Predictor variables of psychological resilience.

Table 3
Confusion matrix.

		Predicted class	
		Low	High
Actual class of training data	Low	186	73
	High	71	214
Actual class of testing data	Low	74	36
	High	26	96

Table 4
Classification accuracy.

		Number	Proportion
Training data	Correct	400	73.53 %
	Wrong	144	26.47 %
	Total	544	–
Testing data	Correct	170	73.28 %
	Wrong	26	26.72 %
	Total	232	–

Table 5
Recall and precision of the prediction model.

Recall Rate[a]		Precision Rate[b]
Low psychological resilience	70.021 %	72.829 %
High psychological resilience	76.167 %	73.985 %

[a] Recall is TP (true positive) divided by TP (true positive) plus FN (false negative).
[b] Accuracy is TP (true positive) divided by TP (true positive) plus FP (false positive).

Recall rate：
$(186+71)/(186+71+73+36) = 70.021\ \%$
$(214+96)/(214+96+71+26) = 76.167\ \%$
Accuracy rate：
$(186+74)/(186+74+71+26) = 72.829\ \%$
$(214+96)/(214+96+73+36) = 73.985\ \%$

5. Discussion

Using the decision tree model and the C5.0 algorithm, this study constructed an eight-factor model for predicting psychological resilience, ranked the importance of predictors for college students' psychological resilience, and evaluated the contribution of all factors derived from previous literature and related data analysis, which indicates that (1) the prediction effect of the model has certain validity. (2) The predictors of psychological resilience in order of importance are self-esteem, sense of school belonging, pro-environmental behavior, subjective well-being, academic procrastination, life autonomy, internet game addiction, and academic achievement.

First, self-awareness, self-esteem, subjective well-being, and life autonomy positively predicted psychological resilience among college students. However, previous research has been unclear regarding the importance of these factors in influencing psychological resilience. Using a decision tree analysis, this study found that self-esteem was the most important predictor among the self-awareness factors, subjective well-being was the fourth most important predictor, and life autonomy was the sixth most important. Clarifying the importance of predictors of the development and improvement of psychological resilience in college students is of great value. Contrary to previous findings that psychological resilience influences and predicts self-esteem [100,101], this study revealed that in this specific group, self-esteem can significantly impact and predict psychological resilience. This finding may be closely related to the subjects and the special circumstances they faced, such as post-pandemic challenges, including economic hardships and psychological distress, which lead to self-esteem playing a more significant role in the formation of psychological resilience. Self-esteem, as an individual's positive evaluation of self-worth and competence, directly influences students' attitudes and behaviors in the face of adversity [102]. The Broaden-and-Build Theory of Positive Psychology suggests that high self-esteem is key to the construction of a positive self-image and reality [49]. Students with high self-esteem are more likely to adopt positive strategies and maintain greater mental toughness. Studies in brain science have found that high self-esteem is linked to strong internal control tendencies and hippocampal area activity [103], enhancing effort in setbacks and directly boosting psychological resilience [104]. In addition, subjective well-being, as an internal assessment of life satisfaction and happiness, directly influences how people perceive and interact with the world around them [105]. The Broaden-and-Build Theory of Positive Psychology emphasizes that this perception is key to how individuals construct their life experiences and reality [50]. For example, students with a high sense of subjective well-being are more likely to face challenges positively and thus show greater psychological resilience in the face of adversity [106,107]. It should be noted that life autonomy has relatively little effect on psychological resilience. Life autonomy is the individual's choice and control over their own life, which is a relatively stable psychological state [108]. Psychological resilience changes as individuals experience various challenges and adversities, making it a relatively dynamic process [109,110]. Although life autonomy can reflect an individual's subjective feelings and control [111], it cannot directly predict their ability to cope with adversity. Coping with adversity requires a combination of multiple individual factors, including cognitive ability, emotional regulation, and social support [112]. Life autonomy is only one aspect of an individual's ability to cope with adversity and cannot fully reflect this ability [113,114].

Second, sense of school belonging and pro-environmental behavior, as perceptive factors of the external environment, also had a significant impact on the psychological resilience of college students. Unlike previous studies, this study further clarified the importance of sense of school belonging and pro-environmental behaviors in predicting psychological resilience. Specifically, sense of school belonging is the second most important predictor, and pro-environmental behavior is the third; both are key predictors of psychological resilience, particularly within the framework of positive constructivist theory. A strong sense of school belonging enhances individual engagement and self-efficacy within the learning environment, which strengthens psychological resilience through the process of positive cognitive evaluation [115]. Furthermore, positive emotions and social connections not only enhance students' sense of well-being but also strengthen their ability to remain optimistic and resilient in the face of adversity, thereby promoting the development of psychological resilience in the long term [108]. Pro-environmental behaviors reflect individual concern and responsibility for the environment as well as positive interactions with the external world [116]. Positive constructivism considers pro-environmental behavior as a way for individuals to actively construct relationships with their environment [51]. By engaging in pro-environmental activities, students not only enhance their sense of responsibility for the environment but also increase their confidence in their abilities, which is extremely important for dealing with challenges [117]. Therefore, it is reasonable to assume that pro-environmental behavior has an important predictive effect on college students' psychological resilience.

Third, this study found that academic procrastination, internet game addiction, and academic achievement, as relevant factors of academic influence, had the least predictive effect on psychological resilience, which differs from previous studies. Previous studies have found that academic procrastination, internet game addiction, and academic achievement were strongly correlated with psychological resilience [118,119]. However, this study found that they were relatively less predictive. The differences between the previous studies and the present study can be explained. Academic procrastination is often viewed as a way of avoiding or putting off tasks [118]. This may affect psychological resilience, but its effect is usually temporary rather than lasting. It is considered a coping strategy in Stress Adaptation Theory [52]. For example, many people who experience academic procrastination readjust their study habits and time management skills to become more motivated and self-controlled [120,121]. However, this study found that, although academic procrastination reflects, to some extent, students' coping strategies in the face of stress, its effect on psychological resilience was not significant. Second, although internet game addiction may affect individual psychological resilience, it is usually not a direct predictor of psychological resilience. Several studies have shown that internet game addiction may negatively affect individual intrinsic factors, but the positive effects of extrinsic factors, such as the environment and social support, can decrease this negative effect and thus increase individual psychological resilience [122,123]. Academic achievement is often considered an indicator of student adaptation and coping with academic stress [124]. Theoretically, although higher academic achievement is associated with higher psychological resilience [125], this study found that the association was not strong. This suggests that academic achievement

may not be a major predictor of psychological resilience in college students. Academic achievement is often short-term performance that does not adequately reflect a person's psychological resilience, and the overall development and adaptability of individuals must be considered [53]. Academic procrastination, internet game addiction, and grades had small effects on the prediction of psychological resilience. It is notable that while previous research mostly found that resilience affects academic procrastination [126,127], this study discovered that academic procrastination impacts resilience. In contrast to previous research results, under the Chinese educational tradition, which emphasizes hard work and achievement, high expectations from family and society may lead students to adopt various coping strategies in the face of academic pressure, including procrastination. The unique pressure environment faced by Chinese students makes academic procrastination a coping mechanism that may weaken their psychological resilience in the face of challenges and adversity.

From the above, the applicability of our findings in similar educational and geographical contexts, especially in the United States, Europe, and the Southeast Asia region, implies that university students and educational institutions worldwide can utilize our findings to adapt to and address the challenges of psychological resilience encountered during public health crises. Furthermore, the research may be applicable to enhancing psychological resilience among university students in countries with similar cultural backgrounds, such as South Korea, Japan, and Singapore. Additionally, the investigations are valuable for exploring the development of psychological resilience among university students in atypical educational settings, including remote and blended learning.

6. Policy recommendations

Several key policy recommendations have emerged based on the results of this study. Enhancing self-esteem is important because it significantly influences resilience. Educational programs should focus on building self-worth. Fostering sense of school belonging is also crucial, as it requires an inclusive and supportive environment. In addition, promoting pro-environmental behavior and improving subjective well-being are important; they can be integrated into curricula and mental health support systems. While factors such as academic procrastination, life autonomy, internet game addiction, and academic achievement have less impact, addressing them can provide a more comprehensive approach to student well-being and balanced recognition of academic achievement. Overall, these strategies aim to create an educational atmosphere that supports the development of psychological resilience among students.

7. Implication

Using the decision tree method, this study analyzed the impact of eight factors including self-esteem, sense of school belonging, and pro-environmental behavior on psychological resilience.

Theoretically, this study expands the positive psychology theory and Stress Adaptation Theory to the field of psychological resilience. The significant influences of self-awareness and perception of the external environment emphasize individuals' initiative and motivation to construct their own reality. The analysis of academic-related factors provides new perspectives on Stress Adaptation Theory. For example, academic procrastination and internet game addiction will adjust and adapt to the current situation in the form of stress to some extent. This finding suggests that broader personal and environmental factors must be considered when understanding psychological resilience.

At the practical level, this study provides valuable guidance for improving the psychological resilience of college students, teachers, and higher education administrators. First, based on the results of this study, enhancing college students' self-esteem, subjective well-being, and sense of school belonging through reading, psychological counseling, participating in group activities, etc., can further improve their psychological resilience. Second, teachers should establish resilience education courses for students and conduct expansion activities. Third, higher education administrators should provide students with the corresponding resources, environment, and educational opportunities. In conclusion, this study provides a comprehensive perspective and practical guidance on how to enhance students' psychological resilience in the university environment, especially by enhancing their positive cognition of themselves and their environment.

8. Limitations and future directions

This study had several limitations. First, it used a cross-sectional design; therefore, the model may not reflect the characteristics and prediction trends of psychological resilience based on time effects. The robustness of the prediction model should also be verified in other fields. Second, this study was based on a sample of students from a technical college in Guangxi, which offers a degree of representativeness. In addition, the model considered only some factors affecting psychological resilience. Owing to the complexity of psychological resilience, some influencing factors may not yet have been discovered [128,129]. Therefore, the model requires further improvement. Nevertheless, this study provides new insight into predicting psychological resilience. Future researchers should adopt a longitudinal approach to obtain panel data and recruit a broader range of volunteers. In addition, future researchers could explore other possible variables to predict college students' psychological resilience and explore ways to enhance college students' psychological resilience from the perspective of predictive variables. Future research could use other models to fit the characteristics of college students' psychological resilience using larger datasets. Integrating multiple decision tree models can improve their stability and generalization ability. We optimized the diversity and scope of sample selection to improve the prediction model and further explored the analysis of psychological resilience differences based on gender.

9. Conclusion

In conclusion, this study established a nuanced understanding of psychological resilience among college students by developing an eight-factor predictive model using decision trees and the C5.0 algorithm. The results showed that our model can predict students' academic procrastination with an accuracy rate of 85.78 %. More importantly, this study is the first to determine the order of importance of these eight factors. Self-esteem, subjective well-being, sense of school belonging, and pro-environmental behavior are the most significant predictors of psychological resilience. Academic procrastination, life autonomy, internet game addiction, and academic achievement also contribute to resilience, albeit to a lesser degree. In addition, two theories are introduced to provide insight into the eight-factor model of this study. On one hand, the Broaden-and-Build Theory of Positive Psychology has highlighted the intricate relationship among individual self-awareness factors (self-esteem and subjective well-being), environmental perception (sense of school belonging and pro-environmental behavior), and resilience. On the other hand, although the effects are less important, academic correlates (academic procrastination, internet game addiction, and academic achievement) also shed new light on psychological resilience through Stress Adaptation Theory. In summary, this model not only provides a comprehensive framework for understanding the predictors of psychological resilience but also offers valuable insights for educators and policymakers in developing strategies to enhance resilience among college students. Future research should explore the interplay of these factors in different cultural and educational settings, examine longitudinal changes in resilience, or investigate the effectiveness of interventions designed to enhance these key predictors. In addition, refining the predictive model by incorporating more diverse variables and employing other data analysis techniques may be valuable.

Ethics approval statement

This study was reviewed and approved by Institutional Review Board of Liuzhou Vocational and Technical College, with the approval number: LVTC-2023-06-879. All participants provided informed consent to participate in the study. All participants provided informed consent for the publication of their anonymised case details and images.

Data availability statement

The data supporting the results presented in this paper are available from the corresponding author upon reasonable request.

CRediT authorship contribution statement

Pu Song: Writing – review & editing, Writing – original draft, Supervision, Methodology, Data curation. **Xuan Cai:** Validation, Project administration, Investigation, Funding acquisition, Data curation. **Dan Qin:** Writing – review & editing, Supervision. **Qingqing Wang:** Writing – review & editing, Visualization, Software, Project administration, Formal analysis. **Xiangwei Liu:** Visualization, Validation, Resources, Investigation, Formal analysis, Data curation. **Mengmeng Zhong:** Software, Resources, Methodology, Conceptualization. **Linying Li:** Visualization, Project administration, Conceptualization. **Yan Yang:** Visualization, Validation, Resources.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] J. Aman, M. Nurunnabi, S. Bano, The impact of social media on learning behavior for sustainable education: evidence of students from selected universities in Pakistan, Sustainability 11 (6) (2019) 1683, https://doi.org/10.3390/su11061683.
[2] M. Aqeel, T. Rehna, K.H. Shuja, Comparison of students' mental wellbeing, anxiety, depression, and quality of life during COVID-19's full and partial (smart) lockdowns: a follow-up study at a 5-month interval, Front. Psychiatr. 13 (2022) 835585, https://doi.org/10.3389/fpsyt.2022.835585.
[3] B.P. Rutten, C. Hammels, N. Geschwind, C. Menne-Lothmann, E. Pishva, K. Schruers, M. Wichers, Resilience in mental health: linking psychological and neurobiological perspectives, Acta Psychiatr. Scand. 128 (1) (2013) 3–20, https://doi.org/10.1111/acps.12095.
[4] N.A. Azadi, A. Ziapour, J.Y. Lebni, S.F. Irandoost, F. Chaboksavar, The effect of education based on health belief model on promoting preventive behaviors of hypertensive disease in staff of the Iran University of Medical Sciences, Arch. Publ. Health 79 (1) (2021) 69, https://doi.org/10.1186/s13690-021-00594-4.
[5] J. Yao, A. Ziapour, R. Toraji, N. NeJhaddadgar, Assessing puberty-related health needs among 10-15-year-old boys: a cross-sectional study approach, Arch. Pediatr. 29 (2) (2022), https://doi.org/10.1016/j.arcped.2021.11.018.
[6] M.H. Benson, A.S. Garmestani, Can we manage for resilience? The integration of resilience thinking into natural resource management in the United States, Environ. Manag. 48 (2011) 392–399.
[7] S.F. Bagheri, V. Hajialiani, J. Hasani, The role of resilience and emotion regulation in psychological distress of hospital staff during the COVID-19 pandemic: a systematic review study, Journal of research and health 11 (6) (2021) 365–374.
[8] G.Z. Kocjan, T. Kavčič, A. Avsec, Resilience matters: explaining the association between personality and psychological functioning during the COVID-19 pandemic, Int. J. Clin. Health Psychol. 21 (1) (2021) 100198.
[9] E. Miller-Karas, Building Resilience to Trauma: the Trauma and Community Resiliency Models, Taylor & Francis, 2023.
[10] L. Tang, S. Lu, Y. Lai, Deng R.,Health as expanding consciousness: change of psychological situation in nursing students,Nursing, Open 10 (3) (2022) 1923–1930, https://doi.org/10.1002/nop2.1444.
[11] L. Shouwei, On the spiritual character of knowledge education, Nanjing Social Science (9) (2020) 141–147, https://doi.org/10.15937/j.cnki.issn1001-8263.2020.09.019.

[12] H. Du, R.B. King, P. Chi, Self-esteem and subjective well-being revisited:The roles of personal, relational, and collective self-esteem, PLoS One 12 (8) (2017), https://doi.org/10.1371/iournal.pone.0183958.
[13] M.M. Tugade, B.L. Fredrickson, Resilient individuals use positive emotions to bounce back from negative emotional experiences, J. Pers. Soc. Psychol. 86 (2) (2004) 320–333, https://doi.org/10.1037/0022-3514.86.2.320.
[14] P. Hank, B. Baltes-Götz, The stability of self-esteem variability: a real-time assessment, J. Res. Pers. 79 (2019) 143–150. https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0183958.
[15] A.Y. Aránega, M.T.D.V. Núñez, R.C. Sánchez, Mindfulness as an intrapreneurship tool for improving the working environment and self-awareness, J. Bus. Res. 115 (2020) 186–193.
[16] V.D. Tendolkar, S. Suraj, P. Pande, K. Meshram, P. Muley, Self awareness as A predictor of adolescent behavior among nursing students: a school based study, Journal of Pharmaceutical Research International (2021), https://doi.org/10.9734/Jpri/2021/V33i40a32223.
[17] A. Au, N.J. Caltabiano, O. Vaksman, The impact of sense of belonging, resilience, time management skills and academic performance on psychological well-being among university students, Cogent Education 10 (2023) 1, https://doi.org/10.1080/2331186X.2023.2215594.
[18] R. Merhi, Á.S.E. Paniagua, F.J.P. Descals, The role of psychological strengths, coping strategies and well-being in the prediction of academic engagement and burnout in first-year university students, Acción Psicol. 15 (2) (2018) 51–68.
[19] I.M. Martínez, C.M. Youssef-Morgan, M.J. Chambel, A. Marques-Pinto, Antecedents of academic performance of university students: academic engagement and psychological capital resources, Educ. Psychol. 39 (8) (2019) 1047–1067.
[20] V. Schirrmacher, Less can Be more: the hormesis theory of stress adaptation in the global biosphere and its implications, Biomedicines 9 (3) (2021) 293, https://doi.org/10.3390/biomedicines9030293.
[21] T. Zhang, J. Cao, Decision tree algorithm for big data analysis, Computer Science (S1) (2016) 374–379, 383.
[22] B. Kamiński, M. Jakubczyk, P. Szufel, A framework for sensitivity analysis of decision trees, Cent. Eur. J. Oper. Res. 26 (2018) 135–159.
[23] E.E. Werner, Resilience in development, Curr. Dir. Psychol. Sci. 4 (3) (1995) 81–84.
[24] D.W. Johnson, Social interdependence: interrelationships among theory, research, and practice, Am. Psychol. 58 (11) (2003) 934.
[25] A.M. Pidgeon, N.F. Rowe, P. Stapleton, H.B. Magyar, B.C.Y. Lo, Examining characteristics of resilience among university students: an international study, Open J. Soc. Sci. 2 (11) (2014) 14–22, https://doi.org/10.4236/jss.2014.211003.
[26] A. Sisto, F. Vicinanza, L.L. Campanozzi, G. Ricci, D. Tartaglini, V. Tambone, Towards a transversal definition of psychological resilience: a literature review, Medicina 55 (11) (2019) 745, https://doi.org/10.3390/medicina55110745.
[27] U. Harikrishnan, A. Ali, Resilience, psychological distress, and self-esteem among undergraduate students in Kollam District, Kerala, Hindu 194 (2018) 66.
[28] N. Andrea, D. Álvarez-García, Anxiety and self-esteem in cyber-victimization profiles of adolescents, Comunicar 29 (67) (2021).
[29] O. Nuttman-Shwartz, The moderating role of resilience resources and sense of belonging to the school among children and adolescents in continuous traumatic stress situations, J. Early Adolesc. 39 (9) (2019) 1261–1285.
[30] J.L. Zhu, Y. Liu, Analysis of positive psychological factors and their correlates among primary care medical personnel with breast cancer, Chinese Journal of Industrial Medicine (2) (2020) 164–166, https://doi.org/10.13631/j.cnki.zggyyx.2020.02.022.
[31] S.A. Satici, A.R. Kayis, B. Satici, M.D. Griffiths, G. Can, Resilience, hope, and subjective happiness among the Turkish population: fear of COVID-19 as a mediator, Int. J. Ment. Health Addiction (2020) 1–16.
[32] Y.Y.Y. Tsui, C. Cheng, Internet gaming disorder, risky online behaviour, and mental health in Hong Kong adolescents: the beneficial role of psychological resilience, Front. Psychiatr. (2021) 1726.
[33] K.M. Connor, J.R. Davidson, Development of a new resilience scale: the Connor-Davidson resilience scale (CD-RISC), Depress. Anxiety 18 (2) (2003) 76–82.
[34] N. Garmezy, Competence and adaptation in adult schizophrenic patients and children at risk, Research in the Schizophrenic Disorders: the Stanley R, Dean Award Lectures II. (1985) 69–112.
[35] M. Rutter, Commentary: some focus and process considerations regarding effects of parental depression on children, Dev. Psychol. 26 (1) (1990) 60.
[36] K.L. Kumpfer, Outcome measures of interventions in the study of children of substance-abusing parents, Pediatrics 103 (Supplement_2) (1999), 1128-1128.
[37] G.E. Richardson, The metatheory of resilience and resiliency, J. Clin. Psychol. 58 (3) (2002) 307–321.
[38] J. Zhang, M. Li, M. Zhang, X.X. Chen, Y.G. Wang, Secondary school students' psychological resilience and teacher-student relationship under the new crown epidemic: the mediating role of cognitive reassessment strategies, Special Education in China (6) (2020) 82–88.
[39] A.N. Wang, J.Q. Zhang, Factors influencing psychological resilience of senior students:social support and academic self-efficacy, Chinese Journal of Health Psychology 23 (12) (2015).
[40] A.D. Ong, K.A. Leger, Advancing the study of resilience to daily stressors, Perspect. Psychol. Sci. 17 (6) (2022) 1591–1603, https://doi.org/10.1177/17456916211071092.
[41] L. Zhang, J. Pang, F. Zhu, Effect of perceived social support on psychache: mediating effect of psychological resilience, Iran. J. Public Health 51 (2) (2022) 386.
[42] S.M.S. Khaksar, T. Maghsoudi, S. Young, Social capital, psychological resilience and job burnout in hazardous work environments, Lab. Ind.: a journal of the social and economic relations of work 29 (2) (2019) 155–180.
[43] A.M.P. Wermelinger, A.L.G. Lucchetti, Association between depression and resilience in older adults: a systematic review and meta-analysis, Int. J. Geriatr. Psychiatr. 32 (3) (2017) 237–246.
[44] X.Q. Zhang, S.T. Wu, S.Y. Han, S.M. Zhang, A longitudinal study of predictors of psychological resilience in patients with gastric cancer during chemotherapy, Chin. J. Ment. Health 33 (9) (2019).
[45] Y.J. Wang, A Study of Orphans' Psychological Resilience Based on Rooting Theory - A Case Study of Bright School in Liaoning Province, Shenyang Normal University, 2019.
[46] V.G. Costa, C.E. Pedreira, Recent advances in decision trees: an updated survey, Artif. Intell. Rev. 56 (5) (2023) 4765–4800.
[47] D. Fletcher, M. Sarkar, Psychological resilience: a review and critique of definitions. Concepts and theory, Eur. Psychol. 18 (1) (2013) 12–23, https://doi.org/10.1027/1016-9040/a000124.
[48] B.J. Ellis, J. Bianchi, V. Griskevicius, W.E. Frankenhuis, Beyond risk and protective factors: an adaptation-based approach to resilience, Perspect. Psychol. Sci. 12 (4) (2017) 561–587, https://doi.org/10.1177/1745691617693054.
[49] M.M. Maurer, D. Daukantaitė, Revisiting the organismic valuing process theory of personal growth: a theoretical review of Rogers and its connection to positive psychology, Front. Psychol. 11 (1706) (2020), https://doi.org/10.3389/fpsyg.2020.01706.
[50] V. Saroglou, C. Buxant, J. Tilquin, Positive emotions as leading to religion and spirituality, J. Posit. Psychol. 3 (3) (2008) 165–173, https://doi.org/10.1080/17439760801998737.
[51] E. Karahan, G. Roehrig, Constructing media artifacts in a social constructivist environment to enhance students' environmental awareness and activism, J. Sci. Educ. Technol. 24 (1) (2014) 103–118, https://doi.org/10.1007/s10956-014-9525-5.
[52] P. Vlachopanou, E. Karagiannopoulou, Defense styles, academic procrastination, psychological wellbeing, and approaches to learning, Journal of Nervous & Mental Disease, Publish Ahead of Print (2021), https://doi.org/10.1097/nmd.0000000000001423.
[53] R. Trigueros, J.M. Aguilar-Parra, A.J. Cangas, R. Bermejo, C. Ferrandiz, R. López-Liria, Influence of emotional intelligence, motivation and resilience on academic performance and the adoption of healthy lifestyle habits among adolescents, Int. J. Environ. Res. Publ. Health 16 (16) (2019) 2810.
[54] M. Rosenberg, Rosenberg self-esteem scale (RSE). Acceptance and commitment therapy, Measures package 61 (52) (1965) 18.
[55] C. Mouatsou, K. Koutra, Emotion regulation in relation with resilience in emerging adults: the mediating role of self-esteem, Curr. Psychol. 42 (2023) 734–747, https://doi.org/10.1007/s12144-021-01427-x.
[56] A.S. Sağkal, Y. Özdemir, Strength-based parenting and adolescents' psychological outcomes: the role of mental toughness, Journal of Psychologists and Counsellors in Schools 29 (2) (2019) 177–189.
[57] C.-Y. Pan, M.-Y. Hsieh, Development of the life attitude scale, Tzu Chi University Journal of Educational Research (6) (2010) 185–229.

[58] R. Yilmaz, Y.F.G. Karaoglan, Problematic internet use in adults: the role of happiness, psychological resilience, dispositional hope, and self-control and self-management, J. Ration. Emot. Cogn. Behav. Ther. (2022) 1–19.
[59] E. Andreou, C. Roussi-Vergou, E. Didaskalou, G. Skrzypiec, School bullying, subjective well-being, and resilience, Psychol. Sch. 57 (8) (2020) 1193–1207.
[60] A. Au, N.J. Caltabiano, O. Vaksman, The impact of sense of belonging, resilience, time management skills and academic performance on psychological well-being among university students, Cogent Education 10 (1) (2023), https://doi.org/10.1080/2331186x.2023.2215594.
[61] L. Zhou, Q. Li, L. Zhu, Behavioral Efficacy, human-land Emotion and tourists' environmentally responsible behavioral intention: an improved model based on the Theory of Planned Behavior, J. Zhejiang Univ. (2) (2014) 88–98, https://doi.org/10.3785/j.issn.1008-942X.2013.09.251.
[62] M. Lin, H. Tseng, Y. Lee, W. Tang, L. Cheng, J. Wu, J. You, Internet use time and subjective well-being during the COVID-19 outbreak: serial mediation of problematic internet use and self-esteem, BMC Psychology 11 (1) (2023), https://doi.org/10.1186/s40359-023-01483-x.
[63] A. Peker, S. Cengiz, Covid-19 fear, happiness and stress in adults: the mediating role of psychological resilience and coping with stress, Int. J. Psychiatr. Clin. Pract. 26 (2) (2022) 123–131.
[64] American Psychiatric Association, Diagnostic and Statistical Manual of Mental Disorders, fifth ed., American Psychiatric Association, Washington, DC, 2013.
[65] F. Janet, Resilience and Psychological Health: the Role of Procrastination, University Of Tasmania, Thesis, 2004, https://doi.org/10.25959/23232851.v1.
[66] L.D.C. Pereira, F.P. Ramos, Academic procrastination in university students: a systematic review of the literature, Psicologia Escolar e Educacional 25 (2021), https://doi.org/10.1590/2175-35392021223504.
[67] R. Merhi, Á.S.E. Paniagua, F.J.P. Descals, The role of psychological strengths, coping strategies and well-being in the prediction of academic engagement and burnout in first-year university students, Acción Psicol. 15 (2) (2018) 51–68.
[68] C. Goodenow, The psychological sense of school membership among adolescents: scale development and educational correlates, Psychol. Sch. 30 (1) (1993) 79–90.
[69] T. Teo, H.Y. Cheung, C.C.S. Kam, Validation of a Chinese version of the psychological sense of school membership (C-PSSM): tests of measurement invariance and latent mean differences, Curr. Psychol. 35 (1) (2016) 83–91, https://doi.org/10.1007/s12144-015-9350-x.
[70] Z. Xing, A review of research on measuring subjective well-being, Psychol. Sci. 25 (3) (2002) 336–338.
[71] E. Diener, Subjective well-being, Psychol. Bull. 95 (1984) 542–575.
[72] B.W. Tuckman, The development and concurrent validity of the procrastination scale, Educ. Psychol. Meas. 51 (2) (1991) 473–480.
[73] Y. Hu, Y. Gan, Development and psychometric validity of the resilience scale for Chinese adolescents, Acta Psychol. Sin. China. 40 (2008) 902–912.
[74] W.N. Qiao, Research on new encryption algorithm based on 2D code and image processing, Mechatronics Engineering Technology (1) (2022) 1–5.
[75] C.A. Schmidt, E.A. Cromwell, E. Hill, K.M. Donkers, M.F. Schipp, K.B. Johnson, S.I. Hay, The prevalence of onchocerciasis in Africa and Yemen, 2000-2018: a geospatial analysis, BMC Med. 20 (1) (2022) 293, https://doi.org/10.1186/s12916-022-02486-y.
[76] S. Rehman, O. Aldereai, K.I. Al-Sulaiti, S.A.R. Shah, Tourism management in financial crisis and industry 4.0 effects: managers traits for technology adoption in reshaping, and reinventing human management systems, Hum. Syst. Manag. 42 (5) (2023) 1–18, https://doi.org/10.3233/hsm-230067.
[77] K. Al-Sulaiti, I. Al-Sulaiti, Tourists' Online Information Influences Their Dine-Out Behaviour: Country-Of-Origin Effects as a Moderator, Qatar University Press., 2023, pp. 1–20.
[78] S. Wang, K.I. Al-Sulati, S.A.R. Shah, The impact of economic corridor and tourism on local community's quality of life under one belt one road context, Eval. Rev. 47 (3) (2023) 0193841X231182749, https://doi.org/10.1177/0193841X231182749.
[79] B.K. Francis, S.S. Babu, Predicting academic performance of students using a hybrid data mining approach, J. Med. Syst. 43 (2019) 1–15.
[80] G. Ramaswami, T. Susnjak, A. Mathrani, J. Lim, P. Garcia, Using educational data mining techniques to increase the prediction accuracy of student academic performance, Information and Learning Sciences 120 (7/8) (2019) 451–467.
[81] N. Hasan, Y. Bao, Impact of "e-Learning crack-up" perception on psychological distress among college students during COVID-19 pandemic: a mediating role of "fear of academic year loss", Child. Youth Serv. Rev. 118 (2020) 105355.
[82] A.R. Wasil, S. Gillespie, R. Patel, A. Petre, K.E. Venturo-Conerly, R.M. Shingleton, R.J. DeRubeis, Reassessing evidence-based content in popular smartphone apps for depression and anxiety: developing and applying user-adjusted analyses, J. Consult. Clin. Psychol. 88 (11) (2020) 983.
[83] S.R. Safavian, D. Landgrebe, A survey of decision tree classifier methodology, IEEE Transactions on Systems, Man, and Cybernetics 21 (3) (1991) 660–674, https://doi.org/10.1109/21.97458.
[84] V. Skrbinjek, V. Dermol, et al., Predicting students' satisfaction using a decision tree, Tert. Educ. Manag. 25 (2) (2019) 101–113, https://doi.org/10.1007/s11233-018-09018-5.
[85] S. Park, Identification of overall innovation behavior by using a decision tree: the case of a Korean manufacturer, Sustainability 11 (22) (2019).
[86] J. Han, M. Kamber, J. Pei, Data Mining: Concepts and Techniques. Saint Louis, Elsevier Science & Technology, 2012.
[87] P.N. Tan, M. Steinbach, V. Kumar, Introduction to Data Mining, Pearson Education India, New Delhi, 2016.
[88] M.T. Mitchell, Machine Learning, The McGraw-Hill Companies, New York, 1997.
[89] V.L. Miguéis, A. Freitas, P.J.V. Garcia, A. Silva, Early Segmentation of Students According, 2018.
[90] J.R. Quinlan, Induction of decision trees, Mach. Learn. 1 (1986) 81–106.
[91] J.R. Quinlan, Improved use of continuous attributes in C4.5, J. Artif. Intell. Res. 4 (1996) 77–90.
[92] I.H. Witten, E. Frank, M.A. Hall, C.J. Pal, M. Data, Practical machine learning tools and techniques, Data Mining 2 (4) (2005, June).
[93] P. Xiong, Data Mining Algorithms and Clementine Practice, Tsinghua University Press, Beijing, 2011. https://book.douban.com/subject/6113968/.
[94] B. Duy, M.A. Yıldız, The mediating role of self-esteem in the relationship between optimism and subjective well-being, Curr. Psychol. 38 (6) (2019) 1456–1463.
[95] A.E. Micah, K. Bhangdia, I.E. Cogswell, D. Lasher, B. Lidral-Porter, E.R. Maddison, J.L. Dieleman, Global investments in pandemic preparedness and COVID-19: development assistance and domestic spending on health between 1990 and 2026, Lancet Global Health 11 (3) (2023) 385–413, https://doi.org/10.1016/S2214-109X(23)00007-4.
[96] K. Al-Sulaiti, I. Al-Sulaiti, S.A.R. Shah, Role of Tourism, Culture, Transportation and Restaurants Selection in Arab Countries, Qatar University Press, 2023, pp. 1–21, https://doi.org/10.1016/qu.2023.100011.
[97] D. Che, Q. Liu, K. Rasheed, X. Tao, Decision tree and ensemble learning algorithms with their applications in bioinformatics, in: H. Arabnia, Q.N. Tran (Eds.), Software Tools and Algorithms for Biological Systems, Springer, New York, NY, 2011, pp. 191–199, https://doi.org/10.1007/978-1-4419-7046-6_19, 2011).
[98] J.R. Quinlan, C5.0: an informal tutorial. https://www.rulequest.com/see5-unix.html, 2019, April.
[99] J. Han, M. Fang, et al., Using decision tree to predict response rates of consumer satisfaction, attitude, and loyalty surveys, Sustainability 11 (8) (2019).
[100] M. Akhtar, N. Bilour, State of mental health among transgender individuals in Pakistan: psychological resilience and self-esteem, Community Ment. Health J. (2019), https://doi.org/10.1007/s10597-019-00522-5.
[101] Y. Liu, Z. Wang, C. Zhou, T. Li, Affect and self-esteem as mediators between trait resilience and psychological adjustment, Pers. Indiv. Differ. 66 (2014) 92–97, https://doi.org/10.1016/j.paid.2014.03.023.
[102] D. Jindal-Snape, D.J. Miller, A challenge of living? Understanding the psycho-social processes of the child during primary-secondary transition through resilience and self-esteem theories, Educ. Psychol. Rev. 20 (3) (2008) 217–236, https://doi.org/10.1007/s10648-008-9074-7.
[103] S.F. Maier, J. Amat, M.V. Baratta, E. Paul, L.R. Watkins, Behavioral control, the medial prefrontal cortex, and resilience, Dialogues Clin. Neurosci. 8 (4) (2006) 397–406, https://doi.org/10.31887/DCNS.2006.8.4/smaie.
[104] Y. Wang, L. Zhang, X. Kong, Y. Hong, B. Cheon, J. Liu, Pathway to neural resilience: self-esteem buffers against deleterious effects of poverty on the hippocampus, Hum. Brain Mapp. 37 (11) (2016) 3757–3766, https://doi.org/10.1002/hbm.23273.
[105] F. Martela, K.M. Sheldon, Clarifying the concept of well-being: psychological need satisfaction as the common core connecting eudaimonic and subjective well-being, Rev. Gen. Psychol. 23 (4) (2019) 458–474, https://doi.org/10.1177/1089268019880886.
[106] M. Yıldırım, G. Arslan, Exploring the associations between resilience, dispositional hope, preventive behaviours, subjective well-being, and psychological health among adults during early stage of COVID-19, Curr. Psychol. (2020), https://doi.org/10.1007/s12144-020-01177-2.

[107] L. Huang, T. Zhang, Perceived social support, psychological capital, and subjective well-being among college students in the context of online learning during the COVID-19 pandemic, The Asia-Pacific Education Researcher (2021) 31, https://doi.org/10.1007/s40299-021-00608-3.
[108] J. Anglim, S. Horwood, L.D. Smillie, R.J. Marrero, J.K. Wood, Predicting psychological and subjective well-being from personality: a meta-analysis, Psychol. Bull. 146 (4) (2020), https://doi.org/10.1037/bul0000226.
[109] R. Tamura, H.J. Chen, Structure of attitude towards life of healthy elderly people living in urban areas in Japan and Taiwan-toward creation of service design for improving quality of life, International Journal of Affective Engineering 20 (4) (2021) 217–224.
[110] A. Stainton, K. Chisholm, N. Kaiser, M. Rosen, R. Upthegrove, S. Ruhrmann, S.J. Wood, Resilience as a multimodal dynamic process, Early intervention in psychiatry 13 (4) (2019) 725–732.
[111] L.C. Steckermeier, The value of autonomy for the good life, an empirical investigation of autonomy and life satisfaction in Europe, Soc. Indicat. Res. (2020) 154, https://doi.org/10.1007/s11205-020-02565-8.
[112] C.P. Polizzi, S.J. Lynn, Regulating emotionality to manage adversity: a systematic review of the relation between emotion regulation and psychological resilience, cognitive therapy and research. https://doi.org/10.1007/s10608-020-10186-1, 2021.
[113] K.J. Yaxley, K.F. Joiner, J. Bogais, H.A. Abbass, Life learning of smart autonomous systems for meaningful human-autonomy teaming, A Framework of Human Systems Engineering: Applications and Case Studies (2020) 43–61.
[114] A. Puspitacandri, Y. Soesatyo, E. Roesminingsih, H. Susanto, The effects of intelligence, emotional, spiritual and adversity quotient on the graduates quality in Surabaya shipping polytechnic, Eur. J. Educ. Res. 9 (3) (2020) 1075–1087.
[115] M.L. Kern, M.L. Wehmeyer, The Palgrave Handbook of Positive Education, Springer International Publishing, 2021, https://doi.org/10.1007/978-3-030-64537-3.
[116] F. Lange, S. Dewitte, Positive affect and pro-environmental behavior: a preregistered experiment, J. Econ. Psychol. (2020) 102291, https://doi.org/10.1016/j.joep.2020.102291.
[117] G. Grilli, J. Curtis, Encouraging pro-environmental behaviours: a review of methods and approaches, Renew. Sustain. Energy Rev. 135 (2021) 110039, https://doi.org/10.1016/j.rser.2020.110039.
[118] Z. Yang, K. Asbury, M.D. Griffiths, An exploration of problematic smartphone use among Chinese university students: associations with academic anxiety, academic procrastination, self-regulation and subjective wellbeing, Int. J. Ment. Health Addiction (2018) 17, https://doi.org/10.1007/s11469-018-9961-1.
[119] Y.Y. Tsui, C. Cheng, Internet gaming disorder, risky online behaviour, and mental health in Hong Kong adolescents: the beneficial role of psychological resilience, Front. Psychiatr. (2021) 12, https://doi.org/10.3389/fpsyt.2021.722353.
[120] A. Madjid, D.A. Sutoyo, S.F. Shodiq, Academic procrastination among students: the influence of social support and resilience mediated by religious character, Jurnal Cakrawala Pendidikan 40 (1) (2021) 56–69.
[121] S. Ahmadi, S. Toulabi, H. Ilanloo, The relationship between tendency to substance abuse and resilience and academic procrastination in secondary school students, Journal of Arak University of Medical Sciences 23 (1) (2020) 108–117.
[122] İ. Taş, Association between depression, anxiety, stress, social support, resilience and internet addiction: a structural equation modelling, Malays. Online J. Educ. Technol. 7 3 (2019) 1–10, https://doi.org/10.17220/mojet.2019.03.001.
[123] J.Y. Yen, H.C. Lin, W.P. Chou, T.L. Liu, C.H. Ko, Associations among resilience, stress, depression, and internet gaming disorder in young adults, Int. J. Environ. Res. Publ. Health 16 (17) (2019) 3181.
[124] J. Gustems-Carnicer, C. Calderón, D. Calderón-Garrido, Stress, coping strategies and academic achievement in teacher education students, Eur. J. Teach. Educ. 42 (3) (2019) 375–390, https://doi.org/10.1080/02619768.2019.1576629.
[125] Y. Wu, W. Yu, X. Wu, H. Wan, Y. Wang, G. Lu, Psychological resilience and positive coping styles among Chinese undergraduate students: a cross-sectional study, BMC Psychology 8 (1) (2020), https://doi.org/10.1186/s40359-020-00444-y.
[126] Z. Soltani, N. Jamali, A. Khojasteniam, S. Dargahi, Role of self-efficacy and psychological resiliency in academic procrastination of students, Educ Strategy Med Sci 9 (4) (2016) 277–284.
[127] H. Huang, Y. Ding, Y. Liang, Y. Zhang, Q. Peng, X. Wan, C. Chen, The mediating effects of coping style and resilience on the relationship between parenting style and academic procrastination among Chinese undergraduate nursing students: a cross-sectional study, BMC Nurs. 21 (351) (2022), https://doi.org/10.1186/s12912-022-01140-5.
[128] A.S. Troy, E.C. Willroth, A.J. Shallcross, N.R. Giuliani, J.J. Gross, I.B. Mauss, Psychological resilience: an affect-regulation framework, Annu. Rev. Psychol. 74 (2023) 547–576.
[129] Ö. Çakmak Tolan, G. Bolluk Uğur, The relation between psychological resilience and parental attitudes in adolescents: a systematic review, Curr. Psychol. 1–27 (2023).