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Tech Feels, Tough Minds:Exploring the Link between Technology Emotions and Digital Resilience Among Chinese Youth in the Era of Intelligent Media

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Abstract

Objective: This study examines the association between technological emotions cultivated through digital engagement and digital resilience among youth. This study uses a mediation-moderation model to explore the factors influencing youths' digital resilience and its underlying mechanisms.

Methods: The study collected data using the online survey platform Diaoyanjia, with undergraduate students serving as the primary research subjects. A total of 493 questionnaires were collected, of which 469 were valid, yeilding a response rate of 95.13%.

Results: (1) technological emotions had a significant positive relationship with youths' digital resilience; (2) prosocial behavior mediated the relationship between technological emotions and youths' digital resilience; (3) this mediation process was moderated by digital literacy. Specifically, the relationship between prosocial behavior and digital resilience is stronger among youth with low digital literacy than for those with high digital literacy.

Conclusion: This study offers a new perspective for understanding youths' digital resilience, emphasizing that in a digital environment filled with both risks and opportunities, youth not only need to develop positive and rational technological emotions, but also require support and empowerment from social systems.

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Keywords

Digital Resilience; Technological Emotions; Broaden-and-Build Theory of Positive Emotions; Digital Literacy; Prosocial Behavior

1. Introduction

The development of digital technology has accelerated the digitalization of society. While it offers new opportunities and resources to address modern uncertainties, it also intensifies society's dependence on these technologies. This dependency often obscures the direct and indirect risks brought about by digital technology, resulting in insufficient preparedness at both individual and societal levels. In response to the rapid innovation of digital tools and the emergence of new digital risks, different social actors have gradually developed a form of resilience unique to the digital era—digital resilience.

In the digital age, resilience remains a critical personal attribute, capacity, and process in responding to stressors, disruptions, and risks. The UK's Digital Resilience Framework defines digital resilience as "a dynamic personal asset that grows through digital activation, i.e., engaging with appropriate opportunities and challenges online, rather than through avoidance and safety behaviors." (UKCIS, 2020) Professor David Wild from the Luddy School of Informatics, Computing, and Engineering at Indiana University introduced the concept of digital resilience in response to the urgent need for secure, reliable, and controllable use of technology in today's digital society. He argues that personal digital resilience is an extension of cybersecurity, with its core aim being to help individuals mitigate the vulnerabilities and risks arising from technological dependence, thereby enhancing their sense of security and control in digital environments.(David Wild, 2020)

As key participants in the digital society, college students' digital resilience is vital to their survival and development in the digital era. While recognizing the benefits of digital technology, it is equally important to empower more students with the competencies to mitigate risks, fostering their engagement in a healthier and more structured digital environment. This not only supports the sustainable development of the digital society but also contributes to a more resilient future society in the face of digital threats.

Today, the infrastructural embedding of technology and communication has increased college students' dependence on digital lifestyles. With the rise of digital social interaction, their exposure to digital risks has also intensified. On one hand, the widespread use of digital technologies has diminished individuals' control over their personal information, intensifying anxiety about digital security. On the other hand, excessive social media use has led to psychological issues such as information overload and fatigue, as well as physical health concerns like insomnia and impaired vision. For college students, finding a balance between seizing digital opportunities and managing digital risks remains a pressing challenge in their digital lives.

(Vandoninck et al., 2010) Therefore, students need to develop more robust digital competencies and coping capacities to manage digital stress and threats. Digital resilience, in this context, can be understood as a dynamic set of digital capabilities enabling youth to respond to digital risks effectively. Exploring and understanding students' digital resilience is essential to their integration into the digital society and helps cultivate more resilient digital citizens.

The construction of digital resilience among youth is associated with a range of external factors, including social support, technological empowerment, and policy frameworks. Digital technologies provide crucial opportunities for social compensation, enabling students to build support systems in digital spaces and thereby strengthening their adaptive capacities. Beyond external conditions, students' own perceptions, attitudes, and behaviors toward digital technology also play a significant role in shaping their digital resilience. However, past research has paid insufficient attention to the emotional dimension. Emotions are fundamental to social perception and shape individuals' future behavioral choices. In the use of digital technologies, technological emotions—defined as individuals' emotional responses and orientations toward technology—are key indicators of how technology is perceived. These emotions significantly associate the willingness to engage with digital tools and ultimately affect students' behavior. Despite their importance, how these emotional responses relate to youths' digital resilience remains underexplored.

Therefore, this study aims to investigate the development of college students' digital resilience through the lens of emotional orientation. By constructing and empirically testing a moderated mediation model, this research explores how technological emotions relate to digital resilience. The goal is to offer theoretical insights and practical recommendations for enhancing digital resilience among youth.

2. Literature Review and Research Hypotheses

2.1 Research on College Students' Digital Resilience

The concept of digital resilience has emerged alongside the widespread adoption of digital technologies. Existing research on digital resilience among college students has primarily focused on the field of education, defining it as the capacity to withstand major disruptions, adapt to disturbances, and re-establish a stable state through the use of digital technologies(Boh et al., 2023).

As digital technologies continue to evolve, research on digital resilience has shifted from its initial focus on skill acquisition—how students develop digital skills to improve adaptability and maintain persistence in online learning environments(Ochieng et al., 2017; Eri et al., 2021)—to a broader concern with how students cope with negative digital experiences and risks(Kurniadi et al., 2023; Sharma et al., 2022). This shift emphasizes digital resilience not just

as preparation for digital transformation in education but as a means to protect students' mental and physical well-being and improve academic performance(Ragni et al., 2022).

A conceptual analysis of digital resilience in educational settings defines it as a dynamic and cyclical process in which individuals recognize risks, acquire methods, and learn skills to recover from stress and adjust their behaviors and psychological functioning when facing digital threats(Sun et al., 2022). According to the UK Council for Internet Safety (UKCIS), digital resilience involves the ability to recognize risk, seek help, learn from experience, and recover through support systems(UKCIS, 2020). Moreover, research has identified various factors influencing digital resilience, including individual attributes (e.g., self-efficacy), social conditions (e.g., support networks), and institutional structures (e.g., policy guarantees)(Zayed, 2024). Enhancing these factors can effectively strengthen digital resilience in college students.

In this study, college students' digital resilience is defined as their ability to cope with digital risks, encompassing two core capacities: resistance to and adaptation to digital threats.

2.2 The relationship between Technological Emotions and Digital Resilience

Emotions have long been central to resilience research. Existing research has consistently regarded emotion as an essential component of resilience theory. In the study of emotion and resilience, there has been a shift from focusing primarily on negative emotions to re-emphasizing the role of positive emotions. For example, the Stress and Coping Framework of Resilience (SCFR) suggests that negative emotions drive individuals to recognize and respond to stressors (Folkman & Lazarus, 1988), but it largely overlooks the contribution of positive emotions in the development of resilience. The Communication Theory of Resilience (CTR) compensates for this limitation by proposing that resilience involves not only rational regulation in coping processes but also the legitimization of negative emotions and the cultivation of positive ones (Buzzanell, 2010).

Recent studies increasingly tend to treat positive and negative emotions as components of a unified affective structure, aiming to capture the comprehensive impact of emotional variables. For instance, the Affective Sensemaking Theory posits that emotion is not merely a part of resilience but a key driving force behind it; resilience emerges through the dynamic interplay of both positive and negative emotional experiences (Vomacka & Buzzanell, 2025). Similarly, the Emotion Dynamics Model of Resilience (EDMR) further demonstrates that the relationship between emotion and resilience is nonlinear, with discourse playing a moderating role in this dynamic process (Zhang et al., 2025).

In summary, emotion plays a central role in the formation and development of resilience. The evolution of related theories reveals that resilience depends not only on rational coping mechanisms but also profoundly on emotional processes. From the early emphasis on the function of negative emotions, to the growing recognition of the regulatory role of positive emotions, and finally to a systemic understanding of emotional interactions as the driving force of resilience, emotion has been firmly established as an indispensable element within the resilience mechanism.

The use of digital technology forms the basis of digital resilience. For individuals to use technology effectively, they must be cognitively and emotionally prepared. The adoption of new technology often provokes physiological and psychological responses, resulting in differing emotional orientations—technophobia and technophilia. Technophobia refers to negative feelings toward technology, perceiving it as a threat to established norms, while technophilia reflects enthusiasm and optimism about technological progress(Martínez-Córcoles et al., 2017).

For college students, technophobia may hinder the development of digital skills, triggering anxiety and aversion in response to new technologies(Khasawneh, 2018). Continuous engagement with digital platforms can also lead to social and information fatigue, while frequent technology use increases exposure to digital risks. Yet, avoidance of digital tools may reduce students' opportunities to build coping mechanisms(Vandoninck et al., 2013). Thus, reducing technophobia is essential for maintaining healthy psychological states(Rehman et al., 2024), while enhancing students' creativity in using digital tools—for learning, communication, and knowledge sharing—can foster positive experiences that alleviate negative emotions(Rahman et al., 2018).

Although the acceptance of technology is complex, positive adaptation is a prerequisite for developing digital resilience. Research shows that students and educators adjust their technological emotions over time, leading to greater trust and acceptance in digital education contexts(McClain et al., 2021; Manyeredzi & Mpofu, 2022). Emotional orientations toward technology are associated with students' willingness to engage with digital tools and shape their behavior. Digital resilience is thus not only about action in the face of risk but also about transforming negative impacts into positive outcomes.

Different emotional orientations toward technology affect how people adopt and use digital tools. The complexity of technological perception may increase fear and anxiety, leading to avoidance(Cavdar et al., 2020), while individuals with positive emotions view technology as a means to solve social problems and enhance quality of life(Brosnan, 2002). While various factors influence technology adoption, fear can significantly impede adaptability to digital environments(Ajlouni & Rawadieh, 2022). According to the Broaden-and-Build Theory of Positive Emotions, positive emotions expand individuals' momentary thought-action repertoires and help build lasting personal resources, including cognitive, physical, and social assets(Fredrickson, 2001).

Positive technological emotions can enhance digital self-efficacy, buffer the impact of online negativity(Andreou et al., 2005), and prepare students with resources to face digital challenges. Based on this, the study proposes the following hypothesis:

H1: Technological emotions are positively correlated with digital resilience among college students—that is, more positive emotional orientations toward technology correspond to higher levels of digital resilience.

2.3 The Mediating Role of Prosocial Behavior

Digital participation has become a central aspect of college students' social interaction, with digital spaces serving as primary environments for learning, development, and relationship-building. When faced with digital risks that cannot be resolved individually, students increasingly rely on collective support. A recent digital resilience intervention study found that beyond the ability to advocate for oneself, the willingness to support peers in overcoming digital challenges is a key factor in developing digital resilience(Lee & Hancock, 2023).

According to the Bystander Intervention Model (Darley, 1970), individuals who are willing to help others in digital environments often feel a strong sense of responsibility, possess the knowledge to provide effective support, and subsequently enhance their digital self-efficacy. In the context of digital engagement, prosocial behavior can be categorized into prosocial expressive participation (e.g., sharing positive messages) and prosocial action-oriented participation (e.g., providing support or resources)(Huang, 2022). In previous studies on cyberbullying, it has been found that prosocial behavior in digital environments can effectively protect both oneself and others from the risks of online bullying. The findings suggest sustained positive and reinforcing cycles of prosocial interactions, but no evidence of long-term negative cycles involving cyberbullying perpetration and victimization.(Erreygers et al., 2018) However, whether digital resilience — as a crucial ability to cope with digital risks — can enhance prosocial behavior remains to be further explored.

Research exploring the link between technological emotions and prosocial behavior among college students shows that positive emotions are significantly correlated with increased prosocial tendencies, while negative emotions tend to suppress such behaviors(Sharma, 2015). Students with more positive emotional orientations toward technology are more likely to engage in helping behaviors. In this sense, positive technological emotions not only promote prosocial engagement but also foster a sense of ethical responsibility in digital environments(Gaffney et al., 2019).

Accordingly, this study proposes the following hypotheses:

H2: Prosocial behavior mediates the relationship between technological emotions and college students' digital resilience.

H2a: Technological emotions are positively correlated with prosocial behavior.

H2b: Prosocial behavior is positively correlated with digital resilience among college students.

2.4 The Moderating Role of Digital Literacy

Digital literacy refers to the “skills, knowledge, and attitudes that enable individuals to critically, responsibly, and creatively use digital media for participation, work, and problem-solving”(Hatlevik et al., 2015). It encompasses multiple dimensions of digital capability.

First, higher levels of digital literacy are associated with greater resilience to online risks. College students with strong digital literacy are better equipped to avoid or cope with digital

threats(Vandoninck et al., 2013). Even when risks are encountered, they can apply more effective strategies to mitigate harm(Sonck & de Haan, 2014).

Second, digital literacy significantly contributes to the accumulation of online social capital, which is closely tied to social support—an important factor in building digital resilience(Chan, 2022). In practical terms, digital literacy enhances students' information management skills(Tang & Chaw, 2016) and supports career development by enabling access to public resources and professional assistance(Barna & Epure, 2020). These capabilities strengthen students' survival and adaptability in the digital society.

Although related, digital literacy and digital resilience are distinct. Digital literacy emphasizes cognitive and skill-based aspects of technology use throughout the entire user experience, while digital resilience refers to the ability to effectively use digital tools and resources in response to digital stress or risk. In this sense, digital resilience is grounded in both risk management and opportunity exploration.

Differences in digital literacy not only affect students' technical proficiency but also shape their capacity to acquire knowledge and form supportive networks in digital spaces. Therefore, this study proposes the following hypotheses:

H3: Digital literacy moderates the second half of the mediating pathway ("technological emotions → prosocial behavior → digital resilience").

Specifically, the positive effect of prosocial behavior on digital resilience is stronger among students with lower digital literacy than among those with higher digital literacy.

In summary, to address gaps in existing research, this study proposes a moderated mediation model incorporating prosocial behavior and digital literacy to explore the relationship between technological emotions and college students' digital resilience, as well as the underlying mechanisms. The proposed research model is illustrated in Figure 1 near here.

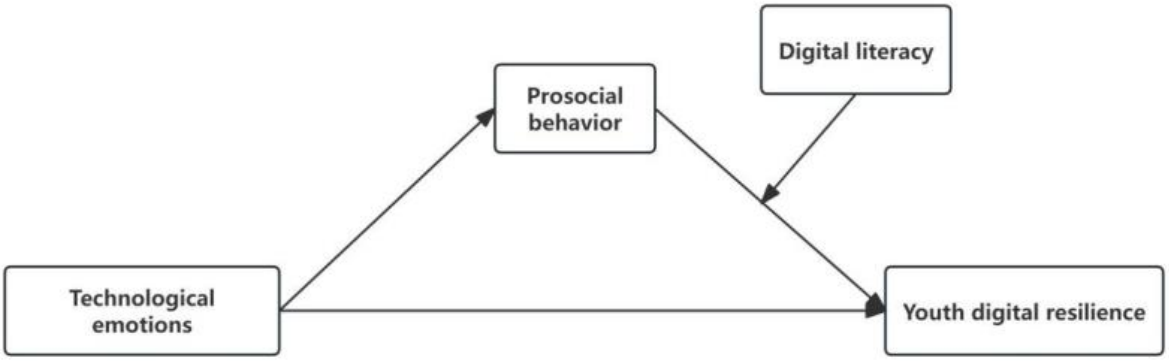

Figure 1 The Hypothesized Moderated Mediation Model

3. Methods

3.1 Procedure and Participants

The study collected data using the online survey platform Diaoyanjia (https://www.surveyplus.cn), with undergraduate students as the primary research subjects. Data were collected from October 15 to October 21. A total of 493 questionnaires were collected, of which 469 were valid, resulting in a response rate of 95.13%. Of the participants, 45.8% (N = 215) were male, and 54.2% (N = 254) were female. Regarding academic standing, 13.2% (N = 62) were freshmen, 34.5% (N = 162) were sophomores, 39% (N = 183) were juniors, and 13.2% (N = 62) were seniors. The demographic data of the samples and their coding methods are shown in Table 1.

Table 1 Demographic Characteristics of the Sample

Variables	Options	Frequency	Proportion	Mean	SD
Gender	Male	215	45.8%	2.52	0.88
	Female	254	54.2%		
Grades	Freshmen	62	13.2%	1.54	0.50
	Sophomores	162	34.5%		
	Juniors	183	39.0%		
	Seniors	62	13.2%		

3.2 Measures

3.2.1 Digital resilience

Youths' digital resilience, the dependent variable, was measured using a revised version of Wilson et al.'s Communication Resilience Processes Scale (Wilson et al., 2021). Respondents rated their resistance and adaptation processes when faced with digital stress by answering eight items. Sample items included: "I try to maintain a normal state of life," "I make action plans and follow through," "I try to look at digital risks or digital stress from new perspectives," and "I actively explore and learn new digital skills and knowledge." It used a five-point Likert scale. Higher scores reflected greater digital resilience. The scale demonstrated high reliability, with a Cronbach's alpha coefficient of 0.88.

3.2.2 Technological Emotions

Technological emotions were assessed using a revised version of Dorokhov et al.'s Technological Emotions Scale (Dorokhov & Gusev, 2023). Respondents rated their feelings of technophobia and technophilia using two subscales, each consisting of five items on a five-point Likert scale. For

the technophobia subscale, a sample item included: "I am very afraid that technology will change how we live, communicate, love, or judge others." Higher scores on this subscale indicated stronger negative technological emotions. For the technophilia subscale, a sample item included: "I believe new technology improves quality of life." Higher scores on this subscale indicated stronger positive technological emotions. The scale demonstrated acceptable reliability, with a Cronbach's alpha coefficient of 0.771.

3.2.3 Prosocial behavior

Prosocial Behavior, which represents an individual's willingness to help others, particularly through prosocial communication. This construct was assessed using a revised version of Brody and Vangelisti's Altruistic Intent Scale (Brody & Vangelisti, 2016). Examples of prosocial behaviors related to digital stress include: "reminding others about digital safety," "spreading positive messages in the digital environment," and "sharing personal experiences about coping with digital stress." Respondents rated three items on a five-point Likert scale, with higher scores reflecting a greater tendency toward prosocial behavior. The scale had moderate reliability, with a Cronbach's alpha coefficient of 0.646.

3.2.4 Digital literacy

Digital literacy was measured using the digital literacy indicators from the 54th Statistical Report on China's Internet Development in China (CNNIC,2025). The items rated on a five-point Likert scale, assessed individuals' digital literacy and information security awareness. Sample items included: "I use word processing tools," "I use spreadsheet or data tools," and "I avoid believing strangers or online advertisements." Higher scores reflected higher levels of digital literacy. The scale had acceptable reliability, with a Cronbach's alpha coefficient of 0.762.

3.3 Data Analysis

Data analysis was performed using SPSS 26.0. Descriptive statistics and Pearson correlations were first used to explore the relationships among technological emotions, prosocial behavior, digital literacy, and digital resilience. Then, the mediating role of prosocial behavior and the moderating role of digital literacy were analyzed using PROCESS Model 4 and Model 14 in the SPSS macro program (Hayes, 2013). Regression coefficients were tested using the bias-corrected and percentile bootstrap method. All variables were standardized before formal analysis.

4. Results

4.1 Common Method Bias Test

To ensure the reliability of the data, a statistical test was conducted to assess potential common method bias (Tehseen et al., 2017). Harman's single factor test was applied by performing an unrotated principal component analysis on all items. The analysis extracted nine factors that together explained 64.75% of the variance. The largest single factor accounted for 24.01% of the

variance, well below the recommended threshold of 40% (Podsakoff & Organ, 1986). These results indicate that there is no significant common method bias in the data, thereby increasing the credibility of the study's findings.

4.2 Correlation Analysis

Descriptive statistics and correlations between variables are presented in Table 2. Digital resilience showed significant positive correlations with technological emotions ($r = 0.67$, $p < 0.01$), digital literacy ($r = 0.68$, $p < 0.01$), and prosocial behavior ($r = 0.70$, $p < 0.01$). Technological emotions were also significantly positively correlated with digital literacy ($r = 0.64$, $p < 0.01$) and prosocial behavior ($r = 0.53$, $p < 0.01$). In addition, digital literacy showed a significant positive correlation with prosocial behavior ($r = 0.51$, $p < 0.01$).

Table 2 Descriptive Statistics and Intercorrelations Among Variables

Variable	M	SD	1	2	3	4
1.Technological Emotions	4.06	0.52	1			
2.Digital Literacy	4.12	0.53	0.64**	1		
3.Prosocial Behavior	4.10	0.61	0.53**	0.51**	1	
4.Digital Resilience	4.08	0.54	0.67**	0.68**	0.70**	1

Note: **$p < 0.01$

4.3 Mediation Effect Test

Hayes' (2012) SPSS Macro Model 4 was utilized to examine the mediating effect of prosocial behavior on the relationship between technological emotions and youths' digital resilience, while controlling for gender and grade level.

The regression results (see Table 3) indicated that technological emotions significantly and positively predicted youths' digital resilience ($\beta = 0.69$, $p < 0.001$), supporting Hypothesis 1. When prosocial behavior was included in the regression model, the direct positive effect of technological emotions on youths' digital resilience remained significant ($\beta = 0.41$, $p < 0.001$). In addition, technological emotions significantly and positively predicted prosocial behavior ($\beta = 0.64$, $p < 0.001$), while prosocial behavior significantly and positively predicted youths' digital resilience ($\beta = 0.44$, $p < 0.001$). These findings supported hypotheses 2a and 2b.

The bootstrapped 95% confidence intervals for both the direct effect of technological emotions on youths' digital resilience and the mediating effect of prosocial behavior did not

include zero (see Table 4). This finding suggests that technological emotions not only directly predict youths' digital resilience, but also indirectly relate to it through the mediating role of prosocial behavior. The direct effect (β = 0.41) and the mediating effect (β = 0.28) accounted for 59.42% and 40.58% of the total effect (β = 0.69), respectively. Hypothesis 2 was therefore supported.

Table 3 Mediator Variable Mode

Regression Equation		Fitness Index			Significance of Regression Coefficients			
Outcome Variables	Predictor Variables	R	R**2**	F	β	SE	LLCI	ULCI
digital resilience		0.67	0.44	123.35				
	Gender				0.02	0.04	-0.05	0.09
	grade				0.00	0.02	-0.04	0.04
	technological emotions				0.69***	0.04	0.62	0.76
prosocial behavior		0.55	0.30	66.28				
	Gender				0.12*	0.05	0.03	0.21
	grade				-0.05	0.03	-0.11	0.00
	technological emotions				0.64***	0.05	0.55	0.73
digital resilience		0.78	0.61	185.19				
	Gender				-0.03	0.04	-0.09	0.03

grade	0.02	0.03	-0.01	0.06
technological emotions	0.41***	0.03	0.34	0.48
prosocial behavior	0.44***	0.02	0.38	0.50

Note: *p <0 .05,**p <0 .01,***p <0 .001

Table 4 Decomposition of Total, Direct and Indirect Effects

	Effect	BootSE	BootLLCI	BootULCI	Relative effect value
Total effect	0.69	0.02	0.49	0.55	
Direct effect	0.41	0.04	0.34	0.48	59.42%
Indirect effect	0.28	0.04	0.21	0.36	40.58%

4.4 Moderation Effect Test

Using Model 14 from the SPSS macro created by Hayes (2012), which assumes that the second half of the model is moderated, consistent with the theoretical framework of this study, a moderated mediation model was tested while controlling for gender and grade level.

The results (see Table 5) show that when digital literacy was included in the model, it significantly and positively predicted youths' digital resilience ($\beta = 0.31$, $p < 0.001$). In addition, the interaction between prosocial behavior and digital literacy significantly and negatively predicted youths' digital resilience ($\beta = -0.12$, $p < 0.05$), suggesting that digital literacy weakens the positive predictive effect of prosocial behavior on youths' digital resilience.

To better illustrate the moderating effect of digital literacy, participants were divided into high and low digital literacy groups based on one standard deviation above and below the mean ($M \pm 1SD$). A simple slope analysis was then conducted (see Figure 2).

As shown in Figure 2, for individuals with low digital literacy (M - 1SD), prosocial behavior significantly and positively predicted youths' digital resilience ($\beta = 0.42$, $p < 0.001$). However, for individuals with high digital literacy (M + 1SD), the positive predictive effect of prosocial behavior on youths' digital resilience was weaker ($\beta = 0.29$, $p < 0.001$). These findings suggest that as digital literacy increases, the positive predictive effect of prosocial behavior on youths' digital resilience decreases (see Table 6).

Overall, the effect of technological affect on digital resilience through prosocial behavior was moderated by digital literacy. Specifically, for individuals with low digital literacy, the indirect effect of technological affect on youths' digital resilience through prosocial behavior is

relatively larger (β = 0.27, 95% CI [0.19, 0.35]). In contrast, this indirect effect is relatively smaller for individuals with high digital literacy (β = 0.19, 95% CI [0.10, 0.29]) (see Table 7). Hypothesis 3 is therefore supported.

Table 5 Moderated Mediation Model

Regression Equation		Fitness Index			Significance of Regression Coefficients			
Outcome Variables	Predictor Variables	R	R^2	F	β	SE	LLCI	ULCI
digital resilience		0.82	0.67	133.44				
	Gender				-0.04	0.03	-0.10	0.01
	grade				0.00	0.02	-0.04	0.03
	technological emotions				0.26***	0.04	0.18	0.34
	prosocial behavior				0.35***	0.03	0.30	0.41
	digital literacy				0.31***	0.04	0.24	0.39
	prosocial behavior×digital literacy				-0.12*	0.05	-0.22	-0.02

Note: *p <0 .05,**p <0 .01,***p <0 .001

Table 6 Conditional Effects of the Predictor Considering the Moderator = M ± SD

	digital literacy	Effect	BootSE	BootLLCI	BootULCI
Direct effect	M-1SD	0.42	0.04	0.35	0.49
	M	0.35	0.03	0.30	0.41
	M+1SD	0.29	0.04	0.20	0.38

Table 7 Conditional Indirect Effects

	digital literacy	Effect	BootSE	BootLLCI	BootULCI
Indirect effect	M-1SD	0.27	0.04	0.19	0.35
	M	0.23	0.04	0.16	0.30
	M+1SD	0.19	0.05	0.10	0.29

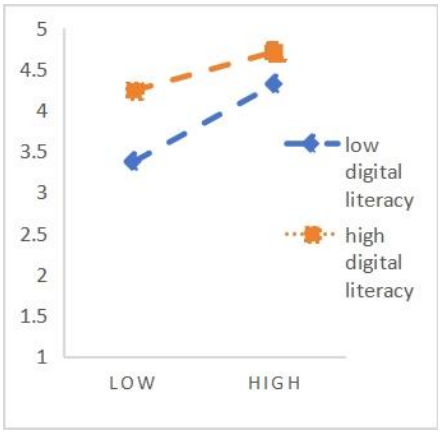

Figure 2 The effect of the two-way interaction between prosocial behavior and digital literacy on digital resilience

5. Conclusion and Discussion

Building on prior research, this study constructs a mediated moderation model to examine the relationship between technological emotions and youths' digital resilience, with prosocial behavior as the mediating variable and digital literacy as a moderator. The findings show that technological emotions not only have a direct positive effect on digital resilience but also are associated with it indirectly through prosocial behavior. The more positive students' technological emotions are, the stronger their digital resilience. Moreover, more positive technological emotions are associated with greater prosocial behavior, which in turn enhances digital resilience. This mediation process is moderated by digital literacy. These findings reinforce the importance of cultivating positive technological emotions and highlight the need to consider individual differences in digital literacy when fostering digital resilience among students.

5.1 The Association between Technological Emotions and Digital Resilience

This study found that technological emotions had a significant positive effect on college students' digital resilience. This relationship is both direct and indirect, mediated by prosocial behavior and moderated by digital literacy. This suggests that enhancing students' digital resilience not only requires external support but also hinges on fostering positive emotional orientations toward digital technology.

According to Lazarus's Cognitive Appraisal Theory, emotions arise from cognitive evaluations of one's surroundings(Lazarus, 1995). Technological emotions, therefore, are developed through sustained interactions with the digital environment and reflect individuals' positive or negative evaluations of how digital technology affects their lived experience. As a critical motivational factor, technological emotions are related to not only students' everyday technology practices but also their ability to manage digital risks. Strengthening digital resilience depends on constructive digital participation, which in turn is shaped by emotional orientations toward technology—whether one engages with digital life passively or actively.

Excessively negative emotions can reduce digital engagement and limit valuable digital experiences. First, they may hinder self-improvement by causing students to fear, reject, or avoid technology, thereby weakening their ability to evaluate risks accurately and respond effectively. This results in increased vulnerability and diminished competitiveness in the digital society. Second, fear of technology exacerbates the digital divide, widening gaps not only in risk resistance and adaptability to digital transformation but also across broader social competencies. Technophobia reduces adaptive capacity and impairs timely responses to digital threats. It is also associated with heightened anxiety and psychological stress, leading to emotional instability and reduced resilience in the face of digital adversity.

In contrast, positive technological emotions empower students to confront and transform risks. First, they ignite enthusiasm for innovation, encouraging active learning, experimentation, and creative problem-solving—qualities that enable students to seize opportunities afforded by technological development. Second, students with positive technological emotions often act as early adopters and promoters of new technologies. According to Diffusion of Innovations Theory, their usage helps accelerate technology acceptance within broader populations. These students also demonstrate altruistic behaviors by sharing their knowledge and experience, providing valuable guidance to others. Finally, students' emotional orientations shape not only their own behavior but also the broader direction of technological development. Historically, students who viewed technology as a vehicle for progress were often at the forefront of digital innovation.

In today's deeply digitalized world, building resilience requires not only "positive participation" but also critical reflection. As neuroscientist António Damásio suggests, effective decision-making emerges from a complementary relationship between emotion and rationality(Damasio, 2018). For college students, digital technologies are deeply embedded in their personal development. While positive emotions support adaptation, unchecked technophilia—excessive dependence on digital tools—can impair rational analysis. Overreliance may cause students to overlook potential risks, diminish critical thinking, and erode resilience.

Studies show that overdependence on short-form video platforms leads to poor time management, distraction, and academic procrastination(Dang, 2024). Likewise, reliance on generative AI tools such as ChatGPT has been linked to sluggish thinking and decreased problem-solving capacity, driven by avoidance motivation and passive learning styles(Ye et al., 2024). Thus, while fostering positive technological emotions is essential, it is equally important to avoid overreliance on technology, which may obstruct students from developing adaptive digital behaviors and constructive digital agency.

5.2 The Mediating Role of Prosocial Behavior

This study confirms that prosocial behavior mediates the relationship between technological emotions and digital resilience among college students. This finding underscores that social relationships remain fundamental to students' digital well-being. In digital spaces, prosocial behavior is a proactive expression of digital participation and reflects longstanding values such as altruism, social responsibility, and collectivism.

Compared to other groups, college students exhibit more positive technological emotions and a stronger willingness to engage with digital tools. When facing digital threats, their intention to act with integrity becomes a defining feature of their prosocial behavior. Typical forms include information dissemination, knowledge sharing, promoting digital civility, and advocating for multicultural inclusion. Specific responses to digital risks may include sharing valuable content to raise awareness, providing emotional support, or offering free tutorials to improve others' digital literacy.

Prosocial behavior facilitates reciprocal interactions in digital participation, enabling students to build social capital that supports resilience. Social Constructionism views society as co-created through social interaction, language, and culture(Berger & Luckmann, 1966). Within this framework, dynamic interaction among diverse actors can yield emergent forms of resilience. In complex digital environments, students' prosocial actions—motivated by shared goals—foster mutual trust and support. As a result, students shift from passive bystanders to active participants, a phenomenon of emergent micro-level resilience embedded in broader systemic structures(Benbya et al., 2020).

Prosocial behavior also addresses collective action dilemmas in responding to digital risks, where conflicting interests may discourage coordinated efforts. Social Exchange Theory posits that individuals evaluate the costs and benefits of social interaction to maximize gain(Homans, 1958). Under this logic, students' prosocial behavior in digital spaces may be driven by:First-year students' need to build interpersonal relationships and gain social capital;A desire to cultivate a positive digital identity by signaling personal values and moral character;Emotional drivers such as empathy and compassion, which create emotional resonance and motivate helping behavior.

5.3 The Moderating Role of Digital Literacy

This study finds that digital literacy moderates the second half of the mediation pathway—specifically, the relationship between prosocial behavior and digital resilience. Notably, the

positive effect of prosocial behavior on digital resilience is stronger among students with lower digital literacy.

For students with higher digital literacy, prosocial behavior has a weaker effect on resilience. This may be due to their greater autonomy and capacity to solve digital problems independently. These students often possess richer psychological resources, particularly high self-efficacy, which plays a more dominant role in coping with digital threats—thereby diminishing the relative contribution of prosocial behavior. This finding highlights the need for differentiated intervention strategies:For students with lower digital literacy, interventions should focus on promoting prosocial behavior and peer support; For more digitally literate students, the emphasis should shift toward enhancing collaboration, empathy, and social responsibility, encouraging them to become advocates, not just beneficiaries, of prosocial engagement.

However, digital literacy did not moderate the relationship between technological emotions and prosocial behavior among youth. This may be explained by the following reasons. From a theoretical perspective, digital literacy may function by influencing digital self-efficacy rather than directly altering the strength of the path between emotions and behavior. Moreover, the behavior driven by emotional motivation may operate relatively independently—youths with lower levels of digital literacy may still be willing to help others, showing limited interference from their literacy level. From a methodological perspective, the measurement of digital literacy in this study mainly focused on digital technology use and digital security awareness, without incorporating social dimensions such as digital ethics and digital collaboration, making it difficult to assess its impact on prosocial behavior.

Foundational digital skills are essential to national digital transformation and to building societal digital resilience. It is a common misconception that younger generations inherently possess strong digital abilities. In reality, many college students lack essential digital competencies(Sánchez-Caballé et al., 2020). Digital literacy and digital resilience are not static but evolve with environmental complexity and individual autonomy needs.

In the context of increasing misinformation and online risks, digital literacy emphasizes critical information evaluation, while digital resilience emphasizes coping with and recovering from digital stress(Livingstone et al., 2017). Together, they form a complementary skillset for responsible and effective digital engagement(Reeves & Crowther, 2019). Digital literacy also promotes ethical and responsible use of digital tools, reducing exposure to digital risks and mitigating their negative effects. High digital literacy enhances individuals' ability to access and use diverse resources, respond effectively, and anticipate and prevent more serious digital challenges.

Ultimately, maximizing digital opportunities while minimizing digital harm is the central issue digital resilience seeks to resolve. In recent years, communication scholars have increasingly engaged in resilience research. According to the Communication Theory of Resilience, resilience is a dynamic communicative process involving adaptation and transformation, stability and change, disruption and reintegration(Buzzanell, 2017). College students' digital resilience develops through ongoing negotiation between risk management and

opportunity recognition. Emotional factors have become key drivers in this process, emphasizing the necessity of cultivating positive technological emotions in digital engagement.

From an ecological perspective, resilience is formed through interaction between individuals and their environments. Resilience at the personal, community, and national levels are interrelated(Kimhi, 2016). Thus, the development of students' digital resilience depends not only on individual efforts—such as building positive and rational emotional orientations—but also on external support systems. Families, schools, and governments must work to create a digital environment that fosters security, trust, and hope for students as they navigate the challenges of the digital age.

6. Limitations and Future Research Directions

The study has several limitations that warrant further investigation. One notable limitation is the lack of an explicit measure of digital risk exposure. Future research could distinguish between objective risk exposure and subjective risk perceptions to better understand their respective effects on digital resilience. In addition, other variables such as social support and digital resources should be included to further improve the study of the mechanisms influencing digital resilience. The relationship between positive technology perceptions and digital resilience highlights the potential influence of digital self-efficacy. Future studies could examine these factors in combination with others to provide a more comprehensive understanding of youths' digital resilience.

Ethics Statement

The studies involving human participants were reviewed and approved by the Scientific Research Ethics Committee of School of Media and Communication, Shenzhen University. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments. The participants provided their online informed consent to participate in this study. Parents of all participants under 18 years of age also signed an online informed consent form describing the purpose, method, process, and publication plan of the study.

Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Data Availability Statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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