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Examining the Mediating Role of Digital Self-Efficacy in the Relationship Between Academic Self-Concept and Academic Performance of Students

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A B S T R A C T

Objective: The present study aimed to examine the relationship between academic self-concept and academic performance, mediated by digital self-efficacy, in male students in the first year of secondary school.

Methods and Materials: The present study is applied in terms of its objective and descriptive-correlational in terms of its method. The statistical population of this study included all male students in District 5 of Tehran who were enrolled in the first year of secondary school during the 2022-2023 academic year. Accordingly, the sample size was determined to be 200 based on Kline's perspective. The sample was selected using purposive and accessible sampling by visiting the first-year secondary schools in District 5 of Tehran. The tools used for data collection included the Academic Self-Efficacy Scale by Ulfert and Schmidt (2022), the Academic Self-Concept Scale by Yasin-Chin (2004), and the students' most recent GPA.

Findings: The direct effect of academic self-concept on digital self-efficacy ($\beta = 0.29$, $t = 2.94$) is significant. Additionally, the direct effect of academic self-concept on academic performance ($\beta = 0.39$, $t = 3.44$) is significant. Finally, the direct effect of digital self-efficacy on academic performance ($\beta = 0.38$, $t = 3.37$) is also significant. The indirect effect of academic self-concept on academic performance is 0.22, and the total effect is 0.64.

Conclusion: Therefore, it can be concluded that in the relationship between academic self-concept and academic performance, the variable of digital self-efficacy can serve as a mediator and strengthen this relationship.

Keywords: *Academic Self-Concept, Academic Performance, Digital Self-Efficacy, Students.*

1. Introduction

School is considered one of the most important and fundamental social institutions in any country, playing a crucial role in guiding, educating, and controlling members of society while also serving various social, economic, cultural, and other functions. Its purpose extends beyond merely teaching and educating students. Cooperation, collaboration, discipline, healthy competition, identity formation, and learning ethical principles are some of the additional functions of schools. Moreover, the primary mission of schools is to focus on students, who are the main investment and should be the focal point of educational efforts. The educational system is tasked with preparing a generation for social life, and neglecting the conditions, exigencies, and necessities of social life may result in learners failing to acquire the necessary skills to adapt to society, leading to significant harm (Nejatifar et al., 2021). Students are considered the future builders of any country. Since the most important duty of students is studying and achieving academic success, one of their primary responsibilities is indeed studying and academic achievement (Garg et al., 2020). Unlike in the past, when it was believed that an individual's learning ability was a function of their intelligence and innate talents, recent years have seen a strengthening of the theory among psychologists that, despite the role of determining innate factors like intelligence and talent in learning, other non-intrinsic factors also play a significant role in this relationship. This issue is no longer viewed from a unidimensional perspective. In this regard, variables such as academic performance and academic self-concept have attracted the attention of education specialists and psychologists (Hausen et al., 2022).

Experts in educational psychology believe that the fundamental goals of any educational system are to create conditions and utilize modern and effective methods to help learners maximize their potential and achieve greater success. The indicator of such progress is academic performance, which includes several components such as self-efficacy, achievement motivation, anxiety reduction, lack of outcome control, and the use of appropriate study strategies. Self-efficacy refers to having confidence in one's academic abilities and educational activities, motivation is the driving force behind behavior, and lack of outcome control means that increasing effort does not necessarily lead to the desired academic results (Alalwan et al., 2019). Academic performance refers to the ability to plan, self-efficacy, motivation, anxiety reduction, the use of beneficial goals, and engaging in study-related activities, and it can be considered one of the most important outcomes of the educational system (Ferla et al., 2009; Marashian & Khorami, 2012). Regarding the importance of addressing academic performance, it can be stated that a review of the research literature shows that students with good academic performance are accepted by peers, parents, and teachers and possess higher self-esteem and a sense of adequacy. In contrast, students with poor academic performance feel inadequate and inferior and may drop out of school (Noronha et al., 2018). Different definitions and methods for measuring academic performance exist, which are mainly categorized into two areas: objective and subjective. In studies on evaluating academic performance, course grades or academic terms have been considered the primary determinants of academic performance (Ghaffari et al., 2015). It can be said that one of the criteria for the efficiency of any country's higher education system is learners' academic progress. As a result, every educational system seeks to identify factors influencing learners' academic performance to achieve its goals and develop strategies to reach them (Cernat & Moldovan, 2018).

Academic self-concept is defined as how an individual perceives their academic progress and includes aspects such as grade point average, creativity, motivation, and problem-solving abilities. Since academic self-concept influences learners' cognitive performance and learning ability, cultivating it in students is crucial (Hausen et al., 2022). Ferla, Valcke, and Cai (2009) believe that students' academic self-concept results from comparing themselves with others, and those who feel more confident and capable in their academic activities have a more effective academic self-concept and achieve greater success (Ferla et al., 2009). According to Liu and Wang (2005), academic self-concept has two dimensions: academic confidence and academic effort (Liu & Wang, 2005). Self-concept is an essential part of an individual's personality formation and reflects the level of personality development. It is an internal factor that influences a person's behavior throughout life (Marsh & O'Mara, 2008; Ng & Boey, 2023; Porparizi et al., 2018). A strong academic self-concept has many educational benefits for students and positively predicts academic success (Wu & Kang, 2023; Zahed-Babelan et al., 2014). Academic self-concept is one of the factors influencing academic performance and is defined as an individual's overall attitude toward their abilities in relation to school learning (Schmitt et al.). Bang (1996) considers academic self-concept as an

individual's personal perception of their self-efficacy in academic subjects. In this regard, factors such as successful or unsuccessful academic experiences during the early years of schooling initially influence perceptions of abilities related to academic subjects (affect related to school). After gaining more experience, affect related to school and eventually academic self-concept are formed. Affect related to a subject reflects a student's interest and motivation for specific subjects, and affect related to school reflects their attitude toward the entire school experience. Academic self-concept reflects an individual's overall perceptions of their abilities in relation to school learning (Ng & Boey, 2023).

Self-efficacy is the core concept of Bandura's cognitive theory and refers to individuals' perceptions of their ability to perform tasks and activities. Accordingly, people tend to engage in activities in which they feel confident, and if they feel incapable of performing an activity, they typically avoid it. Self-efficacy perception relates to individuals' expectations about their ability to act in future situations. Individuals with high self-efficacy are likely to put more effort into challenging tasks, persist in their efforts, remain calm during task performance, and organize their thoughts analytically (Bandura, 1986, 1997, 2004, 2006, 2012a, 2012b). The importance of self-efficacy is so significant that many believe that perhaps the most important task of education in schools should be to create self-efficacy in academic and other aspects of life. Without self-efficacy, students may forget what they learn, and the efforts of the educational system may be wasted. However, if students develop self-efficacy, they can independently find the information they need or even generate new knowledge (Freund & Holling, 2011). As a result, many approaches have been proposed for assessing self-efficacy. These approaches range from task-specific self-efficacy, domain-specific self-efficacy, to general self-efficacy (Marsh et al., 2017). According to Ulfert and Schmidt (2022), digital self-efficacy measures digital competencies across five dimensions: 1) information and data literacy; 2) collaboration and communication; 3) digital content creation; 4) safety; 5) problem-solving (Ulfert-Blank & Schmidt, 2022; Ulfert et al., 2022). Information literacy includes searching, evaluating, managing, and understanding data and digital content. Collaboration and communication involve interaction, sharing, and participation in digital technologies, as well as digital ethics and identity management. Digital content creation includes developing, creating, integrating, explaining, and revising digital content, as well as programming and adhering to copyright laws. The safety dimension encompasses protecting information and privacy, well-being, the environment, and digital tools. Finally, the problem-solving dimension consists of solving technical problems, identifying needs and responding to them through technology, creativity in using technology, and identifying gaps in digital competencies (Parsakia et al., 2023).

The education system of any country plays a crucial role in its social, political, and cultural fate. Strengthening the country's scientific and educational foundations, transmitting culture to future generations, preserving the heritage of the past, reinforcing national will, creating accurate political insights, establishing social relationships, and strengthening economic foundations are among the functions of the educational system in which schools can play a significant role. Therefore, the flourishing of schools is one of the most sensitive and vital missions of educational institutions (Amiri, 2021). In other words, the school years are among the most important years of education because the habit of studying and strengthening academic foundations is formed during this period, which can lead to a bright academic and professional future. Therefore, given the importance of variables such as academic performance and academic self-concept, and considering that no study in Iran has quantitatively examined digital self-efficacy, the present study aimed to investigate the mediating role of digital self-efficacy in the relationship between academic self-concept and academic performance of students.

2. Methods and Materials

2.1. Study Design and Participants

The present study is applied in terms of its objective and descriptive-correlational in terms of its method. The statistical population of this study included all male students in District 7 of Tehran who were enrolled in the first year of secondary school during the 2022-2023 academic year. Accordingly, the sample size was determined to be 200 based on Kline's perspective. The sample was selected using purposive and accessible sampling by visiting the first-year secondary schools in District 5 of Tehran. The tools used for data collection included the Digital Self-Efficacy Scale, the Academic Self-Concept Scale, and the students' most recent GPA. After determining the sample size, the researcher employed purposive and accessible sampling methods and continued until 200 questionnaires were completed.

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2.2. Measures

2.2.1. Digital Self-Efficacy

This scale was developed by Ulfert and Schmidt in 2022 to measure the digital competencies of respondents in using digital technologies. It was translated and standardized in Iran by Parsakia et al. (2023). This questionnaire consists of 25 items and measures digital self-efficacy across five dimensions: 1) information and data literacy (3 items); 2) collaboration and communication (8 items); 3) digital content creation (4 items); 4) safety (5 items); and 5) problem-solving (5 items). The items on this scale are scored on a 6-point Likert scale. Therefore, the overall score of this questionnaire ranges from 25 to 150. Additionally, the subscale scores range from 3 to 18 for information and data literacy, 8 to 48 for collaboration and communication, 4 to 24 for digital content creation, and 5 to 30 for both safety and problem-solving. The validity of this questionnaire was assessed and confirmed by its developers using methods such as face validity, convergent validity, divergent validity, and confirmatory factor analysis. The reliability of this scale was also confirmed using the test-retest method. The correlation coefficients for the test-retest reliability of this scale were reported as follows: 0.59 for the information and data literacy subscale, 0.59 for the collaboration and communication subscale, 0.77 for the digital content creation subscale, 0.68 for the safety subscale, and 0.71 for the problem-solving subscale. In Iran, Parsakia et al. (2023) conducted a study in which, after confirming face validity, five factors with eigenvalues greater than 1 were identified through exploratory factor analysis, with the five factors explaining 70.55% of the variance in digital self-efficacy. Confirmatory factor analysis also showed the significance of the items for each of the five factors. Additionally, the coefficients for convergent validity, test-retest reliability, Cronbach's alpha, and composite reliability were all above 0.70, indicating the scale's appropriate reliability (Parsakia et al., 2023).

2.2.2. Academic Self-Concept

This questionnaire was developed by Yasin-Chen in 2004 to measure academic self-concept after being administered to 1,612 Taiwanese elementary school students. The questionnaire consists of 15 items and aims to assess various dimensions of academic self-concept (general, academic, and non-academic). The scoring range is based on a 5-point Likert scale. Therefore, the score range for this questionnaire is 15 to 75, with higher scores indicating a higher academic self-concept. Marsh and O'Mara (2008) reported a convergent validity of 0.89 for this questionnaire. In Iran, this questionnaire was used by Marashian (2012) in a sample of 36 participants, and a Cronbach's alpha of 0.93 was obtained (Marashian & Khorami, 2012).

2.2.3. Academic Performance

In this study, students' GPA for the semester was used to assess their academic performance.

2.3. Data analysis

The data obtained from the completed questionnaires were statistically analyzed using SPSS and AMOS software, Pearson correlation coefficient, and structural equation modeling to test the research hypothesis.

3. Findings and Results

Regarding the demographic findings of the present study, all participants were male, and the mean (standard deviation) age of the participants was 12.85 (1.90) years. The descriptive statistics of the variables in this study are reported in Table 1.

Table 1

Descriptive Statistics of the Research Variables

Variable	Mean	Standard Deviation	Kurtosis	Skewness
Academic Performance	17.93	1.88	0.80	1.15
Digital Self-Efficacy	92.56	20.70	0.44	0.39
Academic Self-Concept	43.79	14.66	-0.89	-1.11

As shown in Table 1, the mean (standard deviation) scores of the participants for academic performance, digital self-efficacy, and academic self-concept were 17.93 (1.88), 92.56 (20.70), and 43.79 (14.66), respectively. Additionally,

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the values for kurtosis and skewness all fall between -2 and +2, indicating that the data follows a normal distribution. The results of the Pearson correlation test are reported below.

To examine the normality of the distribution of variables, the Kolmogorov-Smirnov test was used. The results indicated that all variables had a normal distribution ($p > .05$). Pearson correlation was used to examine the relationships between the variables. The results of the Pearson correlation test are presented in Table 2.

Table 2

Pearson Correlation Coefficients Between Research Variables

Variable	1	2	3
1. Academic Performance	1		
2. Digital Self-Efficacy	0.30*	1	
3. Academic Self-Concept	0.35*	0.31*	1

*p<0.05

The results in Table 2 indicate that the Pearson correlation coefficient for the relationship between digital self-efficacy and academic self-concept, digital self-efficacy and academic performance, and academic self-concept and academic performance are all significant at the 0.05 level, suggesting that the relationships between all variables are direct and significant.

The goodness-of-fit indices for the three-factor model indicated an acceptable fit. The chi-square to degrees of freedom ratio (χ^2/df) was 2.92, which is below the recommended threshold of 3. The Root Mean Square Error of Approximation (RMSEA) was 0.081, indicating an adequate fit as it is below 0.10. The Goodness of Fit Index (GFI) was 0.91, the Adjusted Goodness of Fit Index (AGFI) was 0.95, the Normed Fit Index (NFI) was 0.93, and the Comparative Fit Index (CFI) was 0.93. All these indices were above the 0.90 threshold, further supporting the model's good fit. The Non-Normed Fit Index (NNFI) also had a value of 0.94, confirming the overall adequacy of the model. Therefore, it can be concluded that the proposed model of the study has a good and desirable fit. The estimated direct effects between the research variables are reported in Table 3.

Table 3

Estimates of Direct Effects Between Research Variables

From Variable	To Variable	Standardized Parameter (Beta)	Standard Error	t	Result
Academic Self-Concept	Digital Self-Efficacy	0.29	0.04	2.94	p < 0.05 (Confirmed)
Academic Self-Concept	Academic Performance	0.34	0.01	3.37	p < 0.05 (Confirmed)
Digital Self-Efficacy	Academic Performance	0.38	0.02	3.44	p < 0.05 (Confirmed)

As shown in Table 3, the standardized parameter, standard error, and t-test results are reported. Based on the values obtained in this table, the direct effect of academic self-concept on digital self-efficacy ($\beta = 0.29$, $t = 2.94$) is significant. Similarly, the direct effect of academic self-concept on academic performance ($\beta = 0.34$, $t = 3.37$) is significant. Finally, the direct effect of digital self-efficacy on academic performance ($\beta = 0.38$, $t = 3.44$) is also significant. The results further showed that the indirect effect of academic self-concept on academic performance was 0.12, and the total effect was 0.46. Therefore, it can be concluded that in the relationship between academic self-concept and academic performance, the variable of digital self-efficacy acts as a mediator and can strengthen this relationship. The final research model along with the direct effects is shown below.

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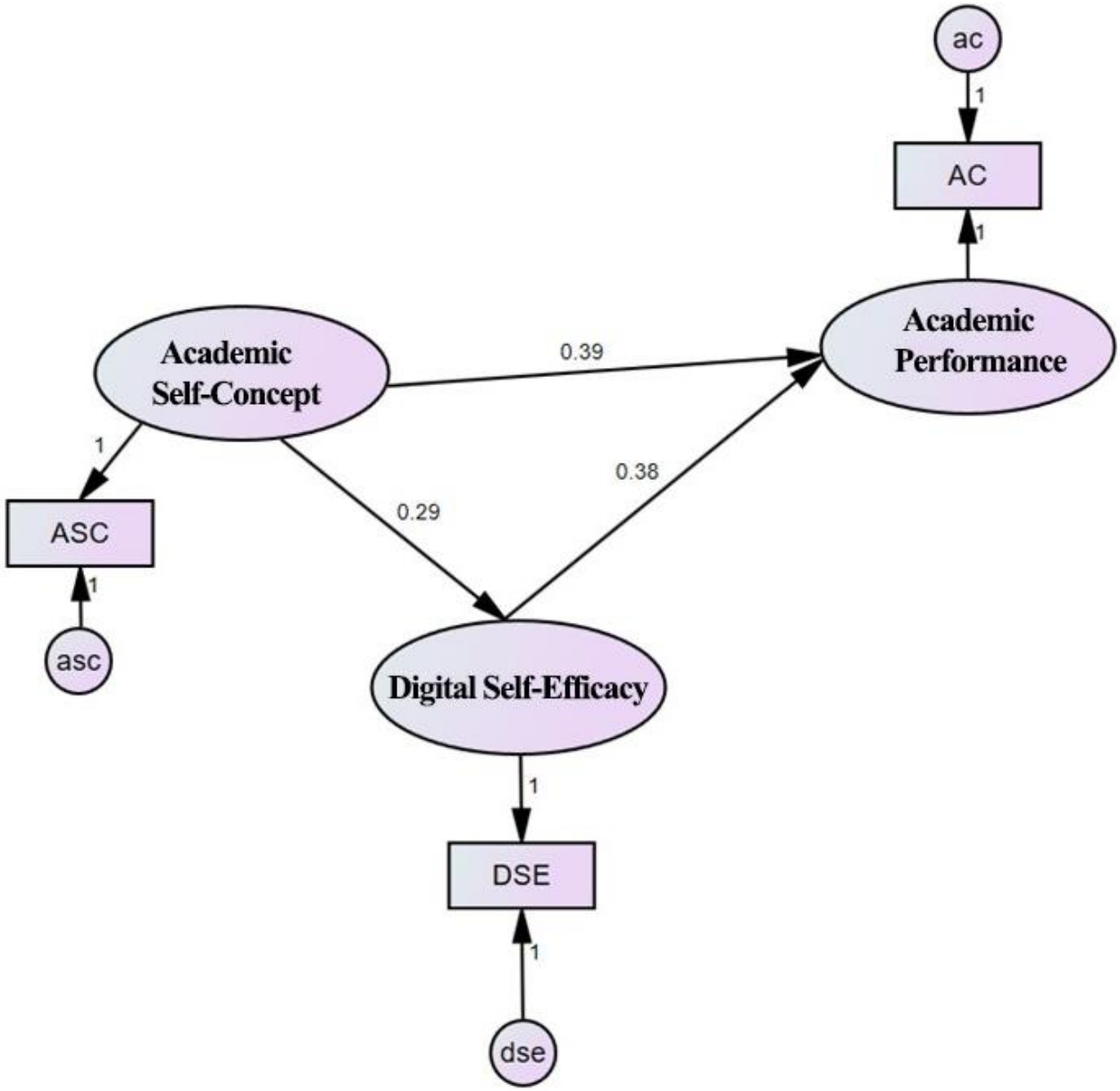
Figure 1

Final Research Model



4. Discussion and Conclusion

The present study aimed to investigate the mediating role of digital self-efficacy in the relationship between academic self-concept and academic performance among students. The results of the statistical analysis of the data using correlation coefficients and structural equation modeling showed that the relationship between academic performance and academic self-concept in male students in the first year of secondary school is significant. Additionally, the findings of this study revealed that digital self-efficacy mediates the relationship between academic self-concept and academic performance in the research sample. These findings are consistent with the results obtained in prior studies (Amiri, 2021; Bandura, 1986; Ferla et al., 2009; Malodia et al., 2023; Yu & Hu, 2022; Zimmerman & Kitsantas, 2005).

In explaining the results obtained from the statistical analysis of the findings, it can be stated that academic self-concept is the process of forming an evaluation of self-concept influenced by learners' educational experiences and

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the interpretation of the educational environment (Ferla et al., 2009). Self-concept is an important and perhaps the most significant aspect of an individual's personality because it deals with the concept of individual identity, distinguishing a person from others and encompassing a unique set of characteristics. The concept of self includes awareness of being alive, awareness of thinking, reasoning, performing specific actions, and believing in one's awareness of oneself more than others (Schmitt et al.). In fact, individuals' self-concept represents their description of themselves. According to many psychologists, your answer to the question "Who am I?" is what constitutes your self or self-concept, and your evaluation of your answer to this question reflects your self-esteem or the level of self-acceptance and self-liking. According to many theorists, self-concept and self-esteem play an important role in adaptation (Wu & Kang, 2023). Academic self-concept is categorized into subject-specific self-concepts (such as literature, mathematics, and science), and in Marsh's view, academic self-concept in students arises from internal comparisons (comparing one's abilities with one's own) and external comparisons (comparing one's abilities with those of others) (Wu & Kang, 2023). Academic self-concept refers to an individual's overall attitude towards their abilities in relation to school learning (Lau et al., 2022). According to Liu and Wang (2005), academic self-concept has two dimensions: academic confidence and academic effort among students (Liu & Wang, 2005). On the other hand, knowledge and skills related to digital tools and various software have become essential skills in modern societies (Ulfert et al., 2022). Self-efficacy was first introduced by Albert Bandura (1986) and is generally defined as individuals' perceptions of their abilities and capabilities in executing tasks (Bandura, 1986). Self-efficacy is widely regarded as one of the most important indicators of individuals' capabilities in responding to challenges and unfamiliar situations (Taba et al., 2022; Tetri & Juujärvi, 2022). High levels of self-efficacy lead individuals to expect better outcomes, be more inclined to identify and utilize opportunities around them, and make more effort to overcome problems and obstacles (Maran et al., 2022). Self-efficacy refers to an individual's firm belief that they can successfully perform the specific behavior required to achieve the desired outcome (Bandura, 2004). Self-efficacy is related to individuals' ability to use methods that give them control over events that affect their lives. Self-efficacy beliefs form the foundation of individuals' functioning. People who believe they can create desirable outcomes through their activities are encouraged to pursue tasks when they encounter difficulties (Zysberg & Raz, 2019). Additionally, digital self-efficacy comprises five dimensions: 1) information literacy, which includes searching, evaluating, managing, and understanding data and digital content; 2) communication and collaboration, which includes interacting, sharing, and participating in digital technologies, and also encompasses digital ethics and identity management; 3) digital content creation, which includes developing, creating, integrating, explaining, and revising digital content, as well as programming and adhering to copyright laws; 4) safety, which includes protecting information and privacy, well-being, the surrounding environment, and digital tools; and 5) problem-solving, which involves solving technical problems, identifying needs, and responding to needs through technology, creativity in using technology, and identifying gaps in digital competencies (Parsakia et al., 2023). Therefore, the results can be explained in such a way that with the expansion and widespread use of digital tools and resources, especially in educational settings, learners with higher digital self-efficacy can also perform better in academic performance, and thus, through these competencies, the relationship between academic self-concept and academic performance is strengthened by digital self-efficacy.

5. Limitations & Suggestions

Every research study has limitations, and this study is no exception. One of the limitations is the use of self-report questionnaires for data collection. This method of data collection may not guarantee the accuracy and precision of the gathered data, as participants might not complete the questionnaires accurately for various reasons, such as not adhering to the principle of honesty, wanting to present themselves favorably, making mistakes while filling out the questionnaire, or being unmotivated to complete it. Additionally, this study used a convenience sampling method, which, like other studies in the social and human sciences, limits the generalizability of the sample to the entire population. Therefore, it is strongly recommended that caution be exercised when using and generalizing the results of this study.

Given the limitations of this study, it is recommended that researchers examine the variables used in this study in relation to other variables and use different populations with different demographic characteristics (gender, educational level, city, etc.). It is also suggested that the results obtained

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from this study be used in the design of more comprehensive models. Furthermore, the results of this study can be useful in the development of educational, counseling, and therapeutic protocols. It is recommended that these results be integrated into educational packages. Additionally, these results can be beneficial in counseling and therapy sessions for better understanding clients. Moreover, it is suggested that professionals use the tools employed in this study in their work.

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Declaration of Interest

The authors of this article declared no conflict of interest.

Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

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Authors' Contributions

All authors equally contributed to this article.

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