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Analysis of Self-Esteem and Metacognition in Health Science Students

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Abstract:
Self-esteem is how an individual evaluates himself; metacognition refers to the degree of knowledge about one's own cognitive processes. This research aims to analyze the relationship between the levels of self-esteem and metacognitive skills in students of the Faculty of Health Sciences of the National University of Chimborazo in the second term of 2022. The study had a non-experimental design with an analytical scope and cross-section. One thousand and one hundred forty-six students constituted the population in this study. Data were obtained through the application of two instruments: Inventory of Metacognitive Skills and Rosenberg Self-Esteem Scale. A predominance of a very high level of metacognition and its two dimensions was observed, with frequencies ranging between 60.38% and 64.31%. The majority of participants had high self-esteem (42.15%). Regarding self-esteem, both variables were significantly associated according to Pearson's chi-square test (p<0.01). The results indicated a statistically significant association between the levels of metacognitive dimensions and self-esteem. The values of the multinomial logistic regression showed a predictive capacity for regulating high metacognition with regard to low and medium levels of self-esteem. The novelty of the results was the empirical verification of the correlation between the dimensions and factors of metacognition concerning self-esteem, which was positive and of slight intensity.

Keywords: self-esteem, metacognition, students, higher education.

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健康科学专业学生自尊与元认知分析

摘要：
自尊是一个人如何评价自己；元认知是指一个人对自身认知过程的了解程度。本研究旨在分析 2022 年第二学期钦博拉索国立大学健康科学学院学生自尊水平与元认知技能之间的关系。该研究采用非实验设计，分析范围 和横截面。本次研究的人口为一千一百四十六名学生。数据是通过应用两种工具获得的：元认知技能清单和罗森伯格自尊量表。观察到非常高水平的元认知及其二维的优势，频率范围在 60.38%到 64.31%之间。大多数参与者有很高的自尊心（42.15%）。关于自尊，根据皮尔逊卡方检验，这两个变量均显着相关（p<0.01）。结果表明，元认知维度和自尊水平之间存在统计学上显着的关联。多项逻辑回归的值显示出调节低和中等自尊水平的高元认知的预测能力。结果的新颖之处在于对自尊元认知维度与因素之间的相关性进行了实证验证，该相关性呈正相关且强度较小。

关键词：自尊，元认知，学生，高等教育。

1. Introduction

Self-esteem is how an individual evaluates himself and acts accordingly, generating appreciation from an affective and cognitive basis. Thus, this category is directly related to self-concept, which implies the recognition and acceptance of one's own limitations, capacities, abilities, and bodily characteristics, granting value and importance to himself from his self-perception (Aydin et al., 2018; Gómez Tabares et al., 2020).

Zamora-Marin and Leiva-Colos (2022) mention that difficulties caused by low self-esteem can affect people's mental health, mainly young people.

Metacognition refers to the person's degree of knowledge about their own cognitive process or mental operation (Arias and Aparicio, 2020). Delmastro and Salazar (2008) define it as "a conscious activity of high-level thinking, which allows one to investigate and reflect on how the person learns and controls their own learning strategies and processes, with the aim of modifying and/or improving them" (p. 45). In this regard, Brown (1987) established that metacognition comprises two fundamental dimensions: knowledge and regulation of metacognition.

Contemporary educational systems should consider implementing actions for the adequate development of self-esteem and metacognitive skills in students through the stimulation of self-concept, motivation, and self-regulation of learning (Siegesmund, 2017; Dapp and Roberts, 2021).

Considering the common aspects between both constructs, Kolubinski et al. (2019) developed a metacognitive model with the ability to positively affect self-esteem.

The study of the relationship between metacognition and self-esteem has been addressed by several authors in different populations and contexts (Moh et al. (2019; Elif, 2013; Inci et al., 2021), managing to associate both variables with a divergence of intensity.

Jabasingh et al. (2022) established a strong correlation between both variables in undergraduate university students. These researchers implemented metacognitive strategy training programs that showed effectiveness in the participants' personal development, mainly in aspects inherent to self-esteem (Castillo, 2001; Repetto and Carvallo, 2014).

The main objective of this study is to analyze the relationship between different levels of self-esteem and metacognitive skills in students of the Faculty of Health Sciences of the National University of Chimborazo in the second semester of 2022.

2. Materials and Methods

This study had a non-experimental design with an analytical and cross-sectional scope. The population comprised 1146 students, consisting of those enrolled in the courses of the Faculty of Health Sciences of the National University of Chimborazo (UNACH), Riobamba, Ecuador, during the 2022-2S academic period.

The data were obtained through the application of two instruments:

- Inventory of Metacognitive Skills (IMS) (Schraw and Denninson, 1994), which consisted of 52 items measured using a Likert-type scale (completely disagree – 1, rather disagree than agree – 2, moderately agree/disagree – 3, rather agree than disagree – 4 and completely agree – 5); allowing the establishment of the global state of the variable and that of two fundamental metacognitive dimensions:

- Knowledge of cognition was measured using the indicators declarative knowledge (items 5, 10, 12, 16, 17, 20, 32, 46), procedural knowledge (items 3,14, 27, 33), and conditional knowledge (items 15, 18, 26, 29, 35).

- Regulation of cognition, determined by indicators: planning (items 4, 6, 8, 22, 23, 42, 45), organization (items 9, 13, 30, 31, 37, 39, 41, 43, 47, 48), monitoring (items 1, 2, 11, 21, 28, 34, 49), debugging (items 25, 40, 44, 51, 52), and evaluation (items 7, 19, 24, 36, 38, 50).

The processing of this instrument makes it possible

to frame the state of the variable, dimensions, and indicators in four possible levels: very low, low, high, and very high.

- The Rosenberg Self-Esteem Scale, which includes ten items focused on exploring feelings and thoughts about the individual's self-acceptance, uses a scale of four values (1 = strongly agree, 2 = agree, 3 = disagree, and 4 = totally disagree). Processing is carried out through the sum of the scores, which must be done by inverting the numbers of the items: 3, 5, 8, 9, and 10. This is taken directly. The results are interpreted as follows: 30 to 40 (high), 26 to 29 (medium), and less than 25 (low). Vázquez Morejón *et al.* (2004) determined its adequate internal consistency using a Cronbach's alpha of 0.87 (Chacón López et al., 2019).

The main theoretical level methods used by researchers were synthetic-analytical, inductive-deductive and logical-practical.

The study was conducted in six general stages (Figure 1).

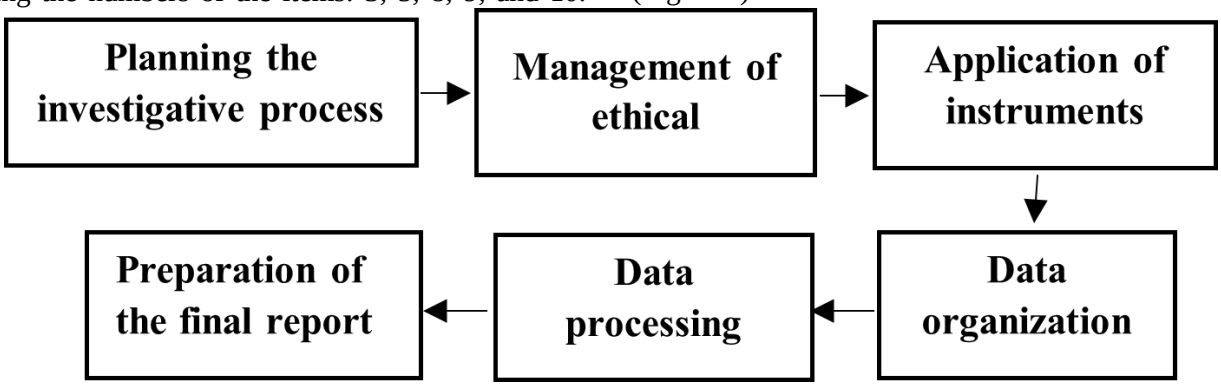

Figure 1. Stages of the research process (Developed by the authors)

Data were processed using SPSS software in version 25.0. The researchers described the metacognitive skills and self-esteem of the participants through relative and absolute frequencies. The Kolmogorov and Smirnoff test results showed that the data distribution did not meet the normality criteria (p<0.05). Therefore, it was decided to use non-parametric tests for relationship analysis: the chi-square of independence and the Spearman correlation coefficient. The statistical power of the relationships was established using the beta value.

The cause-effect analysis was performed as follows:

• Logistic regression is based on a linear function that processes independent variables at different dependent variable levels (Sagaró-del Campo et al., 2019).

• Multinomial logistic regression was used to identify the factors that affect the levels of self-esteem, requiring several inferential tests: Chi-square (to associate the variables), R^2 of Cox and Snell, and R^2 of Nagelkerke (an indicator of goodness of fit of the model) and odds ratio (as a measure of the probability with which a factor could modify a certain variable) (Ceniceros, 2014).

During the research, the informed consent procedure was implemented in the participants with the commitment to respect their anonymity. The study was endorsed by the Research Directorate of the National University of Chimborazo through Resolution No.40-CIV-16-2-2022, which approved the execution and financing of the project.

3. Results

The descriptive processing of the data made it possible to appreciate a predominance of the very high level in both dimensions of metacognition, as well as in the global one, with frequencies that ranged between 60.38 and 64.31%. There was an incidence of less than 3% in the sum of the low and very low levels. Regarding self-esteem, most participants had a high evaluation (42.15%). The p values of the Pearson chi-square test were less than 0.01. Therefore, both variables were significantly associated (Table 1).

Table 1. Association of metacognitive skills with self-esteem levels (Developed by the authors)

Metacognition	Level	Self-esteem			x^2	P
		Low	Medium	Elevated		
Global	Very low	-- (--)	-- (--)	6 (0.52%)	46.97	0.00 **
	Low	3 (0.26%)	4 (0.35%)	11 (0.96%)		
	High	94 (8.20%)	198 (17.4%)	131 (11.43%)		
	Very high	130 (11.34%)	234 (20.4%)	335 (29.23%)		
Knowledge	Very low	-- (--)	-- (--)	6 (0.52%)	37.26	0.00 **
	Low	3 (0.26%)	4 (0.35%)	12 (1.05%)		
	High	83 (7.24%)	180 (15.71%)	121 (10.56%)		
	Very high	141 (12.30%)	252 (21.99%)	344 (30.02%)		
Regulation	Very low	-- (--)	-- (--)	5 (0.44%)	57.16	0.00 **
	Low	1 (0.09%)	3 (0.26%)	12 (1.05%)		
	High	100 (8.73%)	206 (17.98%)	127 (11.08%)		
	Very high	126 (10.99%)	227 (19.81%)	339 (29.58%)		
	Total	227 (19.8%)	436 (38.1%)	483 (42.1%)		--

Notes: ** Significant (p<0.01); P - p-value; X 2 - chi-square

The multinomial logistic regression analysis reflected statistical significance regarding the general association of the set of metacognitive variables concerning self-esteem (X^2 =26.54; p<0.05). However, the values of Cox and Snell's R^2 (0.19) and Nagelkerke's R^2 (0.21) were not close to 1, indicating a low level of goodness of fit of the model (Table 2).

Table 2. Summary of the criteria of multinomial logistic regression analysis (Developed by the authors)

Self-esteem (independent variable)	x^2	df	Sig.	Log-likelihood-2	Cox and Snell R^2	Nagelkerke R^2
Values	26.54	6	0.01*	117.87	0.19	0.21

Notes: Gl - degrees of freedom; R^2 - R squared; Sig. - statistical significance; X^2 - chi square; * Significant (p<0.05)

The multinomial logistic regression analysis allowed us to establish that self-esteem at its low and medium levels statistically significantly predicts the high level of metacognition regulation (p=0.00).

The odds ratio values indicated that students in the investigated population with low and medium levels of self-esteem are 3.93 and 3.56 times (respectively) more likely to have a high regulation of metacognition (Table 3).

Table 3. Predictability of self-esteem as a function of metacognition. Multinomial logistic regression (Developed by the authors)

Self-esteem level	Regulation of metacognition	β	Next.	Exp (β) = Odds ratio	95%. CI. for EXP(β)	
					Lower	Lower
Low	High	1.36	0.00**	3.93	1.51	10.17
Half	High	1.27	0.00**	3.56	1.58	8.02

Notes: β - beta; EXP(β) - beta exponential odds ratio; CI – confidence interval; Sig – statistical significance

The Pearson correlation test allowed us to determine the significant presence of this statistical condition in all the dimensions and indicators of metacognitive skills concerning self-esteem (p < 0.01 or p < 0.05), being of mild intensity in all cases and only negative in the relationship with global metacognition (r=-0.110) (Table 4).

Table 4. Bivariate correlational analysis of self-esteem and metacognitive skills (Developed by the authors)

Metacognition	Self-esteem		
	Rho	P	β
Global metacognition level	-0.110	0.000**	0.96
Regulation of cognition	0.116	0.000**	0.97
Assessment	0.087	0.003**	0.83
Depuration	0.069	0.019*	0.64
Monitoring	0.091	0.002**	0.87
Organization	0.104	0.001**	0.94
Planning	0.098	0.001**	0.91
Knowledge of cognition	0.095	0.001**	0.89
Conditional knowledge	0.066	0.026*	0.60
Procedural knowledge	0.070	0.019*	0.65
Declarative knowledge	0.086	0.004**	0.83

Notes: β - beta; P - p-value; Rho – the Spearman correlation coefficient; ** Significant p<0.01; * Significant p<0.05

4. Discussion

The figures allowed us to confirm the existence of a significant association between the levels of regulation, knowledge, and global metacognition and the different levels of self-esteem. In previous studies, statistically significant relationships were demonstrated (p<0.05) between these variables in different populations (Inci et al., 2021; Moh et al., 2019).

Bedford and Rajeswari (2022) also found a statistically significant, directly proportional, and mild association between metacognition and self-esteem (p < 0.01) in university students, although in the Faculty of Arts and Sciences. Likewise, Cepeda and Mahecha (2022) reported a similar result, mentioning a positive and weak correlation (r=0.207).

Some metacognitive therapies aimed at adolescents and young people have been developed based on limitations in adaptive thinking and cognitive control processes (Wells et al., 2009). Detection of psychological disorders related to self-esteem, stress, and depression, among others, is predominant (Farahmand et al., 2014; Normann and Morina, 2018).

Metacognitive skills enhance affective reactivity and changes in self-esteem assessments (Palmier-Claus et al., 2011), whereas insufficient development of these skills is associated with thoughts of rumination that are predictive of the state of self-esteem (Kolubinski et al., 2019; Fearn et al., 2022).

In another study, the researchers applied a regression model and observed that metacognition is an element with a predictive capacity of low self-esteem level by 16% (Hagen et al., 2020).

In Germany, during a research process related to the regulation of self-learning and self-esteem in 60 higher education students, Schnaubert et al. (2021) established that most models developed showed that the state of each variable was not significantly explanatory of the other (β<0.01; p=0.246); although, a correlation was observed between both (r=0.569; p<0.001). Elif (2013) found a statistically significant positive correlation of moderate intensity (r = 0.421; p=0.000).

5. Conclusion

The novelty of the results was the empirical verification of the correlation between the dimensions and factors of metacognition concerning self-esteem, which was positive and of slight intensity. However, it was inversely proportional to the level of global metacognition.

The high and very high levels predominated in global metacognition and its dimensions, whereas in

self-esteem, they were medium and high. The findings indicated a statistically significant association between the levels of metacognitive dimensions and self-esteem.

Multinomial logistic regression analysis allowed us to establish the predictive capacity of regulating high metacognition with regard to low and medium levels of self-esteem.

6. Limitations and Further Study

The main limitation of the study was the lack of normality in the data distribution. Therefore, non-parametric inferential statistics were used, which reduced the ability to extrapolate the results to other similar environments.

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Authors' Contributions

Conceptualization, Y.R.-H. and M.C.-L.; methodology, G.P.-G. and A.S.-S.; formal analysis, Y.R.-H., S.A.-G, G.P.-G., A.S.-S. and E.B.-A.; investigation, Y.R.-H. and M.C.-L.; writing—original draft preparation, G.P.-G., A.S.-S. and E.B.-A.; writing—review and editing, D.T.-L.; supervision, Y.R.-H. All authors have read and agreed to the published version of the manuscript.

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