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Analysis of high sensory processing sensitivity with achievement motivation / intrinsic-extrinsic and self-esteem in university students

Análisis de alta sensibilidad de procesamiento sensorial con motivación de logro / intrínseca-extrínseca y autoestima en estudiantes universitarios

Análise da alta sensibilidade do processamento sensorial com motivação para realização /intrínseca-extrínseca e autoestima em estudantes universitários

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Resumen

Antecedentes y objetivo: El interés científico en conocer más sobre las personas altamente sensibles (PAS), dentro del nuevo rasgo de personalidad denominado sensibilidad de procesamiento sensorial (SPS), es creciente. En este trabajo se analiza dicho rasgo, en relación a la motivación de logro general y dividida en intrínseca-extrínseca (ML/MLI-MLE) y a la autoestima (A), y también con variables sociodemográficas. Método: 158 universitarios (Medad = 20,61; DT = 4,179; mujeres 75,9%) contestaron tres escalas: HSPS-S (Chacón et al., 2021), CLAMS/IAM-EAM (Cassidy & Lynn, 1989; Story et al., 2009) y RSES (Martín-Albo et al., 2007). Se aplicaron análisis descriptivos e inferenciales (t de Student, ANOVAS, correlaciones y análisis de mediación). Resultados: Se encontró un perfil de nivel medio en SPS y ML, y medio-alto en A; también una correlación negativa entre alta SPS y A, y otra positiva entre ML y A. Con mayores ingresos familiares mayor A y en PAS mayor ML cuando no se tiene beca. La MLE y sus dimensiones poder adquisitivo, competitividad y estatus fueron mayores en PAS. La MLI y destreza, dominancia y estatus fueron mayores con alta A. Con alta SPS la A fue menor, influyendo a su vez en una menor MLI y MLE. Conclusiones: Este grupo de estudiantes universitarios muestra como la A es una variable mediadora clave en las PAS, así como también la ML/MLI-MLE, y su estudio multidisciplinar debería ampliarse, dada su influencia en el bienestar y calidad de vida, además, de analizarse en la infancia, adolescencia, adultez intermedia y vejez.

Abstract

Background and aim: There is growing scientific interest in knowing more about highly sensitivity persons (HSP) within the new personality trait called sensory processing sensitivity (SPS). The aim of this work is to analyze that trait, in relation to general achievement motivation (AM) and AM divided into intrinsic-extrinsic (IAM-EAM), and self-esteem (S-E), as well as their relationship with sociodemographic variables. Method: 158 university students (Mage = 20.61; SD = 4.179; women 75.9%) answered three scales: HSPS-S (Chacón et al., 2021), CLAMS/IAM-EAM (Cassidy & Lynn, 1989; Story et al.., 2009) and RSES (Martín-Albo et al., 2007). Student's t-test, ANOVAS, correlations, and mediation analysis were applied. Results: They showed a medium level profile in SPS and AM, and a medium-high level in S-E; in addition, a negative correlation between HSP and S-E, and another positive one between AM and S-E were found. The higher the family income, the higher the S-E and in HSP, the higher AM without grant. EAM and its dimensions of acquisitiveness, competitiveness and status aspiration were greater in HSP. IAM and mastery, dominance and status aspiration were greater when S-E was high. S-E was lower in HSP, and this, in turn, resulted in a lower IAM and EAM. Conclusions: This group of students shows how S-E is a key mediating variable in HSP, as well as AM/IAM-EAM, and its multidisciplinary study should be expanded, given its influence on well-being and quality of life and, furthermore, it should be analyzed in childhood, adolescence, middle age and old age.

Resumo

Antecedentes e objetivo: O interesse científico em conhecer mais sobre as pessoas altamente sensíveis (PAS), dentro do novo traço de personalidade denominado sensibilidade ao processamento sensorial (SPS), está crescendo. Neste trabalho, analisa-se esse traço em relação à motivação para realização geral e dividida em intrínseca-extrínseca (MR/MRI-MRE) e à autoestima (A), assim como com variáveis sociodemográficas. Método: 158 universitários (Midade = 20,61; DP = 4,179; mulheres 75,9%) responderam a três escalas: HSPS-S (Chacón et al., 2021), CLAMS/IAM-EAM (Cassidy & Lynn, 1989; Story et al., 2009) e RSES (Martín-Albo et al., 2007). Foram aplicadas análises descritivas e inferenciais (teste t de Student, ANOVAs, correlações e análise de mediação). Resultados: Encontrou-se um perfil de nível médio em SPS e MR, e médio-alto em A; também uma correlação negativa entre alta SPS e A, e outra positiva entre MR e A. Com maiores rendimentos familiares, maior A; e em PAS, maior MR quando não se possui bolsa de estudos. A MRE e suas dimensões poder aquisitivo, competitividade e status foram maiores nas PAS. A MRI e as dimensões habilidade, dominância e status foram maiores com alta A. Com alta SPS, a A foi menor, influenciando por sua vez em uma menor MRI e MRE. Conclusões: Este grupo de estudantes universitários demonstra como a A é uma variável mediadora chave nas PAS, assim como também a MR/MRI-MRE, e seu estudo multidisciplinar deveria ser ampliado, dada sua influência no bem-estar e na qualidade de vida, além de ser analisado na infância, adolescência, idade adulta intermediária e velhice.

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Introduction

A new personality trait was identified in the 1990s, known as sensory processing sensitivity **(SPS)** **(Aron & Aron, 1997)**, which has gained recognition in the field of psychological research, especially in people who score high in it **(HSP: Highly sensitive person/s)**, and it is still of interest today **(De Gucht & Woestenburg, 2024; Greven et al., 2019; Rosas-Jiménez, 2020; Salinas-Quintana et al., 2024)**.

The general aim of the present study is to expand existing knowledge about this trait, in highly sensitive persons, hereinafter HSP, after exploring its relationship with variables such as achievement motivation/intrinsic achievement motivation-extrinsic achievement motivation hereinafter AM/IAM-EAM, and self-esteem, hereinafter S-E, and its relationship with certain sociodemographic variables.

In the first part of this study a brief description of those three variables will be presented, separately, as well as the current knowledge on the relationships between the three of them. Next, the entire methodological part will be developed and finally, the results, the discussion and some conclusions with the bibliographical references will be presented.

Sensory processing sensitivity **(SPS)**. When talking about this type of trait at a high level in people, known as HSP, it refers to a neurobiological trait **(Acevedo et al., 2014; Jagiellowicz, et al., 2016)** present in between *15-30%* of the general population **(Aron & Arón, 1997; Lionetti et al., 2018)**. This trait allows people to perceive and process information in a broader and deeper way, both about the environment and about our own internal body system. This overactivation trait can pose both a challenge to the health, quality of life and well-being of people who have it **(Andresen et al., 2018; Aron, 2011; Costa-López et al., 2021)**, as well as having advantages. in positive and favorable contexts **(Jagiellowicz, et al., 2016; Malinakova et al., 2021)**, and as such its investigation and knowledge are of much relevance. Among the drawbacks of having this trait are a greater likelihood of developing anxiety and depression as a result of higher levels of stress than the rest of the population. Among the advantages, these people are both creative and aware of many details, as well as more empathetic due to their greater attentional capacity and cognitive-social processing.

SPS scale structure. There are different proposals regarding the factors or structural dimensions that underlie the SPS scale, both for the pioneers in the introduction of the trait in the scientific literature **(Aron & Aron, 1997)**, and for Hofmann and Bitran **(2007)**, who understand it to be a single unidimensional structure, while for Listou-Grimen and Diseth **(2016)** and Konrad and Herzberg **(2017)** it has the following three dimensions: aesthetic sensitivity, low sensory threshold and ease of excitation. Subsequently, Aron et al. **(2012)** make a distinction between four key aspects in this unidimensional structure: behavioral inhibition, sensitivity to (mostly subtle) sensory stimuli, depth of processing of sensory stimuli, and emotional or physiological reactivity. More recently, Chacón et al. **(2021)** have proposed five factors or dimensions: sensitivity to overstimulation, aesthetic sensitivity, low sensory threshold, fine psychophysiological discrimination and harm avoidance. A new proposal to expand the original questionnaire from *27* items to *43* has been proposed by De Gucht et al. **(2022)**, to include more positive aspects or factors that the previous test did not underscore. Thus, the following six factors were finally included in this new scale **(SPSQ)**: sensory sensitivity to subtle internal and external stimuli, emotional and physiological reactivity, sensory discomfort, sensory comfort, social-affective sensitivity and aesthetic sensitivity.

Regarding the population distribution of this trait, for Pluess et al. **(2018)**, there are three levels between *8* and *19* years old: low sensitivity *(25-32%)*, medium *(41-47%)*, and high *(20-35%)*. In a study with university psychology students **(Mora-Grimón et al., 2023)** the resulting levels were: low, *0.6%*, medium, *67.7%*, and high, *31.7%*. For Lionetti et al. **(2018)**, in the adult population, the percentages vary, with the low sensitivity group being *29%*, the average sensitivity group being *40%*, and the high sensitivity group being *31%*. According to the latter triple classification, its authors have associated each level of sensitivity with a flower that could symbolically represent them, thus, low, medium and high sensitivity would correspond to the dandelion, the tulip, and the orchid, respectively.

A study on the extent to which SPS, and its interaction with parenting quality, predicting positive and negative experiences in response to emotional stimuli, shows that HSP respond more intensely to emotional stimuli, especially positive ones, without experiencing increased arousal, unless the person has had an especially high-quality upbringing **(Jagiellowicz, et al., 2016)**.

Another recent study by Pérez-Chacón et al. **(2023)** examined health-related quality of life indicators in HSP in relation to selected personality traits and coping strategies. The results show that neuroticism and the use of maladaptive coping strategies act as risk factors, while extraversion, conscientiousness and adaptive coping strategies play a protective role. Furthermore, these findings highlight the need to develop and subsequently implement preventive programs targeting HSP.

Achievement motivation **(AM)**. Motivation as a general construct is an innate impulse that moves each person to get involved in certain activities or tasks, and an important part of this motivation is the so-called achievement motivation **(Dong et al., 2024)**, which entails a greater determination to pursue and achieve success in something **(Atkinson, 1964)**. AM is one of the three most important from a vital point of view, along with affiliation and power **(Stoeber et al., 2018)**. AM in the academic field is what moves students to choose, persevere, make efforts and get involved in tasks related to those achievements **(Erentaitė et al., 2022)**, in addition to tasks considered a challenge **(Barreto-Trujillo & Álvarez-Bermúdez, 2020)**. AM from the cognitive-social model emphasizes the importance of the way in which each individual interprets information and how this influences their motivation. In addition, an essential part of this with regard to students are the beliefs about their own scholastic competence, and they are the ones that are at the center of their expectations to be successful in academic tasks **(Eccles & Wigfield, 2020)**. Relationships have been found between motivation in general and the cognitive behavior of procrastinating. Thus, the expectations that a person has regarding the results of doing a task or not, as well as the positive or negative evaluation they make of the task itself, are key to trying to understand the relationship of procrastination or voluntary delay with the motivational process **(Angarita-Becerra, 2014)**.

Multidimensional model of achievement motivation. Another approach to AM, and one that is of special interest in this work, is the multidimensional model that has given rise to various analysis measures, including the CLAMS, a 7-factor AM scale created by Cassidy and Lynn in 1989, and later reformulated into the two-factor theory of achievement motivation (intrinsic and extrinsic factors) by Story et al. **(2009)**. Both of the aforementioned instruments are used in the present study in a successive and complementary manner. Story et al. **(2009)** summarized the Cassidy and Lynn **(1989)** CLAMS-7 factors: work Ethic (effort based on enjoying the work for its own sake), acquisitiveness for money and material wealth (effort based on a need to obtain valued material objects and money), dominance (effort based on the need to exert influence on others), excellence (effort based on the need to meet a personal standard of excellence), competitiveness (effort based on the need to outperform others), status aspiration (effort based on the need to climb the "social ladder"), and mastery (effort based on the need to solve or perform challenging tasks). For Story et al. **(2009)** although each factor offers unique insight into the complexity of achievement motivation, a clearer understanding of achievement motivation may emerge by collapsing the seven factors into a parsimonious two-factor theory. As such, there is an intrinsic AM **(IAM)** and another extrinsic AM **(EAM)**. As components, of the seven of Cassidy and Lynn **(1989)**, in the intrinsic factor, Story et al. **(2009)** include: work ethics, excellence and mastery; and in the extrinsic factor: acquisitiveness, dominance, competitiveness, and status aspiration.

Self-esteem **(S-E)**. This is a historically relevant concept in psychology and has been a controversial topic in the academic world when it comes to defining its use and analysis. In this regard, Rosenberg **(2015)**, one of the pioneers to talking about this variable in the seventies of the last century, S-E is a phenomenon generated by social and cultural forces directly associated with psychological well-being. Furthermore, the above author considered it a global aspect that needs to be evaluated with the use of global scales. Coopersmith **(1967)** took a different position and proposed measuring it in items such as "general self-esteem", "social self-esteem", "academic schooling self-esteem" and "home-parents".

A more recent and integrative definition of S-E comprises a set of evaluations that a person makes about themselves that can be both positive and unfavorable. Thus, an individual with good self-esteem is one who is assertive with other people, respecting both their own rights and those of others, and is flexible in the face of adversity, as well as having emotional self-control **(González-Martínez, 1999)**.

Self-esteem in young people and students. On numerous occasions, the role of S-E has been investigated in young people, and their current problems, for example, Challco-Huaytalla et al. **(2016)** found that low S-E was related to addiction to social networks in adolescents. Similarly, Collantes and Tobar **(2023)** have recently studied the same association with the university population, where they demonstrated the influence of social media networks on the mental health of young people.

Various research works also show that the development of secure attachment in the bond with caregivers is related to high S-E and the development of self-expression social skills in young people **(Homola & Oros, 2023)**. On the other hand, S-E is considered a mediator between the experience of bullying and the appearance of depression **(Balluerka et al., 2023)**. In this respect, Cáceres-Ruíz and Ponce-Delgado **(2023)** point out that S-E is a fundamental aspect in the adaptive process of people, as well as a protector against suicidal behavior.

In the specific field of students and their academic performance, it has been reported that individuals with low S-E tend to experience greater procrastination in tasks **(Hidalgo-Fuentes et al., 2022)**. Other authors, such as Chávez-Parillo and Peralta-Gómez **(2019)**, refer to the importance of having correct S-E in university students as a protective factor against associated academic stress. There is a relationship between experiencing high S-E and having greater life satisfaction in secondary school and university students **(Ávila & Cañas-Lucendo, 2023; Ruiz-González et al., 2018)**. It therefore seems relevant to understand S-E as a key protective factor in mental health when confronting the vital challenges of psychosocial development that young people face in academic contexts.

Relationships between SPS, AM/IAM-EAM and S-E. Regarding the relationship of the SPS personality variable with AM, there are no previous studies to the best of the authors' knowledge. The relationship between SPS and the more specific IAM-EAM has been explored previously. IAM is usually associated with those tasks that produce satisfaction in themselves, while EAM would be due to the consequences or separate effects they produce. Samsen-Bronsveld et al. **(2022)** found, in a sample of students aged *8* to *13* years, that in the HSP both motivations correlated with each other, and that EAM decreased as the students got older but not IAM.

Regarding HSP and S-E, the broad Multidimensional Self-esteem Inventory **(MSEI)** scale seems to show a significant negative correlation both with overall self-esteem and with most of its components: sense of competence, sense of being loved, popularity, leadership skills, self-control, vitality, identity integration, and defensive self-esteem enhancement **(Baryła-Matejczuk et al., 2021)**. In addition, HSP have been found to respond better and benefit more than the rest of the population after an intervention aimed at increasing their S-E, in addition to reducing their levels of depression **(Kibe et al., 2020)**.

As for the relationship of AM with S-E, Fernández-Angulo **(2020)** found a positive relationship between the two variables with secondary school students. Thus, a positive or negative self-assessment would determine the type of initiative or effort exerted to perform certain actions.

Aron **(2010)** argued that there is a low S-E in HSP because many of them suffer from a poor self-image, due to their high degree of perfectionism. In itself, this characteristic has been shown to be a negative stress factor in academic contexts, whether it is self-oriented or socially directed **(Aguilar-Durán, 2020)**. Baryla-Matejczuk et al. **(2020)** and Bas et al. **(2021)** found that most HSP are perfectionists. Sohst **(2017)** emphasizes that HSP feel misunderstood due to their way of experiencing things, which negatively affects their S-E, thus slowing down optimal evolutionary development in those unfavorable school and professional contexts.

Likewise, HSP tend to examine and observe contexts from the outside before acting in new situations. This can lead them to have negative prior ideas about strangers **(Chacón et al., 2021)**, resulting in a low S-E. In social contexts, minors with HSP and low S-E do not usually feel valued by others or themselves, and are intolerant of frustration and difficulties **(Chacón et al., 2021)**. In HSP, comparisons can hinder self-recognition of their strengths, focusing on the unfavorable. As adults, in the professional field, this could be reflected in work conflicts where they feel they need to appear self-confident, as well as difficulties with concentration and productivity **(Sohst, 2017)**.

Given the psychosocial importance of the three variables summarized above, the authors will now further explore their relationships, interactions, and influences between them, in the critical period of personal academic development that university represents, by means of the following general and specific aims.

General aim

To analyze HSP within the new personality trait called SPS, in relation to general AM and AM divided into IAM-EAM, and S-E, as well as their relationship with sociodemographic variables.

Specific aims

1. To obtain a general profile of the participating sample with the three levels of SPS, AM and its factors, and S-E.
2. To analyze possible relationships and interactions between SPS, focusing on HSP, with AM and with S-E in relation to the following sociodemographic variables: gender, income, having a grant and residence.
3. To analyze possible relationships, interactions, and direct and indirect influences of the variables between each other, SPS/HSP, AM, as well as IAM and EAM and their dimensions, and S-E in relation to sociodemographic variables.

Method

Participants

A total of *158* Spanish university students who met each and every one of the following criteria for inclusion: voluntary students, enrolled in the second year of the psychology degree at the university center involved, with or without a scholarship, of any age, nationality, gender, type of family and residence during the academic year, without limitations to

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answer the survey independently with pen and paper, with participation in the same classroom and time of the session as the rest of the participating group. The resulting age range was between *19* and *50* years of age *(Mage = 20.61; SD = 4.179; women 75.9%)* and the rest of the information on the most relevant socio-demographic variables for the study (see Sociodemographic section in Instruments) was: gender, family income, any grant, and type of residence are shown in Table 1

Table 1.
Participants´ socio-demographic variables

Variables		n	%
Gender	Masculine	35	22.20
	Feminine	120	75.90
	Other	3	1.90
	Total	158	100
Family income	Low	59	37.30
	Medium low	60	38
	Medium high	29	18.40
	High	10	6.30
	Total	158	100
Grant	With	88	55.70
	Without	70	44.30
	Total	158	100
Residence	With family	83	52.5
	Without family	75	47.5
	Total	158	100

Design

A descriptive study with a quantitative cross-sectional design and observational methodology. A non-probabilistic convenience sampling was carried out among volunteer psychology students from a university center to collect data.

Instruments

Four questionnaires were applied successively. The first concerned the sociodemographic data of the participants, the second SPS **(HSPS-S)**, the third AM **(CLAMS/IAM-EAM)**, and the last S-E **(RSES)**. They are described in more detail below:

1. ***Sociodemographic data***. Gender, monthly family income level, hereinafter income *(up to €1,645, between €1,645 and €2,500, between €2,500 and €4,386, more than €4,386)*. In addition, whether or not the participants were awarded a grant for their university studies and whether their residence during the course was with the family, or without the family (in a shared apartment, as a couple, in a university residence, in a single apartment or another type of home). Once the data analysis was performed, it was concluded that the variables that best allowed making more or less homogeneous subgroups for the analyses, compared to the great difference in gender, were income (from four initial levels to finally two levels: high and low), grant (with/without), and residence (with/without family). See Table 1.

2. ***Highly Sensitive Person Scale-S*** **(HSPS-S, Chacón et al., 2021).** The version adapted to the Spanish population was used. It measures the sensitivity of sensory processing through the *27* items of the original scale developed by Aron and Aron **(1997)** (Do you easily get overwhelmed by strong sensory stimuli? / Do you seem to be aware of the subtleties around you? It uses a Likert-type scale with seven response options ranging from *1* (totally disagree) to *7* (totally agree), and as such scores are obtained summatively in a range of *27* to *189*. Cronbach's α and total McDonald's ω were *0.92* and *0.93*, respectively. The scores for the five factors or subscales were the following: sensitivity to overstimulation (SOS), *0.86* and *0.87*, aesthetic sensitivity **(AES)**, *0.79* and *0.80*, low sensory threshold **(LST)**, *0.82* and *0.85*, fine psychophysiological discrimination **(FPD)**, *0.56* and *0.57*, harm avoidance **(HA)**, *0.67* and *0.68*. Direct scores *(27 to 189)* were used to obtain the SPS levels, and the higher the score, the higher the level of sensitivity and vice versa, with the following three numerically equivalent intervals being set: low level, *27-81*, medium level, *82-135*, and high level (sensitivity), *136-189*.

3. ***Achievement Motivation Scale*** **(CLAMS/IAM-EAM, Cassidy & Lynn, 1989; Story et al., 2009).** This scale consists of *49* items, with seven achievement motivation factors: work ethic (I can easily sit for a long time doing nothing), acquisitiveness (if there is an opportunity to earn money I am usually there), dominance (if given the chance I would make a good leader of people), excellence (I hate to see bad workmanship), competitiveness (I try harder when I am in competition with other people), status aspiration (I want to be an important person in the community) and mastery (I prefer to work in situations that require a high level of skill). Cronbach's alpha was *0.84* for the total score of the scale, while each dimension corresponded to a separate value, as follows: work ethic *0.74*, acquisitiveness *0.67*, dominance *0.73*, excellence *0.65*, competitiveness *0.77*, status aspiration *0.72*, mastery did not have an individual alpha value **(Cassidy et. al., 1989)**. It is presented in a polytomous response format, where you can choose between true, false, or question mark (if the answer is in the middle of the two previous options). The global scale comprises three equivalent intervals: low *0-32*, medium *33-65*, and high *66-98*, while each subscale of the seven factors ranges between 0-14.

Using the original scale with the seven factors of Cassidy and Lynn **(1989)**, Story et al. **(2009)** adapted them in a two-factor model, the IAM (intrinsic achievement motivation, with work ethic, excellence, and mastery) with *α = .71,* and the EAM (extrinsic achievement motivation, with acquisitiveness, dominance, competitiveness, status aspiration) with *α = .64*. This second part of the aforementioned instrument from Story et al. **(2009)** was not passed on again to the students, but was regrouped, as described above, and subsequently analyzed for the third aim.

4. ***Rosenberg Self-Esteem Scale*** **(RSES, Martín-Albo et al., 2007)**. The Rosenberg scale was used and validated in the version translated into Spanish. The scale consists of ten items with an equal number of statements worded positively and negatively. The Likert-type format is presented with four response options ranging from *1* (strongly disagree) to *4* (strongly agree). With Cronbach's alpha of *0.81* for the total scale score. Direct scores are used *(0 to 40)* to obtain S-E levels, so that the higher the score, the higher the S-E. Thus, the final scale includes three numerically equivalent intervals: low level: *0-25*, medium level: *26-29*, and high level: *30-40*, following the model of Acosta-García et al. **(2019)**.

Procedure

The survey with the four questionnaires was conducted in a university classroom, with the *175* students who had previously agreed to participate voluntarily, after having previously signed up on a list handed out in class. In that single session, they were informed about the inclusion criteria and the topic of the survey, which included four questionnaires to which they had to answer in pen and paper format in situ, anonymously in a maximum of 60 minutes, and that these data would be used for a research. In addition, and for the final questionnaire to be valid, the students were told again they had to answer each and every one of the questions with complete sincerity, with there being no right or wrong answers, and that their anonymous data would be treated confidentially. Once the survey with the four questionnaires had been handed out, they were asked to sign the informed consent on the first page, if they agreed to answer them for the research after being orally informed by the researchers. The order in which the questionnaires were presented was: 1) Socio-demographic data, 2) Highly Sensitive Person Scale-S, 3) Achievement Motivation Scale, and 4) Rosenberg Self-Esteem Scale. Finally, the number of surveys that did not meet the requirements (in this case, only because they did not answer each and every one of the questions in the questionnaires of the survey) were *17* and were discarded, leaving the final sample of participants at *158*.

Data analysis

Data for this research was analyzed using the SPSS computer statistical program. In the first part, descriptive statistical analyzes were performed to obtain the means and standard deviations of the variables. In addition, the normality of the SPS, AM, and S-E variables was studied, confirming the same in all three cases. Pearson correlation analysis was also developed with the main variables of the study. On the other hand, regarding means comparison tests, Student's t measures and ANOVAS were established. For part of the second and third aims, mediation analyses were performed with the PROCESS macro tool **(Hayes, 2022)**, among which nine simple mediation models were analyzed, and Bootstrap samples with *10,000* replications were used to estimate the indirect effect. Finally, the *95%* confidence intervals were calculated using the percentile method.

Ethical considerations

The present study followed the regulations applied by this university (Organic Law 3/2018, of December 5) related to the International Declaration of Helsinki with voluntary human participants for works, in this case of psychological data research, provided they signed the informed consent form, as mentioned above in the Procedure section.

Results

First aim. To obtain a general profile of the participating sample with the three levels of SPS, AM, and factors, and S-E.

SPS, AM, and S-E. The data show a general profile in which two-thirds of the students obtained average scores in both SPS, as well as, although somewhat higher, in AM, while approximately half of the students obtained high scores in S-E, and that added to the scores the mean average level reached *69%* of the sample. See Table 2a.

Table 2a
Participant scores levels (n / %) in the three main variables (SPS, AM, S-E)

Level of punctuation	SPS		AM		S-E	
	n	%	n	%	N	%
Low	-	-	4	2.5	49	31
Medium	98	62	118	74.7	40	25.3
High	60	38	36	22.8	69	43.7
Total N / %	158 / 100					

Note. SPS: Sensory processing sensitivity; AM: Achievement motivation, S-E: Self-esteem.

Regarding the AM scale and its seven factors, excellence was the highest, followed at a considerable distance and above the average by status aspiration and work ethic, while below and close to the average came dominance, mastery, and acquisitiveness. The least rated was competitiveness. See Table 2b.

Table 2b
Participant´ scores (M / SD) in the seven factors of the AM scale (Work ethic, Acquisitiveness, Dominance, Excellence, Competitiveness, Status aspiration, and Mastery)

	Work ethic	Acquisit.	Dominan.	Excellenc.	Competit.	Status asp.	Mastery
M	8.14	6.70	6.85	13.27	5.06	8.67	6.68
SD	3.41	3.04	3.61	1.07	3.24	3.19	2.87

Note. Scores between 0-14.

Second aim. To analyze the possible relationships, interactions, and influences between SPS, focusing on HSP, AM, and S-E, and also those in relation to sociodemographic variables.

SPS/HSP, AM, S-E, and sociodemographic variables gender, income, grant, and residence. The results obtained showed that there were no significant relationships between SPS and AM *(p > .05)*. On the contrary, there was a significant negative correlation between SPS and S-E; therefore, the greater the sensitivity of sensory processing **(HSP)**, the lower the S-E *(p < .01)*. In addition, there was a significant positive correlation between the AM and S-E variables *(p < .05)*, whereby the greater the AM, the greater the S-E. See Table 3.

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Tabla 3.
Correlations between study variables

Variable	1	2	3	4	5
1. Sensory processing sensitivity (SPS)	-	-	-	-	-
2. Achievement motivation (AM)	.147	-	-	-	-
3. Self-esteem (S-E)	-.338**	.179*	-	-	-
4. Income	-.094	.155	.138	-	-
5. Grant	.048	-.021	.006	-.403**	-

Note. *p < .05, **p < .01

As regards the four analyzed sociodemographic variables, Table 3 also shows that only two of them were related to each other: income and grant. Thus, there was a significant negative correlation between the income variable and the grant variable *(p < .01)*, whereby those students with a lower level of income obtained more grants.

A positive correlation also appeared between this income variable and S-E; thus, the higher the income level, the greater the S-E. See Table 4.

Table 4. Descriptive statistics of SPS, AM, and S-E, based on income

	Low income		High income		t (156)	p	d Cohen
	M	SD	M	SD			
SPS	129.96	19.16	127.15	22.43	0.76	.45	0.14
AM	54.69	11.77	57.59	8.89	-1.41	.16	0.26
S-E	28.08	5.37	30.16	5.87	-2.05	.04*	0.38

Note. *p < .05

Direct and indirect effects of mediation model between SPS, AM, and S-E. The independent variable was SPS, the mediating variable was AM, and the dependent variable was S-E. Table 5a shows that the direct effect was significant, but not the indirect effect, thus the greater the SPS **(HSP)**, the more negative the influence on the S-E, while the mediating variable AM had no effect of SPS on S-E. See Figure 1.

Table 5a.
Effects in the mediation model between SPS, AM y S-E

		Confidence intervals 95%	
PROCESS Model 4	Effect	Lower	Upper
Direct effect: SPS – > S-E	-0.10**	-0.14	-0.06
[a]Indirect effect: SPS – > AM – > S-E	0.01	-0.0005	0.02

Note: AM: Achievement Motivation, S-E: Self-Esteem, SPS: Sensory Processing Sensitivity. Unstandardized coefficients. **p < .01
[a] Bootstrap sample = 10000 with replacement

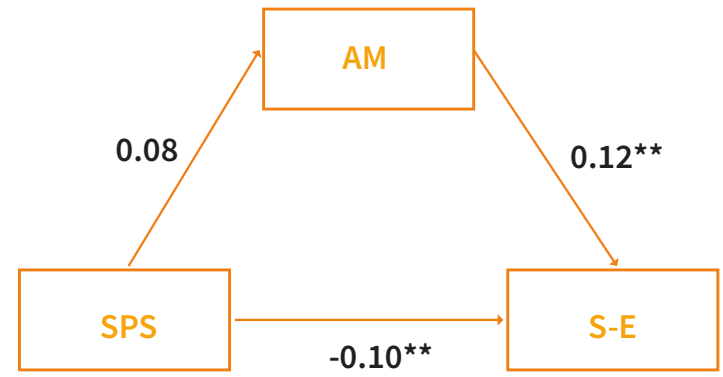

Figure 1.
Unstandardized regression coefficients for the simple mediation

model 4 between the variables sensory processing sensitivity (SPS), achievement motivation (AM) and self-esteem (S-E) **p < .01

Direct and indirect effects of mediation model between SPS, S-E, G, and AM. In the case of this model, the independent variable was SPS, the mediator variable was S-E, the moderator variable G (grant) and the dependent variable was AM. As can be seen in Table 5b, the direct effect in the without grant condition was significant, while in the with grant condition, it was not. Thus, due to this direct effect, the higher the SPS **(HSP)**, the higher the AM when one does not have a grant. The indirect effect was also statistically significant. Figure 2 shows that as SPS increases **(HSP)**, S-E decreases, and as this decreases, AM decreases.

Table 5b.
Effects in the mediation model between SPS, S-E, Grant and AM

		Confidence intervals 95%	
PROCESS Model 5	Effect	Lower	Upper
Conditional direct effect: SPS – > AM			
Without grant	0.18**	0.04	0.31
With grant	0.1	-0.02	0.22
[a]Indirect effect: SPS – > S-E – > AM	-0.05*	-0.08	-0.02

Note: AM: Achievement Motivation, S-E: Self-Esteem, SPS: Sensory Processing Sensitivity. Unstandardized coefficients. * p < .05 **p < .01
[a] Bootstrap sample = 10000 with replacement

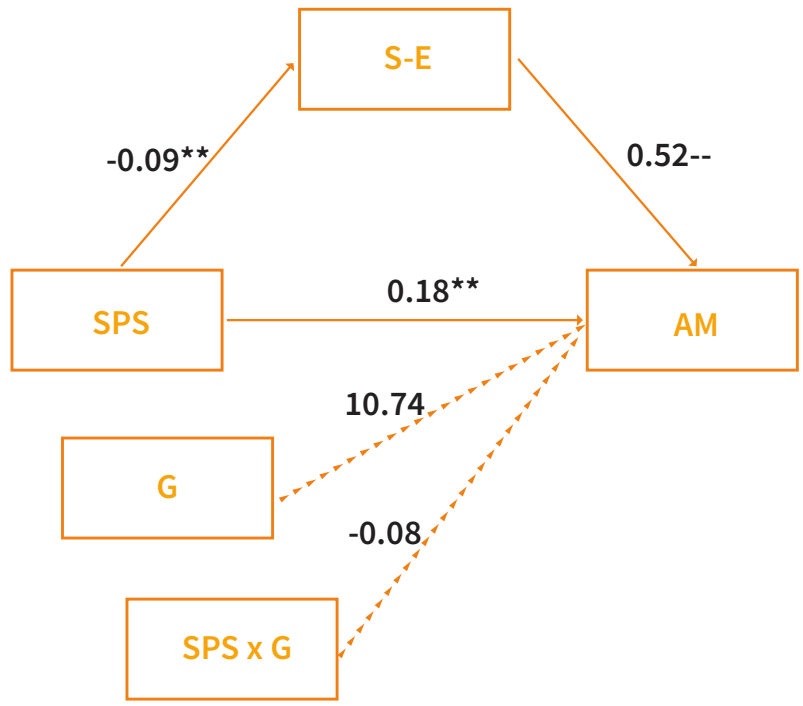

Figure 2.
Unstandardized regression coefficients **(Model 5, Hayes, 2022)**

between the variables SPS, S-E, AM and Grant. **p <.01

Third aim. Analysis of relationships, interactions, and direct and indirect influences of the three variables among themselves, SPS/HSP, IAM-EAM, and S-E, and those with sociodemographic variables.

Relations between SPS/HSP, IAM/EAM, and S-E. There was a statistically significant linear correlation between SPS and EAM, whereby HSP showed greater extrinsic achievement motivation. See Table 6.

Table 6.
Correlations between the variables

Variable	1	2	3
1. Sensory processing sensitivity (SPS)	–	–	–
2. Intrinsic achievement motivation (IAM)	-.05	–	–
3. Extrinsic achievement motivation (EAM)	.21**	.07	–

Note. **p < .01

Direct and indirect effects of mediation model between SPS, IAM/EAM-dimensions, and S-E.

Figure 3 shows a general representation that outlines the nine analyzed models with their corresponding non-standardized regression coefficients.

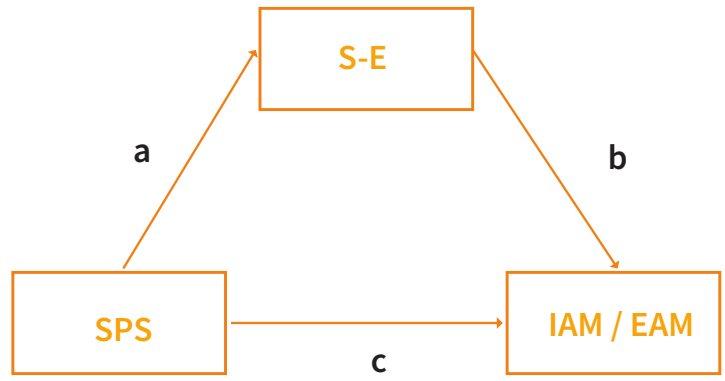

Figure 3.
Simple mediation model: SPS (sensory processing sensitivity), S-E (self-esteem), and IAM/EAM (intrinsic/extrinsic achievement motivation)

The values of these coefficients are shown in Table 7. The coefficient "c" represents the direct effect and the product "a*b" the indirect effect.

In these nine models, the independent variable was SPS, the mediating variable was S-E, and the dependent variables were the two types of IAM/EAM with their corresponding dimensions. Thus, the IAM with work ethic, excellence, and mastery, and the EAM with acquisitiveness, dominance, competitiveness, and status aspiration.

Table 7.
Unstandardized regression coefficients between SPS, IAM/EAM-dimensions, and S-E

					Confidence intervals 95% a*b	
	a	b	c	a*b	Lower	Upper
IAM	-0.094**	0.087**	0.003	-0.008*	-0.015	-0.003
WE	-0.094**	0.111*	0.007	-0.01*	-0.021	-0.001
EX	-0.094**	0.023	0.004	-0.002	-0.006	0.001
MA	-0.094**	0.125**	-0.002	-0.012*	-0.022	-0.003
EAM	-0.094**	0.065	0.031**	-0.006	-0.013	0.001
AC	-0.094**	-0.046	0.026*	0.004	-0.004	0.014
DO	-0.094**	0.171**	0.022	-0.016*	-0.028	-0.005
CO	-0.094**	-0.028	0.03*	0.003	-0.006	0.013
SA	-0.094**	0.165**	0.043**	-0.015*	-0.026	-0.006

Note: IAM: Intrinsic Achievement Motivation, WE: Work Ethic, EX: Excellence, MA: Mastery; EAM: Extrinsic Achievement Motivation, AC: Acquisitiveness, DO: Dominance, CO: Competitiveness, SA: Status Aspiration. *p < .05 **p < .01

As can be seen in Table 7, in the case of IAM and its three dimensions, the direct effect was not statistically significant, therefore, high SPS did not influence IAM; while the indirect effect (b) was statistically significant, except for the excellence dimension. In the case of the EAM and its four dimensions, the direct effect (c) was statistically significant in three of the cases, so that in the HSP the EAM, and the acquisitiveness, the competitiveness, and the status aspiration, were greater, except in dominance; in the case of the indirect effect (b) it was only statistically significant in the dimensions of dominance and status aspiration. In all these cases, where the indirect effect was significant, the sign of the coefficient was negative (a), which shows that as SPS increased **(HSP)**, S-E decreased, and as S-E decreased, the corresponding dependent variable decreased.

Discussion

The main results of this work are summarized below to later compare and discuss them with other similar works, following the same order of the specific objectives, pointing out some advantages and limitations and, finally, coming to some conclusions.

The general profile of this sample showed a medium level in sensory processing sensitivity **(SPS)** and in general achievement motivation **(AM)**, and a medium-high level in self-esteem **(S-E)**. When high sensory processing sensitivity **(HSP)** was present, self-esteem was lower, and when general achievement motivation was higher, self-esteem was higher. When the participants' family had a higher

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income level, greater self-esteem appeared. Furthermore, in those with high sensory processing sensitivity, greater general achievement motivation appeared and at the same time they were the ones who did not have scholarships. Extrinsic achievement motivation **(EAM)** and its dimensions of acquisitiveness, competitiveness and status aspiration were greater in those with high sensory processing sensitivity. Intrinsic achievement motivation **(IAM)** and its dimensions of mastery, dominance and status aspiration were greater when self-esteem was high. In general, self-esteem appeared lower in those with high sensory processing sensitivity, and this resulted in lower intrinsic achievement motivation as well as lower extrinsic achievement motivation.

First aim. In relation to the results of this aim, which focused on the general profile of the participants in the three main variables (SPS, AM and S-E), it appears that the majority, of SPS of the sample is at a medium level, and are data that coincide with the results from a previous work with adults as in Lionetti et al. **(2018)**, while just over a third of the total sample appears as HSP, which is also in line with other recent studies such as that of Greven et al. **(2019)** and that of Chacón et al. **(2021)**. Regarding the average level found in general AM, there are studies that show different levels, from medium to high, depending on the characteristics of the region of the same country **(Dong et al., 2024)**. A study conducted during the recent **COVID-19** pandemic with engineering and health sciences students found these same average levels of AM **(Suraj et al., 2024)**. In the case of the more specific results in the seven factors of the AM variable, it should be noted that having the complete sample score, the excellence factor at its maximum would imply both a high academic goal and a high level of self-imposed demands, as other studies on this factor report **(Aguilar-Durán, 2020)**. Regarding the S-E found in two-thirds of the sample, adding the medium and high levels, it confirms what Acosta-García et al. **(2019)** define as a natural pattern in the general population, without taking into account different countries and cultures, or the tendency to have a positive S-E, which in Rosenberg's language is equivalent to having a high one. Furthermore, it should be noted that the remaining third of the sample with low S-E also seem to coincide in proportion with the part of the sample that is HSP, and that research on this topic has been directly relating one another **(Aron, 2010)**.

Secord Aim. Regarding the relationship and interaction between these three main variables, the initial results between SPS/HPS and AM did not reveal any significant values, although they did reveal a negative relationship between HPS and S-E. This last finding coincides with the results of the work of Kibe et al. **(2020)**, but in an sample comprised of adolescents, where being HPS was related to significantly lower levels of S-E. In this case, and the present study, a possible evolutionary continuity is shown these two united life periods, adolescence and early adulthood, in these two variables, although there has not been a psychoeducational intervention with the specific S-E variable that could have modified it **(Aron, 2020; Nocentini et al., 2018)**.

Furthermore, the above finding could be connected with what was previously mentioned about the excellence factor, by supporting the theory that relates HSP and one of the central characteristics of S-E most present in HSP, perfectionism **(Aron, 2010)**. Thus, people who are perfectionists with maladaptive characteristics would tend to experience low S-E, the opposite would happen in adaptive perfectionists since they usually score highly in this **(Helguera & Oros, 2018)** and, as such, S-E would improve psychological functioning. Auza-Montalvo **(2018)** also reported a positive relationship between the AM variable and positive (adaptive) perfectionism, as well as a very low, although present, positive relationship with negative (maladaptive) perfectionism. Therefore, when S-E is stable in the HSP, it could favorably influence AM, increasing this adaptive perfectionism. On the contrary, if S-E is negatively affected in the HSP, AM would tend to decrease. S-E could also be related to another variable such as its dominant locus of control, high with the internal locus and low with the external locus **(Suraj et al., 2024)**. It is possible to hypothesize here, in the absence of confirmation in future studies, that the HSP with more adaptive perfectionism would have a more internal locus of control compared to HSP with maladaptive perfectionism, with a more external locus, according to some studies, but which did not include that HSP variable **(Aguilar-Durán, 2020; Sotardi & Dubien, 2019)**.

It should be noted that in the HSP adolescent population, despite the disadvantages of having this trait, after establishing a psychoeducational intervention program, notable improvements have been found in the levels of their S-E **(Kibe et al., 2020)**, which could serve as an example to promote the strengthening of S-E in adults too, to stimulate self-confidence and self-worth. Regarding the positive relationship found between AM and S-E, the findings of other studies with an adolescent population are confirmed **(Fernández-Angulo, 2020)** in which higher S-E was associated with greater AM. Consequently, an interrelationship can be established between the S-E and AM variables that favor more adaptive behaviors in students, such as avoiding procrastination, as reported by Morales-Rodríguez **(2023)**. Students with high AM tend not to procrastinate or postpone planned tasks and if, in addition, they also have a high S-E, there would be reinforcement for this same AM **(Silva-Escorcia & Mejía-Pérez, 2015)**. Therefore, the existence of a positive level of both variables (AM, S-E) would represent a protective factor against less adaptive academic behaviors.

Regarding the other results of the second aim, the influence or mutual interaction between the main variables of this work, it is worth mentioning the mediation of S-E between SPS/HSP and AM. In the direct effect, a possible explanation is that high S-E could act on HSP, reducing its maladaptive perfectionist part, discussed above, so characteristic in HSP, in addition to the fact that AM would be positively enhanced with that high S-E **(Naegeli, 2018)**. Finally, in the relationship with sociodemographic data, an unexpected finding was observed between SPS and obtaining a grant. Those students with HSP showed more AM when they did not have a grant than when they did. This could reveal a related facet of this group of people with intrinsic motivation **(Samsen-Bronsveld et al., 2022)**, although in the general population, without evaluating the SPS, it has been reported that grants reduce dropout and increase timely graduation, with larger effects among males and students, who are more at risk of withdrawal from university **(Facchini et al., 2021)**. Concerning the positive relationship found between income or socioeconomic level with the S-E of the students, where the higher the income, the greater the S-E, these results have been widely proven, even longitudinally **(Kraus & Park, 2014; Orth, 2018)**.

Third aim. Concerning, the results of this aim, the relationship, interaction, and influence of the three variables, with the analysis in addition to the AM variable divided into IAM-EAM, the results showed that HSP would have more EAM and not IAM, which would demonstrate that highly sensitive people would be more extrinsically motivated by behaviors such as obtaining more money and greater material goods, greater leadership and competitiveness with others, as well as aspiring to higher social status. These data would contrast with a characteristic linked to HSP, in item *8* of the SPS scale "I have a rich, complex inner life" **(Aron & Aron, 1997)**, more of an intrinsic type, and this raises the question of whether HSP would focus more on extrinsic motivation, as contexts of the external world are generally "more difficult" to manage and control for them (pause to check, attention to subtle stimuli, more reactive to stimuli...) than for non-HSP **(Acevedo et al., 2014)**. The other noteworthy result is the key role that S-E plays as a mediating variable in IAM-EAM which reduces them, meaning that, if HSPs were worked on to raise and keep their S-E stable, the two types of motivations and their

dimensions would not be so negatively affected, as has been verified in the abovementioned results of the first aim with the complete and mostly non-HSP sample, where the highest score was given to the intrinsic excellence dimension. Given the result of the higher S-E, the greater the IAM, students with HSP and with high S-E, whether their own or trained, could probably increase their levels of IAM, and the satisfaction associated with it, which is of great importance in their academic development **(Samsen-Bronsveld et al., 2022)**.

Advantages. It is worth highlighting the methodological instruments used, due to their wide use and proven validity and reliability. In addition, having studied this new personality variable in the university population, SPS/HSP was found to be directly associated with two other variables that are highly relevant in their academic development: the AM/IAM-EAM and the S-E. The interaction and influence between them were confirmed, whose analysis can be expanded on in future studies.

Limitations. The main limitation of this work involves the over-representation of university women compared to university men, therefore, the sample is not very homogeneous in terms of gender. Similarly, having a university sample with only psychology students meant that a specific profile was determined in the variables SPS/HSP, AM/IAM-EAM, and S-E, and their relationships, which may be different to that of students from other academic disciplines, something which should be explored in future studies.

Conclusions

The main findings of this work show the existence of a relationship, interaction and relevant influence between SPS/HSP, AM/IAM-EAM and S-E in university psychology students. On the one hand, HSP tend to have less S-E and, on the other hand, people with higher AM tend to show higher S-E. When the three interact, SPS, IAM-EAM and S-E, the latter is decisive in the relationship and results between them. Given the scarce research in this area of SPS, the importance of intervening psycho-educationally in HSP should be emphasized, evaluating and treating the most influential variable here, according to the data presented, S-E **(Aron, 2020)**, as well as detecting and controlling its aspects related to adaptive/maladaptive perfectionism and locus of control, among others better.

Given that being an HSP can determine well-being and quality of life throughout the life cycle, its research should be expanded and in a multidisciplinary manner. This could help many people to adapt better to those contexts that they have to live in as part of their evolutionary development, such as that of their time at university.

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