Original

PREDICTORES DEL COMPROMISO ACADÉMICO Y DEPORTIVO EN MUJERES ADOLESCENTES: ANÁLISIS DE CLÚSTER MEDIANTE ANN-SOM

PREDICTORS OF ACADEMIC AND SPORTS COMMITMENT IN ADOLESCENT WOMEN: CLUSTER ANALYSIS USING ANN-SOM

Carratalá-Bellod, H.[1]; Buendía-Ramón, V.[2]; Guzmán-Luján, J. F.[1]

[1]*Department of Physical Education and Sports Sciences, University of Valencia*

[2]*Department of Technological Solutions, Municipal Transport Company*

Correspondence to:
Helio Carratalá Bellod
Faculty of Physical Activity and Sport
Sciencies, University of Valencia
C/ Gascó Oliag, 3, Valencia. PC: 46010
helio.carratala@uv.es

RESUMEN

Esta investigación analiza cómo las variables resiliencia, afrontamiento y estrés predicen el compromiso académico y deportivo en general y en función de agrupaciones creadas a través de análisis de clúster mediante ANN-SOM. La muestra estuvo formada por 182 mujeres adolescentes (M= 14,86 / DT= 1,832) que completaron diversas escalas test para conocer el uso de estrategias de afrontamiento y el grado de resiliencia, compromiso y estrés, tanto en el ámbito deportivo como académico. Las variables deportivas predictoras del compromiso académico fueron el afrontamiento orientado a la tarea y la resiliencia, y las académicas se referían al promedio de las calificaciones y el afrontamiento orientado a la tarea. Se identificaron tres grupos de participantes. El grupo en el que las variables deportivas predijeron en mayor medida el compromiso académico correspondió a aquel con mayor nivel y compromiso deportivo. Las variables deportivas del compromiso académico fueron el nivel, afrontamiento orientado a la tarea y resiliencia, y las académicas el afrontamiento emocional y de distanciamiento y la resiliencia, mostrando el afrontamiento de tarea una tendencia. Por clústeres, el grupo con mayor media académica fue aquel en el que menor valor predictivo tuvieron los determinantes deportivos sobre el compromiso académico.

Palabras clave: Actividad Física; Afrontamiento; Estrés; Resiliencia; Compromiso.

ABSTRACT

This research analyses how the variables resilience, coping and stress predict academic and sport commitment in general and it also takes into account gatherings created through cluster analysis using ANN-SOM. The sample consisted of 182 adolescent women (M= 14,86 / SD= 1,832) who completed various test scales to know the use of coping strategies and the degree of resilience, commitment and stress, both in the sports and academic fields. The sport-variable predictors of academic engagement were task-oriented coping and resilience, and the academic ones were about the Grade Point Average (GPA) and task-oriented coping. Three groups of participants were identified. The group in which the sports variables predicted the academic commitment to a greater extent corresponded to the one with the highest level and sports commitment. The sports variables of academic engagement were the level, as well as the task-oriented coping and resilience; the academic variables were emotional coping and distancing and resilience, with task coping showing a clear trend. By clusters, the group with the highest GPA was the one in which the sporting determinants had the lowest predictive value over their academic commitment.

Keywords: Physical Activity; Coping; Stress; Resilience; Commitment

INTRODUCTION

Sports practice can provide a plethora of benefits for both physical and psychological health (Barbosa & Urrea, 2018). The psychological benefits include reducing anxiety and stress, and improving mood, self-esteem, resilience, teamwork, socialization or discipline (Jiménez et al.,2008; Serrano et al., 2015). However, data on the sports habits of European youngsters show a low practice especially in the case of girls (54%) (European Commission, 2018).

Different studies (California Department of Education, 2005; Maureira Cid, 2018) show that, as the level of studies increases, sports practice also increases, so that in people with intermediate and higher education, the practice is situated at values close to the 75% (Ministerio Cultura y Deporte, 2020). However, data on academic performance and persistence also show a high academic dropout rate, which in 2019 was 17,3%, reaching 13% in women, significantly better than in men (21,4%), placing Spain as one of the worst performing countries in the European Union (Ministerio de Educación y Formación Profesional, 2020).

This situation justifies the need to delve into the variables that determine sports and academic dropout. First, the socioeconomic aspects should be considered (Ministerio Cultura y Deporte, 2020), such as poverty, which can largely explain the lower participation in sports (Liu, 2009), as well as dropout and lower academic performance (Claro et al., 2016; Reardon, 2011). However, there are also differences in these aspects in people who are in similar socioeconomic situations. For this reason, we propose to study various cognitive variables that could have effects on the commitment that young women, as they are a vulnerable group, established both in the academic and sports environments. To do this, we are based on the metamodel of stress, emotions and performance of Fletcher et al. (2006), which postulates that stressors arise from the environment and are mediated by the processes of perception, evaluation and coping, resulting, as a consequence, in responses which can change mood and performance. In their model, they consider three moments or stages. They called the first stage person-environment; in which the person perceives the environment and performs a first analysis of the degree of threat that it poses to their immediate

personal integrity. The second stage is called emotion-performance, where the positive or negative emotions associated with the perception of having or not having sufficient resources to face the situation appear. The third stage was called coping and result; that is where the person faces the situation and acts in front of it, achieving a certain performance. It proposes that the use of adequate coping strategies favours obtaining positive results. The model proposes that this transactional process is influenced by personal characteristics (e.g. self-confidence) and situational ones (e.g. social support). Coping is understood by Lazarus and Folkman (1984) as a set of constantly changing cognitive and behavioural efforts that aim to manage specific internal and / or external demands that are valued as a burden or excess of personal resources. Nicholls and Polman (2007) identified three dimensions of coping in their systematic review of coping in sport. First, problem-focused coping refers to cognitive and behavioural attempts to control anguish by reducing or eliminating the stressor. Second, emotion-focused coping refers to the regulation of emotional arousal and anguish (Lazarus, 2000; 2006). When this coping fails to create a positive emotional state, we speak of negative emotional coping, characterized by expressing or acting while being carried away by feelings such as frustration or anger (Sandín & Chorot, 2003). Finally, the avoidance approach includes behavioural and psychological efforts to dissociate yourself from a stressor (Krohne, 1993). The use of a particular coping strategy does not guarantee its effectiveness, but depends on the context in which it is used, although some coping strategies have been shown very often to be better than others (Lazarus, 2000; 2006). Coping strategies focused on the problem are the most used by athletes (Polman, 2012) and are associated with better performance and psychological health than those focused on emotions or avoidance (Nicholls & Polman, 2007; Ntoumanis & Biddle, 2000).

This study aimed to analyse how the resilience, coping and stress variables, predicted academic and sports commitment in adolescent women. Likewise, it sought to analyse the relationship between sports and academic variables with academic and sports coping, to study the possible relationship between both areas. Likewise, it attempted to analyse the existence of groups of students with different profiles

in these variables. We established as the first hypothesis that academic as well as sport commitment would be positively related to task coping and resilience and negatively to stress and emotional coping. The second hypothesis formulated was that there would be a relationship between academic and sports variables, especially in coping strategies. The third hypothesis was that through Self-Organizing Maps Artificial Neuronal Networks (ANN-SOM), characterized by the absence of human participation during the analysis process, we would identify groups of young people with different profiles in the variables related to academic and sports commitment and that these examples would be perfect to identify risk groups that could benefit from some interventions to improve academic and sports engagement based fundamentally on the teaching of coping strategies, which could use the sports practice as a learning context (Serrien et al., 2017).

MATERIAL AND METHODS
Study design and participants

We use a selective research methodology, with an ex-post-facto retrospective design. The sample consisted of 182 women between the ages of 13 and 18, with an average age of 14,86 (SD 1,832) years, and a previous year GPA of 7,19 (SD 1,315) out of 10. The inclusion criteria in the study were: being a woman, attending secondary education and practicing any sports.

Measures
Data collection for subsequent analysis was carried out using a battery of tests, validated for the Spanish population, to measure coping, resilience, stress and commitment in the sports and academic environment. Sports coping was measured using the Coping Strategies in Sport Competition by Molinero et al. (2010) while academic coping was measured through the Sandín and Chorot (2003) Coping Stress Questionnaire. On the other hand, sports resilience was assessed through the 14-Items Sports Resilience Questionnaire (RS-14) by Wagnild and Young, validated by Sánchez-Teruel and Robles-Bello (2015). Academic resilience was measured with the Connor and Davidson CD-RISC questionnaire validated by Serrano-Parra et al. (2012). To measure sports stress, the Pedrosa et al. (2012) EEAD Questionnaire was used; and for academic stress the

Cohen et al. Perception Scale (EEP / PSS) in its 14-item version validated by Remor and Carrobles (2001). Regarding sports engagement, it was measured using the Orlick Sports Engagement Scale validated by Belando et al. (2012). Academic engagement was measured using the Schaufeli and Bakker UWES-S Questionnaire, validated and abbreviated (9 items) by Parra and Pérez (2010). The degree of reliability in all our questionnaires was adequate. The reliability analysis and the dimensions of the questionnaires are shown in table 1. The answers were presented by means of a Likert scale with a range of values from 1 (never) to 5 (very often) in all the variables except the academic commitment variable that uses a Likert scale with values from 0 (not once) to 6 (every day).

Table 1. Dimensions and reliability of the scales used in the study

Variable	Questionnaire	Items	Measures	α
Academic Coping	Coping Stress Questionnaire (Sandín & Chorot, 2003)	42	Task Coping	0,742
			Emotional Coping	0,805
			Distance Coping	0,601
Sport Coping	Coping Strategies in Sport Competition (Molinero et al., 2010)	38	Task Coping	0,859
			Emotional Coping	0,738
			Distance Coping	0,658
Academic Resilience	CD-RISC (Serrano-Parra et al., 2012)	17	Academic Resilience	0,874
Sport Resilience	14-Items Sports Resiliencie Questionnaire (RS-14) (Sánchez-Teruel & Robles-Bello, 2014)	14	Sport Resilience	0,827
Academic Stress	Stress Perception Scale (EEP/ PSS) (Remor & Carrobles, 2001)	14	Academic Stress	0,757
Sport Stress	EEAD Questionnaire (Stress Scale in the Sports Field) (Pedrosa et al., 2012)	15	Sport Stress	0,834
Academic Commitment	Questionnaire UWES-S (Parra & Pérez, 2010)	9	Academic Commitment	0,899
Sport Commitment	Sports Engagement Scale (Belando et al., 2012)	11	Sport Commitment	0,901

A sociodemographic data questionnaire was also handed out to the participants where they were asked about different aspects related to their sports practice: sports practiced, competitive level, years of sports practice and reason for practicing (competing, having fun, being healthy). As well as some other questions about their academic situation: GPA of the previous year, repetition of any academic year, preferences on educational areas (arts or science studies) and practice of some extra-curricular regulated study (conservatory, official language school or others).

Procedures

After its approval by the Human Research Ethics Committee of the University of Valencia (procedure number H1521722527067), the scales and informed consent were administered by the study investigators to proceed to the application of the questionnaires on the athletes / students. With the mentioned informed consent, they were informed that, by virtue of the Personal Data Protection Act (PDPA) 15/1999, of December 13th, and the ethical guidelines established in the Declaration of Helsinki of the World Medical Association (2013), the appropriate measure were adopted to guarantee the complete confidentiality of their personal data, establishing an effective anonymization system that does not allow the subsequent identification of the subject, as well as the possibility of the retire from the study at any time. Subsequently, the correlation analysis between variables was carried out; the data processed by using SOM-type ANNs and the differences between clusters, were analysed. Based on the results, the discussion and conclusions were drawn up. The entire process was carried out throughout 2020.

Data analysis

For data analysis, we first performed a correlation analysis of the study variables. We then used an unsupervised ANN-SOM to classify the participants. The introduction of the data to the SOM was carried out with the free program www.livingforsom.com adapted to carry out the automatic calibration of the

training parameters of the networks using genetic algorithms. The parameters for their training were chosen using the following genetic algorithm: 50.000 networks were trained, of which the 50 "survivors" that presented the best quality were chosen. The parameters of these were recombined and underwent mutations, building a new generation of trainings from these combinations and modifications. The process was repeated successively until the convergence of the quality indicator (Kaski & Lagus, 1996), which includes criteria to take into account the quantification error, the level of approximation of the neuron values to the data of input, the topographic error, and how easy it is to visualize the data in the resulting SOM. The SOM allowed the participants to be grouped into three clusters using the Expectation-Maximization algorithm (Dempster et al., 1977), selected for its independence from the spatial distribution of the elements. The differences between them in the different variables of interest were analysed.

Finally, a regression analysis was carried out for each type of commitment, differentiating between the academic and sports variables. Likewise, an analysis was carried out for each cluster and for the general sample.

RESULTS
Correlation analysis

In table 2 we can see that, for the general sample, the academic commitment was positively related to coping with the task (r= 0,320; $p<0,01$) and resilience (r= 0,255; $p<0,01$). Sports commitment was positively related to task coping (r= 0,509; $p<0,01$) and resilience (r= 0,334; $p<0,01$), and negatively to stress (r= -0,152; $p<0,05$). Likewise, academic and sports commitment were not shown to be related (r= 0,090; NS), while all the coping styles were: task (r= 0,399; $p<0,01$), emotional (r=0,250; $p<0,01$) and distancing ones (r= 0,181; $p<0,05$)

Table 2. Bivariate correlations between the study variables ordered according to the academic and sports context and between both contexts.

Academic variables	M	SD	α	1	2	3	4	5	6
1. Academic task coping	3,01	0,429	0,658	1	0,367**	0,158*	0,094	0,414**	0,320**
2.Academic emotion coping	2,36	0,495	0,742		1	0,143	0,077	0,372**	0,129
3. Academic distancing coping	3,22	0,658	0,805			1	0,162*	0,171*	0,004
4. Academic Stress	3,36	0,651	0,901				1	-0,042	0,059
5. Academic Resilience	3,51	0,653	0,859					1	0,255**
6. Academic Commitment	3,29	1,320	0,834						1
Sport variable	M	SD	α	1	2	3	4	5	6
1. Sport task coping	3,26	0,716	0,601	1	0,101	0,297**	-0,129	0,341**	0,509**
2. Sport emotion coping	2,37	0,739	0,827		1	0,430**	0,413**	-0,255**	-0,083
3. Sport distancing coping	2,42	0,657	0,874			1	0,128	-0,035	0,034
4. Sport Stress	2,23	0,611	0,899				1	-0,409**	-0,152*
5. Sport Resilience	3,51	0,620	0,738					1	0,334**
6. Sport Commitment	3,56	0,896	0,757						1
Academic-Sport correlation				1	2	3	4	5	6
1.Task coping				0,399**	0,031	0,121	-0,081	0,263**	0,216**
2.Emotion coping				0,216**	0,250**	0,111	0,053	0,122	-0,056
3.Distancing coping				0,251**	0,185*	0,181*	0,108	0,173*	0,223**
4.Stress				0,154*	0,361**	0,124	0,360**	-0,146*	0,121
5.Resiliencie				0,454**	-0,021	0,144	-0,204**	0,525**	0,296**
6.Commitment				0,261**	-0,109	0,013	-0,132	0,269**	0,090

Note: ** The correlation is significant at the 0,01 level (bilateral). / * The correlation is significant at the 0,05 level (bilateral)

SOM Cluster Analysis

The program autonomously generated three clusters. A General Linear Model (GLM) analysis and post-hoc tests were performed to study the differences between pairs. In table 3 we present a summary with the average and the results obtained in the comparisons.

Cluster 1 was made up of 66 participants, mostly non-competing athletes, with few years of sports practice and basic motives aimed at having fun and keeping fit or healthy, and with the lowest GPA. They showed the lowest levels in resilience, coping, commitment and stress, both in the academic and sports fields. Cluster 2 was made up of 66 participants with a higher competitive level, more years of practice and more prevalence of motivation to compete than the rest, as well as a higher GPA than cluster 1. It was characterized by having the greatest sports commitment. Finally, cluster 3 consisted of 50 participants, who mostly carried out non-competitive sports practice, had a few years of practice and their reasons to practice were fundamentally oriented to having fun and also keeping fit, and had a higher GPA than cluster 1, too. It was characterized for having the highest academic commitment.

Table 3. Values obtained in the variables in general and by clusters, and differences between groups in the academic and sports context

Variable	M	Levene	M Cluster 1	M Cluster 2	M Cluster 3
Age	14,86	2,837	14,58a	15,67b	14,18a
Grade Point Average	7,15	0,009	6,75a	7,29b	7,49b
Academic task coping	3,01	1,219	2,76a	3,05b	3,28c
Academic emotion coping	2,36	0,331	2,11a	2,30b	2,75c
Academic distancing coping	3,22	2,469	2,98a	3,45b	3,23b
Academic Stress	3,36	0,353	3,15a	3,43b	3,54b
Academic Resilience	3,51	1,607	3,10a	3,65b	3,86c
Academic Commitment	3,29	0,089	2,77a	3,34b	3,92c
Years of sports practise	7,78	4,282*	6,44a	9,56b	7,21a
Competitive level	1,09	0,498	0,61a	1,98b	0,56a
Sport task coping	3,26	5,189*	2,78a	3,56b	3,54b
Sport emotion coping	2,37	0,624	2,11a	2,44b	2,64b
Sport distancing coping	2,42	0,660	2,15a	2,51b	2,66b
Sport Stress	2,23	1,566	2,20a	2,25a	2,25a
Sport Resilience	3,51	0,283	3,31a	3,62b	3,63b
Sport Commitment	3,56	7,415**	3,03a	4,12c	3,51b

* ($p<0,05$), ** ($p<0,01$) / Bonferroni's pot-hoc analysis were performed when equal variances were assumed, and Games-Howell's post-hoc analysis when equal variances were not assumed; a, b, and c indicate that there were significant differences between groups.

Predictive engagement analysis

Two regression analysis were performed for each cluster and for the sample as a whole. In the first one, the academic variables were analysed and in the second, we analysed the sports variables. The bootstrapping technique was used with 1.000 samples.

Academic commitment

The analysis of academic commitment (table 4) showed that, for the general sample, the predictive variables of the academic determinant were very significant (r= 0,349; r2= 0,122; *p*<0,001) being their GPA of the previous year (β= 0,378; *p*= 0,001) and task coping (β= 0,598; *p*= 0,010), the main predictor variables. In relation to the general sports

determinants, a significant general prediction was obtained (*p*= 0,001), the most significant predictor variables being task-type coping (β= 0,446; *p*= 0,006) and resilience (β= 0,411; *p*= 0,020). In the cluster analysis, it was observed that, in cluster 1, the predictor variable of the academic determinant is the GPA of the previous year (β= 0,437; *p*= 0,001), no significant predictor variable of the sporting determinant was found. In cluster 2, the predictor variable for the academic determinant was task coping (β= 1,338; *p*= 0,011) while for the sports determinant it was resilience (β= 0,674; *p*= 0,008). In cluster 3, the GPA (β= 0,404; *p*= 0,007) appeared as the main predictor variable of the academic determinant, while emotional coping (β= -0,586; *p*= 0,038) was the main predictor variable and showed a negative tendency

Table 4. Predictive variables and trends in the linear regression analysis of the determinants of academic engagement for each cluster and for the sample in general.

Group	Determinants	ANOVA F (Sig.)	Predictor V	β	Sig.	IC95% lower	IC95% higher
Cluster 1	Academics	2,90 (0,015)	Average	0,437	0,001	0,234	0,650
	Sports	1,38 (0,236)	-	-	-	-	-
Cluster 2	Academics	2,93(0,014)	Task Coping	1,338	0,011	0,158	2,187
	Sports	4,07 (0,002)	Resilience	0,674	0,008	0,170	1,130
Cluster 3	Academics	2,43 (0,042)	Average	0,404	0,007	0,124	0,664
	Sports	1,78 (0,126)	Emotional Coping	-0,586	0,038	-1,102	-0,001
General	Academics	10,15 (<0,001)	Average	0,378	0,001	0,240	0,500
			Task Coping	0,598	0,010	0,176	1,039
	Sports	4,05 (0,001)	Task Coping	0,446	0,006	0,124	0,772
			Resilience	0,411	0,020	0,042	0,731

Sports commitment

The analysis of the determinants of sports commitment (table 5) indicated that, for the general sample, there is a very significant correlation (r= 0,705; r2= 0,496; *p*<0,001) for both the academic and sports determinants, being the main predictor variables: emotional coping (β= -0,439; *p*= 0,002), with a negative nuance, and the distance coping type (β= 0,279; *p*= 0,005) and resilience (β= 0,349; *p*= 0,002), with a positive character. The task coping predictor variable shows a strong tendency to significance (β= 0,295; *p*= 0,074). In relation to the sports determinants, sports level (β= 0,405; *p*= 0,001), task coping (β= 0,515; *p*= 0,001) and resilience (β= 0,222) they are presented as the main predictor variables; *p*= 0,045). The cluster analysis showed us that in cluster 1, emotional coping (β= -0,541; *p*= 0,019) appeared as the main predictor variables of the academic determinant, showing a negative character and distancing coping (β= 0,471;

p= 0,014). Resilience (β= 0,273; *p*= 0,074) presented a very important trend. For the sports determinant, task-type coping was the main predictor variable (β= 0,581; *p*= 0,007). It also presents the sports level variables as predictor variables very close to significance (β= 0,457; *p*= 0,057) and the emotion coping variable shows a negative trend, (β = -0,243; *p* = 0,082). In cluster 2, the main predictor variable of the academic determinant was the coping of distancing, with a negative tendency, (β= -0,271; *p*= 0,032); the emotional coping variable (β= -0,258; *p*= 0,088) also showed a negative tendency to significance in relation to the sports determinants. The main predictor variables are task-type coping (β= 0,318; *p*= 0,016) and distancing coping, which shows a negative trend (β= -0,229; *p*= 0,047). The sports level variable presented an important trend (β= 0,152; *p*= 0,063). Cluster 3 did not show any predictor variable in the academic determinant. For the sports determinant, the sports level (β= 0,810; *p*= 0,005) was the only significant predictor variable.

Table 5. Predictor variables and trends in the linear regression analysis of the determinants of sports commitment for each cluster and for the sample in general.

Group	Determinants	ANOVA F (Sig.)	Predictor V	β	Sig.	IC95% lower	IC95% higher
Cluster 1	Academics	2,60 (0,027)	Emotional Coping	-0,541	0,019	-0,998	-0,085
			Distance Coping	0,471	0,014	0,083	0,775
			Resilience	0,273	0,074	-0,006	0,611
	Sports	7,61(<0,001)	Level	0,457	0,057	-0,013	0,851
			Task Coping	0,581	0,007	0,286	0,969
			Emotional Coping	-0,243	0,082	-0,515	0,045
Cluster 2	Academics	2,29 (0,047)	Emotional Coping	-0,258	0,088	-0,563	0,024
			Distance Coping	-0,271	0,032	-0,535	-0,031
	Sports	2,80 (0,018)	Level	0,152	0,063	-0,002	0,311
			Task Coping	0,318	0,016	0,072	0,580
			Distance C	-0,229	0,047	-0,479	-0,021
Cluster 3	Academics	0,77 (0,596)	-	-	-	-	-
	Sports	4,88 (0,001)	Level	0,810	0,005	0,319	1,273
General	Academics	7,48 (<0,001)	Task Coping	0,295	0,074	-0,019	0,651
			Emotional Coping	-0,439	0,002	-0,672	-0,197
			Distance Coping	0,279	0,005	0,082	0,479
			Resilience	0,349	0,002	0,120	0,574
	Sports	28,75 (<0,001)	Level	0,405	0,001	0,295	0,525
			Task Coping	0,515	0,001	0,330	0,701
			Resilience	0,222	0,045	-0,009	0,421

DISCUSSION

We established as a first hypothesis that academic and sports commitment would be positively related to task coping and resilience and negatively to stress and emotional coping. The results of the regression analysis for the sample in general show that academic commitment was predicted negatively by emotional coping and positively by coping with distancing and resilience, with a tendency for task coping, perhaps due to its high correlation with resilience. (r= 0,414 $p<0,01$). Regarding sports coping, this was positively predicted, in addition to sports level, by task coping and resilience, which were also related to each other (r= 0,341 $p<0,01$).

The results of the study show the relationship between using one type or another of coping strategy and commitment, highlighting the strategies of task orientation as helpful in this relationship. These strategies presented a significant positive relationship with resilience and commitment both in the academic and sports fields. On the other hand, the distancing strategy was also favourable in the academic field and showed that the ability to postpone or taking some distance from problems in this field can sometimes be positive. On the other hand, emotional coping negatively predicted the engagement in the academic area.

The use of task sports coping strategies, understood as the optimal ones due to their ability to reduce stress levels (Fernández Jiménez & Polo Sánchez, 2011) is a determining variable of sports commitment that results in improvements in academic performance, being coincident with the studies of Carver et al.(1992); Thomas et al. (2017); Zeidner and Saklofske (1996).

The second hypothesis formulated was that there would be a relationship between academic and sports variables, especially in coping strategies. In our study, this relationship was significant in the three types of coping.

The use of one or another coping strategy depends on the situational context (González-Cabanach et al., 2018; Somerfield & McCrae, 2000), but also on personal factors such as age, sex and experience in the task performed (Flores Moreno et al., 2017). We must bear in mind that coping with stress is a dynamic process, which evolves as the subject matures, based on the environment and the demands it produces (Morales, 2008). The fact that there is a correlation in the use of coping techniques in the sports and academic context leads us to think that well-directed sports practice may be a situational factor that can end up affecting the athlete's personal processes and help them to cope better in the academic environment as well. For this reason, competitive sports practice, if well directed, may be prescribed to the population in the growing-up / maturing period, as is the case in our sample, and may contribute to providing them with greater mental strength (Guillén & Laborde, 2014) and really help improving their coping strategies in stressful situations.

The use of emotional coping strategies, such as social support or the communication of feelings, is recurrent in the female population (Sagone & De Caroli, 2014), decreasing its use, as indicated above, as the competitive level increases, and this is a decisive factor when it comes to encouraging adolescents to practice competitive sports, especially in the case of women. However, our results are in the opposite direction to those of Prieto (2016), which indicate that there is no significant relationship between sports commitment and academic variables. Cluster 2, made up mostly of competing athletes, shows a greater commitment to sports practice, as well as a smaller use of emotional coping strategies.

The existing benefits between sports practice and academic commitment are undeniable and have been previously studied by Álvarez Pérez et al. (2015); Mcknight et al. (2009). Other authors such as (Capdevila Seder et al., 2015) go further and indicate the importance of competitive sports practice for the improvement of academic performance in adolescents and even stated that 88,9% of athletes with High Sports Performance acknowledged, according to the study by Álvarez Pérez et al. (2015), the importance of obtaining an academic degree to carry out a profession after completing their sporting stage.

The third hypothesis of the study expressed that through the ANN-SO, characterized by the absence of human participation during the analysis process, we would identify groups of young people with different profiles in the variables related to academic commitment and that these would serve to identify

risk groups that could benefit from some interventions to improve academic and sports engagement based fundamentally on the teaching of coping strategies, which could use the sports practice as a learning context (Serrien et al., 2017).

The results obtained showed that the use of ANN-SOM is appropriate in the educational and sports field given its ability to gather subjects with characteristics that are very similar to each other and different from those of the rest of the groups, thus being able to better guide the academic and / or sports tasks, as well as discovering hidden subgroups with exceptional characteristics that would otherwise have been overlooked (Thuneberg & Hotulainen, 2006), and based on that, carry out a specific intervention. In the educational field, SOM networks facilitate the analysis of subgroups with very specific characteristics, and is able to make the pertinent adaptations avoiding possible situations of maladjustment and dropout, allowing the teacher to plan interventions in a specific way in order to achieve better success in learning. In the sports field, the use of this type of ANN-SOM is especially useful due to the ability to easily project large volumes of data (Serrien et al., 2017) and, this way, perform predictions of results, improvements in control of workloads, technical-tactical analysis, and so on (Lamb et al.,2010; Schöllhorn et al., 2014; Sun et al., 2016). Another positive aspect of this type of statistical analysis is the absence of human intervention during its process, eliminating possible biases derived from the researcher.

The analysis of the different clusters showed that, in general, the sports variables did predict academic engagement, despite the fact that this situation did not occur in two of the three subgroups. This fact is motivated by the power of cluster 2 (n= 66) formed by the athletes with a higher competitive level, with more years of practice and more predominance of the motivation to compete than the rest of the sample being, therefore, the group with greater commitment and sports performance. The psychological variables present different transfers between the academic and sports spheres, showing that the lower the use of academic coping strategies of an emotional type the greater the sports commitment or, in other words, the lower the academic procrastination, the greater the sports commitment. This cluster is the only one that

predicts a relationship between sports variables when related to academic engagement.

We have observed that in cluster 2 the sports variables predicted improvement in academic performance; But in cluster 3 (n= 50), formed by the athletes with the highest academic performance in the sample, the academic variables did not predict sports commitment, since it seems that the athletes of this group are above all motivated by the results. You only find sports commitment as long as the results are good.

Finally, we can affirm that competitive sports practice influences greatly the use of one type or another of coping with stress, focusing mainly on the task type. The priority use of this type of strategies helps to improve sports performance and, consequently, a reinforcement in commitment to sports practice, which leads them to have healthy lifestyle habits. At the same time, we have detected, that an increase in the competitive sports level is associated with an increase in academic performance, in the women of the sample. However, this association does not occur in the opposite direction, that is to say, a higher academic performance does not imply any greater athletic performance.

As the main strength and weakness of the research we find the use of ANN-SOM in the analysis of psychological and sociodemographic variables. As an advantage, it presents the ability to analyse and project large volumes of data, in a simple graphical way. It also has the ability to group individuals with similar characteristics to each other and different from the rest of the clusters, all without human intervention. On the contrary, there is a scarcity of studies in the field of psychology that use this type of statistical analysis to compare our results with. The main contribution of the study is to present the different positive relationships that exist between competitive sports practice and the academic field. In the future it would be interesting to continue studying the relationship between sports practice and academic performance in adolescents using ANN SOM in order to find subgroups with very specific characteristics with a tendency to academic and / or sports dropout on which we would have to carry out an intervention in order to advise them towards the competitive sports practice using task-type coping

strategies, thus reducing anxiety and increasing

commitment to the activity.

CONCLUSIONS

There is a positive relationship between the stress coping strategies used in both sports and academic contexts.

Stress coping strategies, together with resilience and performance level determine academic and athletic engagement. Coping with tasks and distancing are positively related to commitment and negatively to the emotional factors, although these relationships vary depending on the context and the group in which each subject is found.

The SOM ANNs are an excellent tool for academic-sports psychological analysis due to their ability to analyse a large volume of data and project their results in a simple way, thanks to which they can tell the difference, in an autonomous way and without human intervention, between different gatherings in the sample with similarities in its cognitive and demographic aspects.

REFERENCES

1. Álvarez Pérez, P. R., Pérez-Jorge, D., González Ramallal, M. E., y López Aguilar, D. (2015). La formación universitaria de deportistas de alto nivel: análisis de una compleja relación entre estudios y deporte (High level sportsmen's and women's university studies: an analysis on the difficult relationship between studies and sport). *Retos*, *2041*(26), 94-100. https://doi.org/10.47197/retos.v0i26.34408

2. Barbosa, S., & Urrea, A. (2018). Influencia del deporte y la actividad física en el estado de salud físico y mental, una revisión bibliográfica. *Katharsis,*(25), 141-159

3. Belando, N., Ferriz Morell, R., y Moreno Murcia, J. (2012). Validación de la escala de grado de compromiso deportivo en el contexto español.*European Journal of Human Movement*, *28*(28), 111-124.

4. California Department of Education. (2005). California Physical Fitness Test: A Study of the Relationship Between Physical Fitness and Academic Achievement in California Using 2004 Test Results. *Educational Research*.

5. Capdevila Seder, A., Bellmunt Villalonga, H., y Hernando Domingo, C. (2015). Estilo de vida y rendimiento académico en adolescentes: comparación entre deportistas y no-deportistas (Lifestyle and academic performance in adolescents: comparison between athletes and non-athletes). *Retos*, (27), 28-33. https://doi.org/10.47197/retos.v0i27.34342

6. Carver, C. S., Scheier, M. F., & Pozo, C. (1992). Conceptualizing the process of coping with health problems. En *Hostility, coping, & health.* (pp. 167-187). Washington, DC, US: American Psychological Association. https://doi.org/10.1037/10105-012

7. Claro, S., Paunesku, D., & Dweck, C. S. (2016). Growth mindset tempers the effects of poverty on academic achievement. *Proceedings of the National Academy of Sciences of the United States of America*, *113*(31), 8664-8668. https://doi.org/10.1073/pnas.1608207113

8. Connor, K. M., & Davidson, J. R. T. (2003). Development of a new Resilience scale: The Connor-Davidson Resilience scale (CD-RISC). *Depression and Anxiety*, *18*(2), 76-82. https://doi.org/10.1002/da.10113

9. Dempster, A. P., Laird, N. M., & Rubin, D. B. (1977). Maximum Likelihood from Incomplete Data Via the EM Algorithm . *Journal of the Royal Statistical Society: Series B (Methodological)* (Vol. 39). https://doi.org/10.1111/j.2517-6161.1977.tb01600.x

10. Fernández Jiménez, C., y Polo Sánchez, M. (2011). Afrontamiento, estrés y bienestar psicológico en estudiantes de Educación Social de nuevo ingreso. *EduPsykhé: Revista de psicología y psicopedagogía*, *10*(2), 177-192.

11. Fletcher, D., Hanton, S., & Mellalieu, S. D. (2006). *An organizational stress review: Conceptual and theoretical issues in competitive sport. Literature Reviews in Sport Psychology*.

12. Flores Moreno, P. J., Pérez Ruvalcaba, S. L., Ciria Margarita Salazar, C., Manzo Lozano, E. G., López Gutiérrez, C. J., Barajas Pineda, L. T., y Medina Mendoza, E. J. (2017). Fuentes, síntomas y estrategias de afrontamiento al estrés-competitivo en nadadores. *Revista de Psicologia del Deporte*, *26*, 198-208.

13. González-Cabanach, R., Souto-gestal, A., González-doniz, L., y Franco, V. (2018). Perfiles de afrontamiento y estrés académico en estudiantes universitarios Profiles of coping and academic stress among university students. *Revista de Investigación Educativa*, *36*, 421-433.

14. Guillén, F., & Laborde, S. (2014). Higher-order structure of mental toughness and the analysis of latent mean differences between athletes from 34 disciplines and non-athletes. *Personality and Individual Differences*, *60*, 30-35. https://doi.org/10.1016/j.paid.2013.11.019

15. Jiménez, M. G., Martínez, P., Miró, E., y Sánchez, A. I. (2008). Bienestar psicológico y hábitos saludables: ¿Están asociados a la prática de ejercicio físico? *International Journal of Clinical and Health Psychology*, *8*(1), 185-202.

16. Kaski, S., & Lagus, K. (1996). Comparing Self-Organizing Maps, (January 2013). https://doi.org/10.1007/3-540-61510-5

17. Krohne, H. W. (1993). Vigilance and cognitive avoidance as concepts in coping research. En *Attention and avoidance: Strategies in coping with aversiveness.* (pp. 19-50). Ashland, OH, US: Hogrefe & Huber Publishers.

18. Lamb, P. F., Bartlett, R. M., & Robins, A. (2010). Self-Organising Maps : An objective method for clustering complex human movement. *International Journal of Computer Science in Sport*, *9*(1), 20-29.

19. Lazarus, R. S. (2000). Toward better research on stress and coping. *American Psychologist*, *55*(6), 665-673. https://doi.org/10.1037/0003-066X.55.6.665

20. Lazarus, R. S. (2006). Emotions and interpersonal relationships: Toward a person-centered conceptualization of emotions and coping. *Journal of Personality*, *74*(1), 9-46. https://doi.org/10.1111/j.1467-6494.2005.00368.x

21. Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping*. Springer publishing company.

22. Liu, Y. D. (2009). Sport and social inclusion: Evidence from the performance of public leisure facilities. *Social Indicators Research*, *90*(2), 325-337. https://doi.org/10.1007/s11205-008-9261-4

23. Maureira Cid, F. (2018). Relación entre el Ejercicio Físico y el Rendimiento Académico Escolar: Revisión Actualizada de Estudios. *EmásF, Revista Digital de Educación Física*, *9*(53), 168-184. Recuperado de https://dialnet.unirioja.es/servlet/articulo?codigo=6482543

24. Mcknight, K., Bernes, K., Gunn, T., Chorney, D., & Orr, D. (2009). Life After Sport : Athletic Career Transition and Transferable Skills. *Journal of Excellence*, (13), 63-77.

25. Ministerio Cultura y Deporte. (2020). Anuario De Estadísticas Deportivas 2020. Recuperado de http://www.culturaydeporte.gob.es/servicios-

al-ciudadano/estadisticas/deportes/anuario-de-estadisticas-deportivas.html

26. Ministerio de Educación y Formación Profesional. (2020). Las cifras de la educación en España. Curso 2018-19. Recuperado de https://www.educacionyfp.gob.es/servicios-al-ciudadano/estadisticas/indicadores/cifras-educacion-espana/2018-19.html

27. Molinero, O., Salguero, A., y Márquez, S. (2010). Propiedades psicométricas y estructura dimensional de la adaptación española del Cuestionario de Estrategias de Afrontamiento en Competición Deportiva. *Psicothema*, *22*(4), 975-982.

28. Morales, F. (2008). *Evaluación del afrontamiento infantil: estudio inicial de las propiedades de un instrumento*. Universidad de Málaga.

29. Nicholls, A. R., & Polman, R. C. J. (2007). Coping in sport: A systematic review. *Journal of Sports Sciences*, *25*(1), 11-31. https://doi.org/10.1080/02640410600630654

30. Ntoumanis, N., & Biddle, S. J. H. (2000). Relationship of intensity and direction of competitive anxiety with coping strategies. *Sport Psychologist*, *14*(4), 360-371. https://doi.org/10.1123/tsp.14.4.360

31. Parra, P., y Pérez, C. (2010). Propiedades psicométricas de la escala de compromiso académico, UWES-S (versión abreviada), en estudiantes de psicología. *Revista de Educación Ciencia y Salud*, *7*(2), 128-133.

32. Pedrosa, I., Suárez-Álvarez, J., y García-Cueto, E. (2012). Construcción de una Escala de valoración del Estrés en el Ámbito Deportivo (EEAD). *Revista Electrónica de Metodología Aplicada*, *17*(2), 18-31. Recuperado de http://digibuo.uniovi.es/dspace/bitstream/10651/18991/1/REMA.2012.17.2.18-31.pdf

33. Polman, R. (2012). Chapter 13 - Elite Athletes' Experiences of Coping with Stress.

Routledge Online Studies on the Olympic and Paralympic Games, *1*(53), 284-301. https://doi.org/10.4324/9780203852293_chapter_13

34. Prieto, J. M. (2016). Relación entre competitividad, ansiedad social y compromiso con variables deportivas y académicas en futbolistas jóvenes. *Revista Iberoamericana de Psicología del Ejercicio y el Deporte*, *11*(2), 193-200.

35. Reardon, S. F. (2011). The widening academic achievement gap between the rich and the poor: New evidence and possible explanations. *Whither Opportunity?: Rising Inequality, Schools, and Children's Life Chances*, (July), 91-115.

36. Remor, E. y Carrobles, J. A. (2001). Versión española de la Escala de Estrés Percibido (PSS-14): Estudio psicométrico en una muestra VIH+. *Ansiedad y Estres*, *7*((2-3)), 195-201.

37. Sagone, E., & Elvira De Caroli, M. (2014). A Correlational Study on Dispositional Resilience, Psychological Well-being, and Coping Strategies in University Students. *American Journal of Educational Research*, *2*(7), 463-471. https://doi.org/10.12691/education-2-7-5

38. Sánchez-Teruel, D.; y Robles-Bello, M. A. (2015). Escala de Resiliencia 14 ítems (RS-14): Propiedades Psicométricas de la Versión en Español. *Revista Iberoamericana de Diagnóstico y Evaluación-e Avaliação Psicológica*, *2*(40), 103-113.

39. Sandín, B., y Chorot, P. (2003). Cuestionario de afrontamiento del estrés (CAE) : desarrollo y validación preliminar. *Revista de Psicopatología y Psicología Clínica*, *8*(1), 39-53. https://doi.org/10.5944/rppc.vol.8.num.1.2003.3941

40. Schöllhorn, W., Chow. J.Y., Glazier, P. & Button, C. (2014). *Self-organizing maps and cluster analysis in elite and sub-elite athletic*

performance. Routledge. https://doi.org/10.4324/9780203134610

41. Serrano-Parra, M. D., Garrido-Abejar, M., Notario-Pacheco, B., Bartolomé-Gutiérrez, R., Solera-Martínez, M., y Martínez-Vizcaíno, V. (2012). Validez de la escala de Resiliencia de Connor-Davidson (CD-RISC) en una población de mayores entre 60 y 75 años. *International Journal of Psychological Research*, *5*(2), 49-57. Recuperado de http://dialnet.unirioja.es/servlet/articulo?codigo=4173305%5Cnfiles/877/Parra et al. - 2012 - Validez de la escala de Resiliencia de Connor-Davi.pdf%5Cnfiles/654/Validez escala CD-RISC.pdf%5Cnfiles/484/articulo.html

42. Serrano, M., Castro López, R., Moreno Pulido, R., y Cachón Zagalaz, J. (2015). Estudio comparativo del rendimiento académico y la actividad física en dos institutos de enseñanza secundaria de Andalucía (España). *Sport TK-Revista EuroAmericana de Ciencias del Deporte, vol. 4, nº 2 (2015)*. Recuperado de https://digitum.um.es/digitum/handle/10201/46839

43. Serrien, B., Goossens, M., & Baeyens, J. P. (2017). Issues in using self-organizing maps in human movement and sport science. *International Journal of Computer Science in Sport*, *16*(1), 1-17. https://doi.org/10.1515/ijcss-2017-0001

44. Somerfield, M. R., & McCrae, R. R. (2000). Stress and coping research: Methodological challenges, theoretical advances, and clinical applications. *American Psychologist*, *55*(6), 620-625. https://doi.org/10.1037/0003-066X.55.6.620

45. Sun, Q., Liu, H., Liu, M., & Zhang, T. (2016). Human activity prediction by mapping grouplets to recurrent Self-Organizing Map. *Neurocomputing*, *177*, 427-440. https://doi.org/10.1016/j.neucom.2015.11.061

46. Thomas, C. L., Cassady, J. C., & Heller, M. L. (2017). The influence of emotional intelligence, cognitive test anxiety, and coping strategies on undergraduate academic performance. *Learning and Individual Differences*, *55*, 40-48. https://doi.org/10.1016/j.lindif.2017.03.001

47. Thuneberg, H., & Hotulainen, R. (2006). Contributions of data mining for psycho-educational research: What self-organizing maps tell us about the well-being of gifted learners. *High Ability Studies*, *17*(1), 87-100. https://doi.org/10.1080/13598130600947150

48. Zeidner, M., & Saklofske, D. (1996). Adaptive and maladaptive coping. En *Handbook of coping: Theory, research, applications.* (pp. 505-531). Oxford, England: John Wiley & Sons.

49. Wagnild, G., & Young, H. (1993) . Development and psychometric evaluation of the resilience scale. *Journal of Nursing Measurement, 1,* 165-178