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Learning Approaches and Coping with Academic Stress for Sustainability Teaching: Connections through Canonical Correspondence Analysis

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Abstract: Learning approaches are factors that contribute to sustainability education. Academic stress negatively affects students' performances in the context of sustainability teaching. This study analyzed how deep and surface approaches could be related to coping with academic stress and gender. An online survey was completed by 1012 university students. The relationship between gender, sources of stress and learning approaches was examined through a multivariate canonical correspondence analysis. Results showed differences in stress-coping strategies depending on the learning approach used. In both female and male students, academic stress was handled with a deep learning approach. The findings provide implications for professors and highlight the importance of variables such as deep learning and gender in the teaching and learning sustainability process.

Keywords: sustainability in higher education; learning approaches; coping with academic stress; gender differences; canonical correspondence analysis

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1. Introduction

Universities play an important role in integrating the basic goals of sustainability development in society [1]. They are contributors of new sustainable solutions for both society and the planet [2,3] and new knowledge such as sustainability [4]. Therefore, Education for Sustainability (EfS) in Higher Education (ESHE) has been increasing society's awareness and is a key enabler for sustainable development and an integral element of quality education [5].

The previous literature on EfS at universities emphasized the need for innovation in pedagogical strategies, through the promotion of discovery learning rather than transmissive learning and the change from a theoretical learning approach to one oriented to practice [6]. Furthermore, this change should be framed in the context of interdisciplinary learning take taking into account that active teaching–learning strategies contribute to transformative education [7]. To achieve this, a search for links between educational theories and practice might help [8]. Specifically, the study of learning approaches and their relationship with emotional variables could be helpful. In this way, several studies have investigated learning approaches [8–17] and coping with academic stress [18–22]. Among university students, learning changes depending on context and individual situation, which determine the most appropriate learning approach [23], one which is not static [24] and tends to change based on various contextual variables [25]. Additionally, different forms of coping with stress can interfere at cognitive and emotional levels during the learning process [26]. This student stress comes from sources such as career pressure, study/life imbalance, academic demands, social isolation and adjustment, finances, and familial relationships,

some of which positively correlate with depression and anxiety [19,27–31]. According to [32], it is important to consider the student's positive and negative emotions in the learning process. The findings suggest that the surface approach to learning is usually associated with high levels of anxiety [33,34]. However, there is scarce literature relating both learning approaches (deep and surface) to coping with academic stress at universities, nor are there published studies reporting on the influence of the variable of gender on any possible relationship.

1.1. Learning Approaches

The various experiential learning theories allow us to identify the variables that impact the learning process [35]. Learning approaches are one of the most prominent lines of research in this regard and were first discussed in the Student Approaches to Learning (SAL) theory of Marton and Säljö [17]. Subsequent studies, taking these authors' contributions as a point of reference [36], defined learning approaches via a three-phase model (3P): presage, process and product. This model explains teaching as an interactive and balance process, all of whose elements are interrelated [37] and which is impacted by strategic, emotional and contextual variables. So, these interdependent characteristics strongly represent the systemic principles of sustainability [38].

Biggs [30] described deep and surface learning approaches depending on the motivation or strategies used to approach a particular task. Motive determines the learning direction and the goals set by the individual in order to assimilate the information, while strategy induces said direction to incorporate the required information [39]. Both motive [40] and strategy form part of the teaching–learning process and influence the choice of approach [41]. The deep approach to the content of a task involves the student becoming able to understand its meaning [13,41]. Existing studies indicate that this approach is characteristic of creative students, engaging in autonomous and critical thinking, displaying successful learning with good understanding of information [42,43], expressive skills, clarity of ideas [44] and intrinsic motivation [5]. According to [43], sustainability requires a deep learning approach because students have to understand the relations between environmental, social and economic goals. Further, the teaching techniques, which influence students' adoption of the deep learning approach, are very important because ethical values embedded in sustainability thinking need to be understood, internalized according to individuals' experiences [38].

On the other hand, students who use a surface approach report extrinsic motivation and tend to fulfill the minimum study requirements. They also have fear of failure [42] and carry out their tasks with the minimum possible effort [23] using their memory skills as the basis for their learning [41]. The preferred approach depends on the motivation for learning and on whether there is an aim to understand meanings, and it is not possible for both approaches to coexist at the same time [33].

Therefore, for teachers, creating the conditions for deep learning is important for sustainability education because learning sustainability is based on values, behaviors and analytical skills [37]. So, from the pedagogical point of view, it is important to identify the type of learning approach used by university students in order to adapt teaching methodology to students' forms of learning sustainability.

1.2. Coping with Academic Stress

In the context of EfS, negative emotions (e.g., anxiety, stress) can be evoked by the complexity of topics development from this area. Those emotions can be difficult to face in the learning process. So, there is a need to focus on the emotional aspect as another key competence in EfS [45].

Stress is one of the most commonly discussed topics of adult life and it can hinder academic performance [46–48]. It can even compromise how university students approach the tasks that are part of the learning process [48]. In many cases, academic stress gives rise to some form of clinical symptomatology [49] such as anxiety or depression [50] which

can be exacerbated by various stressors including new responsibilities, vacations/breaks, change in eating habits, increased work load and change in sleeping habits [30]. Other sources of stress have been identified as workload, competition among students and the difficulty of the curriculum [51]. Some of the foregoing sources have a positive correlation with anxiety and depression [19].

Coping with stress is a management tool emotion and the external conditions that induce stress. It refers to conduct that helps the student to cope with their stress [52]. People with emotional skills and rational strategies for coping with stress are considered to report fewer stressful stimuli [53–56].

According to [57] there are two broad categories of strategies for coping with stress: problem-focused and emotion-focused strategies. The first category involves the use of activities such as action and planning, while emotion-focused strategies entail expressing emotions and altering expectations.

Previous research has found that college stress is more common among women [58,59]. Findings also indicate a greater use of emotion-focused strategies, such as seeking emotional and social support, among women [60,61]. However, gender-based differences have not been found in terms of the use of problem-focused strategies, such as planning and action [62], or in terms of the potential relationship to the learning approach that the student adopts.

1.3. Relationships between Learning Approach, Coping with Stress and Sustainability

Although a large body of literature has gauged the effects of learning approach on academic development and sustainability education, few studies have sought to develop a model to incorporate the relationship between learning approach and coping with academic stress in that context. The results that have been published suggest that the surface approach to learning is usually associated with high levels of anxiety and stress [31,32]. On the other hand, it is necessary to enable learning contexts where the deep approach predominates to facilitate sustainability education [43]. According to [43], the students interacting in the learning context are influenced by cultural norms (e.g., those in relation to gender), and in order to promote the goals of sustainability education, we must consider emotion regulation strategies in both genders. Therefore, there is a need for further research examining emotion strategies and coping at different levels in the educative process, such as the relation of these variables with learning approaches and sustainability education. As relationships between the deep and surface approaches and coping with stress appear to be ambiguous [34] and given the scarcity of literature examining this issue., two aims were established for this study: (i) to test whether student coping strategies (seeking support, planning and positive reappraisal) are correlated with the type of learning approach; and (ii) to investigate the extent to which the relationship between coping strategy (rational and emotional) and learning approach (deep and surface) is mediated by gender and if this is important for development concepts linked to sustainability.

2. Materials and Methods

2.1. Participants

The directors and professors at the University of Salamanca (USAL) (Spain) were duly informed about our study and permission was requested for access for the students to participate in our research. Overall, 9018 students were randomly selected, belonging to the first and second academic years. All of them voluntarily participated. The survey was carried out in lesson time during the academic year 2018–2019. The students answered the questionnaire online. The confidentiality and anonymity of students were guaranteed.

The target population comprised 1012 students from various degree courses at the University of Salamanca across five areas of knowledge: arts and humanities (8.7%), health sciences (29.6%), sciences (8.7%), social and legal sciences (51.2%) and engineering and architecture (1.8%). Participant ages were distributed as follows: 18–19 years (65.1%), 20–21 years (22%), 22–23 years (5.5%), 24–25 years (3%) and over 25 years (4.3%).

With regard to the distribution of the sample by gender, 706 subjects (69.8%) were women. The sample comprised 39.9% first-year students, 42% second-year students and 18.1% third, fourth and fifth-year students. Of the students surveyed, 25.6% lived in the family home, 2.7% lived alone and 28.7% were in university residences, 41.4% in shared housing and 1.6% in other environments.

2.2. Instruments

The Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) [13], the reduced version of Biggs' Study Process Questionnaire (SPQ) [36] adapted into Spanish by [63] and validated by [64], was used to evaluate learning approaches. This questionnaire is presented in Appendix A. It consists of 20 items with Likert-type responses ranging from 1 (never or rarely) to 5 (always or almost always). The scale is composed of two factors, with the deep approach made up of ten items (e.g., "There are times when studying brings me great satisfaction") and the surface approach also made up of ten items (e.g., "I can pass most exams by memorizing key parts of a topic without trying to understand them"). The higher the score obtained for each dimension, the more the student identified with that approach [65]. Reliability was examined using Cronbach's alpha, with high consistency for both subscales ($\alpha = 0.77$ for the deep approach and $\alpha = 0.77$ for the surface approach). These scores were in line with those reported by [27] (deep $\alpha = 0.72$ y surface $\alpha = 0.71$).

The confirmatory factor analysis (CFA) showed adequate goodness-of-fit indices for the R-SPQ-2F. The following indicators were obtained: chi-square/df = 2.83; CFI = 0.88; GFI = 0.96; RMSD = 0.06; and RMSEA = 0.04.

The Coping with Academic Stress Questionnaire *(Cuestionario de Afrontamiento del Estrés Académico*) (A-CEA) developed by [66] in Spain was used to measure coping with academic stress. This is a 23-item instrument divided into three dimensions: positive reappraisal, comprising nine items (e.g., "When I am faced with a difficult situation, I ignore the unpleasant aspects and focus on the positive"); seeking support, made up of seven items (e.g., "When I am faced with a difficult situation, I express my opinions and seek support"); and coping through planning, with seven items (e.g., "When I am faced with a difficult situation, I prioritize tasks and organize my time"). Responses for each item were provided on a five-point Likert-type scale (1 = never, 5 = always) to indicate the frequency with which the relevant coping strategy was used.

The Cronbach's alpha coefficient was $\alpha = 0.88$ for positive reappraisal, $\alpha = 0.92$ for seeking support and $\alpha = 0.85$ for planning. These scores were similar to those reported by [66] of $\alpha = 0.86$ for the positive reappraisal factor, $\alpha = 0.90$ for seeking support and $\alpha = 0.83$ for planning.

The level of fit for the model was then analyzed, with the results indicating good fit for the data (chi-square/df = 4.13, CFI = 0.91, GFI = 0.92, RMSD = 0.06, RMSEA = 0.06).

2.3. Procedure

Subsequently to the obtaining of consent and verification of ethical aspects, data were gathered using the R-SPQ-2F and A-CEA questionnaires for the purposes of evaluating learning approaches and coping with academic stress, respectively.

2.4. Statistical Analysis

To confirm the factorial structure of both questionnaires, a confirmatory factor analysis was performed using the maximum likelihood method. The following goodness-of-fit indicators were used: (i) chi-square divided by degrees of freedom (lower index, better fit); (ii) Bentler's comparative fit index; (iii) goodness-of-fit index; (iv) Root Mean Square Deviation (RMSD); and (v) Root Mean Square Error of Approximation (RMSEA).

A descriptive analysis was then carried out for each questionnaire item in order to identify students' approaches to learning and coping with academic stress. We tested whether continuous variables were normally distributed using the Kolmogorov-Smirnov test. An analysis was also performed to examine potential gender-based differences with

each of the dimensions evaluated in terms of learning approach, evaluated using the R-SPQ-2F, and coping with academic stress, evaluated using the A-CEA, using the Mann–Whitney U test for independent samples.

Finally, a restricted ordination method called canonical correlation analysis (CCA) [67] was used to analyze the relationship between learning approaches and coping with academic stress. Canonical Correspondence Analysis (CCA) is a nonlinear multivariate direct gradient analysis method that combines correspondence analysis with multiple regression analysis. This method is traditionally used to evaluate the ambient gradients in ecological studies, and it is able to easily identify the eventual causal relationship between the species distributions and the ambient variables. In our case it was used to evaluate the connection between learning approaches and coping with academic stress. Two data matrices were required for the CCA for the 1012 subjects, one containing information about the learning approach item and the other containing information relating to the items concerning coping with academic stress (Figure 1). The results are presented in an ordination plot, where the scores for the coping with academic stress items are graphically represented using vectors. The coordinates of the arrows are the values of the arrows on the two best synthetic gradients. CCA produced an ordination based on estimated values of the coping with academic stress items depending on the learning approach items. Learning approaches can thereby be explained via a model in which the explanatory variable is a linear combination of the items that evaluate coping with academic stress.

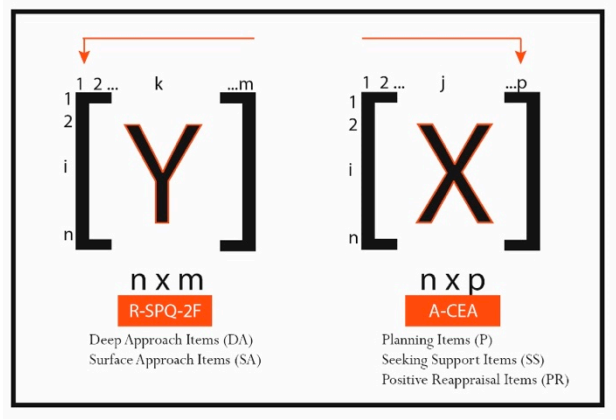

Figure 1. An illustrative diagram of the matrices used in the Canonical Correspondence Analysis (CCA).

CCA was used to determine the weight of environmental variables (items of the coping with academic stress scale):

$$Y_i = b_0 + \sum_{j=1}^{n} b_j X_{ij}$$

where b_j are the canonical coefficients. They define the ordination axes as linear combinations of the academic stress items.

The data were analyzed using version 25 of the IBM SPSS Statistical Package Program. Version 23 of AMOS IBM SPSS was used to perform the confirmatory factor analysis and the CANOCO program for Windows version 4.56 [68] was used for the CCA.

3. Results

Table 1 shows a descriptive analysis of each of the items in the two questionnaires. Higher scores were obtained for the deep approach and the seeking support subscale.

Table 1. Descriptive analysis of the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) and Coping with Academic Stress Questionnaire (A-CEA) items by dimension.

R-SPQ-2F Questionnaire	M	SD	Mdn	IQR
Deep approach				
DA 1	2.79	1.06	3	2–4
DA 2	3.29	1.13	3	2–4
DA 5	2.92	0.98	3	2–4
DA 6	2.38	1.03	2	2–3
DA 9	3.16	1.15	3	2–4
DA 10	3.35	1.15	3	2–4
DA 13	4.08	0.90	4	4–5
DA 14	2.21	1.01	2	1–3
DA 17	2.38	1.09	2	2–3
DA 18	2.98	1.14	3	2–4
Surface approach				
SA 3	2.13	1.20	2	1–3
SA 4	2.85	1.26	3	2–4
SA 7	2.55	1.26	2	1–3
SA 8	2.47	1.17	2	2–3
SA 11	2.22	1.14	2	1–3
SA 12	2.48	1.09	2	2–3
SA 15	1.59	0.87	1	1–2
SA 16	2.66	1.24	2	2–4
SA 19	2.23	1.15	2	1–3
SA 20	1.94	1.08	2	1–3
A-CEA				
Positive reappraisal				
RP 1	2.58	1.05	2	2–3
RP 4	3.42	1.19	4	3–4
RP 7	3.16	1.18	3	2–4
RP 10	3.03	1.16	3	2–4
RP 13	3.23	1.09	3	2–4
RP 16	2.58	1.14	3	2–3
RP 18	3.02	1.19	3	2–4
RP 20	3.07	1.19	3	2–4
RP 22	3.10	1.19	3	2–4
Seeking support				
BA 2	3.20	1.09	3	2–4
BA 5	3.52	1.22	4	2–5
BA 8	3.20	1.26	3	2–4
BA 11	3.43	1.28	4	2–5
BA 14	3.29	1.23	3	2–4
BA 17	3.18	1.19	3	2–4
BA 21	3.23	1.16	3	2–4
Planning				
P 3	3.26	1.06	3	2–4
P 6	3.57	1.15	4	3–5
P 9	2.90	1.14	3	2–4
P 12	3.54	1.06	4	3–4
P 15	3.28	1.05	3	3–4
P 19	2.68	1.23	3	2–4
P 23	3.30	1.03	3	3–4

Values are presented as mean ± standard deviation and median (IQR).

Table 2 presents data relating to the descriptive analyses performed for each of the factors, depicting the learning approach and coping with academic stress scales according to gender. In relation to learning approaches, male respondents reported a higher level of surface approaches (z = −0.082, p = 0.413), with no significant differences found for the deep approach (z= −2.97, p = 0.003). For the coping with academic stress scale, female students reported higher scores in terms of seeking support (z = −3.23, p = 0.001) and males reported higher scores for positive reappraisal (z = 6.66, p = 0.000), with no significant differences found for planning (z = 0.81, p = 0.417).

Table 2. Descriptive statistics by gender.

	General		Male		Female			
	M ± SD	**Mdn (IQR)**	**M ± SD**	**Mdn (IQR)**	**M ± SD**	**Mdn (IQR)**	**z**	***p*-Value**
Learning approach								
Deep approach	29.55 ± 6.13	29 (25–34)	29.49 ± 6.45	30 (25–34)	29.57 ± 6.00	29 (25–34)	−2.97	0.003
Surface approach	23.11 ± 6.53	22 (18–27)	25.20 ± 6.95	25 (20–30)	22.20 ± 6.12	21 (18–26)	−0.082	0.413
Coping with academic stress								
Positive reappraisal	27.17 ± 7.36	27 (22–32)	29.63 ± 6.73	30 (25–34)	26.11 ± 7.37	26 (21–31)	6.66	0.000
Seeking support	23.05 ± 6.94	24 (18–28)	22.03 ± 6.63	22 (17–27)	23.49 ± 7.02	24 (18–29)	−3.23	0.001
Planning	22.52 ± 5.63	23 (18–27)	22.75 ± 5.40	23 (19–27)	22.42 ± 5.73	23 (18–27)	0.81	0.417

Values are presented as mean ± standard deviation and median (IQR).; Assessed using Mann–Whitney U test.

Table 3 shows the covariance matrix for the learning approach and coping with academic stress subscales, with a negative association observed between deep and surface approaches and a positive relationship between the other dimensions.

Table 3. Covariance matrix for the learning approach and coping with academic stress subscales.

	1	**2**	**3**	**4**	**5**
1. Deep approach	37.67				
2. Surface approach	−11.58	42.68			
3. Positive reappraisal	10.85	−3.85	54.25		
4. Seeking support	7.36	−1.35	14.88	48.18	
5. Planning	12.98	−6.82	25.79	17.26	31.78

Differences in the scores for the dimensions of coping with academic stress with respect to learning approaches are presented in Table 4, which shows that students obtained higher scores for the deep than for the surface approach. No significant differences were found in seeking support among males (p = 0.697), although statistically significant differences were found for all other variables.

Table 4. Analysis of differences between learning approaches and dimensions of coping with academic stress in the population and by gender.

	M ± SD	Mdn (IQR)	z	*p*-Value
Overall				
Positive reappraisal Deep Surface	27.99 ± 7.37 25.90 ± 7.19	28 (23–33) 26 (21–31)	4.45	0.000
Seeking support Deep Surface	23.43 ± 6.96 22.46 ± 6.89	24 (18–29) 23 (17–28)	2.19	0.029
Planning Deep Surface	25.90 ± 7.19 20.94 ± 5.57	24 (20–28) 21 (17–25)	7.30	0.000
Men *n* = 162				
Positive reappraisal Deep Surface	30.80 ± 6.64 28.32 ± 6.62	31 (26–35.25) 28 (24–33)	3.26	0.001
Seeking support Deep Surface	22.18 ± 6.60 21.88 ± 6.70	22.50 (17–27) 22 (16–27)	0.39	0.697
Planning Deep Surface	24.06 ± 5.15 21.29 ± 5.34	25 (20–28) 21 (17–25)	4.62	0.000
Women *n* = 457				
Positive reappraisal Deep Surface	26.99 ± 7.36 24.49 ± 7.14	27 (22–32) 24 (19–29.5)	4.36	0.000
Seeking support Deep Surface	23.88 ± 7.03 22.79 ± 6.98	25 (18–29) 23 (17–29)	1.97	0.049
Planning Deep Surface	23.34 ± 5.55 20.74 ± 5.70	24 (19–28) 21 (16.5–25)	5.89	0.000

Values are presented as mean ± standard deviation and median (IQR); Assessed using Mann–Whitney U test.

Multivariate Analysis of Relationship between Learning Approaches and Coping with Academic Stress

The relationship between the R-SPQ-2F and the A-CEA was analyzed using CCA. Table 5 shows the correlations and explained variance for each axis. The proportion of explained variance for the first two axes was higher among the female sample (68.5%) than among the male sample (58.2%).

Table 5. Results of canonical correlation analysis.

	Axis I	Axis II	Axis III	Axis IV
Men				
Correlations between A-CEA and R-SPQ-2F	0.48	0.48	0.38	0.38
Explained variance of A-CEA and R-SPQ-2F	45.10	58.20	67.00	72.60
Women				
Correlations between A-CEA and R-SPQ-2F	0.42	0.37	0.28	0.26
Explained variance of A-CEA and R-SPQ-2F	52.80	68.50	75.10	79.40

The ordination plot organized by gender can be observed in Figure 2. The results indicate a strong association among male students between the items of the various dimensions of the A-CEA. The narrow angle that the items of the seeking support dimension SS-5

and SS-21 form with item P-19 of the planning dimension is striking. Along the same lines, item P-23 of planning presents strong covariance with items PR-7, PR-13 and PR-10 of the positive reappraisal dimension.

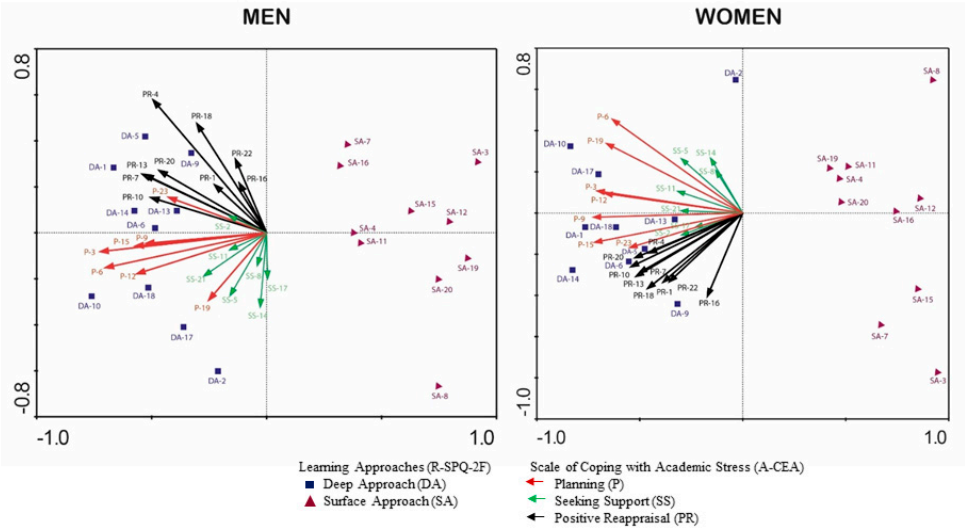

Figure 2. Ordination plot from canonical correlation analysis according to gender.

Items DA-14, DA-1, DA-5 and DA-9 of the deep approach dimension maintain high scores for items PR-10, PR-7, PR-13, PR-20 and PR-18 of positive reappraisal. However, items DA-6, DA-10 and DA-18 present high values for various items of the planning dimension: P-9, P-15, P-3, P-6 and P-12. Additionally, items DA-17 and DA-2 of the deep approach dimension present high values for items SS-21, SS5 and SS-14 of the seeking support dimension.

Among female students, items forming part of the positive reappraisal can be seen to have a strong association with the items of the planning dimension, and the two dimensions are hence not differentiated. It is striking that items DA-10 and DA-17 of the deep approach dimension present high values for items P-6, P-19, P-3 and P-12 of the planning dimension. Items DA-14, DA-1 and DA-18 correspond to high values for items P-9, P-15 and P-23 of the planning dimension. However, items DA-6 and DA-9 have a high correlation to the items corresponding to the positive reappraisal dimension.

Finally, it can be seen that both female and male students coped with academic stress by using a deep learning approach.

4. Discussion

Learning contexts where deep approach predominates in facilitating sustainability education are very important [43] because the students interacting in the learning context are influenced by cultural norms (e.g., those in relation to gender) and, in order to promote the complex goals of sustainability education, we must consider emotion regulation strategies in both genders and the learning approach adopted by the students. Therefore, this research examined emotion regulation strategies and coping at different levels in the educative process, such as the relation of these variables with learning approaches and sustainability education. In this sense, the aims of this research were: (i) to identify the relationship between deep approach and surface approach variables and variables relating to coping with academic stress, including the variable of gender, for sustainability teaching by means of a specific analysis of the items making up each scale (learning approach and coping with academic stress); and (ii) to investigate the extent to which the relationships between coping strategies (rational and emotional) and learning approaches (deep and surface) are mediated by gender and if this is important to development concepts linked to sustainability.

As regards the first goal, the reliability of the questionnaires used (R-SPQ-2F and A-CEA) was examined. High consistency was found for the two subscales that make up the R-SPQ-2F ($\alpha = 0.77$ for deep approach and $\alpha = 0.77$ for surface approach). These scores were in line with those reported by [27]. The same can also be said of the A-CEA ($\alpha = 0.88$ for positive reappraisal, $\alpha = 0.92$ for seeking support and $\alpha = 0.85$ for planning, similar data to those provided by [66]).

With respect to the proposed aims and in line with other studies such as those published by [15,33], the results show the predominance of the deep approach among university students. Male students reported higher levels for the superficial approach and no significant differences were found between male and female students in terms of the deep approach. It is clear that the deep learning approach is a strategy by which students learn more [43]. The literature on EfS at universities emphasizes the need for innovation in pedagogical strategies through the promotion of discovery learning rather than transmissive learning and a change from a theoretical learning approach to one oriented to practice [6]. Furthermore, this change should be framed in the context of interdisciplinary learning and take into account active teaching–learning strategies. According to [69], experiential approaches to EfS can benefit from shifting towards a student-centered perspective and the rise in social interaction. These findings are in line with studies published on other subjects that have developed collaborative approaches [70].

So, in line with [43], sustainability requires a deep learning approach and this work certainly successfully confirmed its predominance in higher education students. In addition, the teaching techniques mentioned in the previous paragraph, which influence students' adoption of deep learning approaches, are very important because ethical values embedded in sustainability thinking need to be understood, internalized according to individuals' experiences [38]. That said, those strategies and teaching techniques should be adjusted to the gender profiles of the students presented in this work for sustainability courses. Previous research has found that women use emotion-focused strategies such as seeking social support [60,61,71] and that college stress is more common among women [58,59]. However, according to [62], gender-based differences have not been found in terms of the use of problem-focused strategies, such as planning and action, or in terms of the potential relationship to the learning approach that the student adopts. The above claim was only partly confirmed by this study, since in the coping with academic stress scale, women reported higher scores for seeking support and men reported higher positive reappraisal values, while as in the study published by [62], no significant differences were found in planning. In other words, men use a form of positive thinking when faced with academic stressors, unlike women. However, as indicated in [62], both men and women use planning strategies to confront these stressors. Women also seek social support as a means to confront stress. Therefore, and in line with previous findings (e.g., [72]), it is possible to corroborate a pattern that distinguishes between men and women in terms of their use of strategies for coping with academic stress. Of the two strategies for coping with stress reported by [57] then, women used both (problem- and emotion-focused) and men focused solely on using the problem-focused category, which is more closely related to planning and positive reappraisal.

With regard to the second objective raised in this research, the results show gender-based differences among students with regard to their learning approach and coping with stress patterns and it is clear that students who characteristically used a deep approach to the learning process coped better with academic stress than those for whom a surface approach was predominant (positive reappraisal: 27.99 ± 7.37 vs. 25.90 ± 7.19; seeking support: 23.43 ± 6.96 vs. 22.46 ± 6.89; and planning: 25.90 ± 7.19 vs. 20.94 ± 5.57). These findings are relevant for consideration by teachers who encourage interdisciplinary approaches to sustainability. So, the complex combination of knowledge, skills, understanding, values and purposes [73–75] which could influence the activation of negative emotions from a gender perspective should be considered in teaching for sustainability.

According to Biggs [11], students using a deep approach display high intrinsic motivation. This assertion is related to findings by authors such as Baker [18], for whom this kind of motivation is associated with lower levels of stress. It may therefore be logical that students reporting a deep approach are more motivated and hence show lower levels of stress, given that interaction with the task is encouraged by the satisfaction experienced when performing it [40]. An analysis of the covariance matrix for the subscales of both questionnaires shows the differences between the deep and surface approaches. In line with [14], a negative overall association can be observed between the two approaches and there is a positive association between the other A-CEA subscales. Students presented higher scores for the deep approach than for the surface approach and no significant differences were found in the seeking support subscale among men ($p = 0.697$), although such differences were found in the two other A-CEA subscales (positive reappraisal and planning). When this same analysis was performed with the sample divided by gender, significant differences were obtained according to the learning approach used. Women showed significant differences in the positive reappraisal and planning subscales and significant differences were only found for men in the planning subscale. There were differences in strategies for coping with stress depending on the student's learning approach, although the seeking support strategy was observed to be a constant for women in terms of coping with stress, regardless of the learning approach adopted.

The resulting ordination plot (see Figure 2) shows that there was a strong association for male students among the items of the various dimensions of the A-CEA. Among female students, items forming part of positive reappraisal had a strong association with items of the planning dimension, meaning that these dimensions were not differentiated. It is striking that both male and female students coped with academic stress by using a deep learning approach. This assertion is important because it is known that the deep learning approach is a strategy by which students extract meaning and understanding from course content [39] thanks to it is a holistic approach to learning [75], which means that sustainability topics can be addressed through the intellect, emotions and values [76]. Therefore, deep learning is relevant in the context of education for sustainability as the range of environmental, social and economic issues require making connections between different aspects using holistic ways of thinking. A measure of the success of implementing sustainability content in the curriculum could be the use of deep learning strategies by students [43].

Finally, according to [76], universities incorporate sustainability in many different ways but the results of this work suggest that educators should pay attention to gender diversity, classroom teaching practices that foster deep learning approaches, disciplinary perspectives and student emotions. It is common knowledge that incorporating sustainability topics into effective pedagogical practice in integrated academic programs is not easy [76]. However, introducing pedagogical practices that foster motivation by gender through strategies that promote a deep learning approach could be the most effective path for EfS.

This makes it necessary to consider that pedagogical practices must be part of the training of future professionals because such practices are not determined solely by the characteristics of the teachers, but also by other variables such as gender diversity, learning approaches and emotions, which foster the processes of planning and design adjusted to student profiles in the context of sustainability courses.

5. Conclusions

The results of the multivariate analysis show the existence of a relationship between the R-SPQ-2F and the A-CEA. The innovative element of this work lies in providing for the first time a combined multivariate graphic representation of learning approaches and coping with academic stress, with regard to which there is scarce previous research. As regards practical implications, the results provided could be used in proposing design strategies and planning processes adjusted to student profiles in the context of sustainability courses.

Certain study limitations should be taken into account. The range of instruments used in the literature impedes rigorous comparison. The difference in sample size between men and women could have consequences in terms of identifying student behavior. It may also be difficult to generalize results, since the academic area and the teaching context and methodology used by teachers may have influenced the responses of students in this analysis. It would therefore be useful in future research to consider the teaching methodology used by teachers in order to identify whether the strategies used to cope with stress are appropriate or not according to the learning approach that is predominant in each student.

Despite its limitations, the findings of this study allow for a better understanding of the studied variables at the university context. Finally, one reflection on the implications of this study for future investigations is that the results provided could be helpful in proposing process design and planning strategies adjusted to the profiles of the students presented in the context of sustainability courses.

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Appendix A. Survey

The survey consisted of three parts. The first part was intended to gather sociodemographic information and its questions are summarized in Table A1. The second part was devoted to evaluating the nature of the learning approaches of the students thanks to the R-SPQ-2F questionnaire, the items of which are detailed in Table A2. The third part the A-CEA questionnaire devoted to evaluating coping with academic stress is detailed in Table A3.

Table A1. Sociodemographic questions of the survey (translated into English).

University:
Areas of knowledge: Arts and Humanities ☐ Health Sciences ☐ Sciences ☐ Social and Legal Sciences ☐ Engineering and Architecture ☐
Academic year: 1st ☐ 2nd ☐ 3rd ☐ 4th ☐ 5th ☐ 6th ☐
Gender: Male ☐ Female ☐
Age: 18–19 years old ☐ 20–21 years old ☐ 22–23 years old ☐ 24–25 years old ☐ older than 25 ☐
In addition to studying, are you currently working? Yes ☐ No ☐
Do you have a scholarship or another kind of financial aid to carry out your studies? Yes ☐ No ☐

Table A2. Items of the R-SPQ-2F questionnaire (translated into English).

DA-01	I find that at times studying gives me a feeling of deep personal satisfaction
DA-02	I have to do enough work on a topic so that I can form my own conclusions before I am satisfied
DA-05	I feel that any topic is highly interesting once I get into it
DA-06	I find most new topics interesting and often spend extra time trying to obtain more information about them
DA-09	I find that studying some academic topics can be as exciting as reading a good novel or watching a good film
DA-10	I test myself as much as is necessary when I study important topics until I understand them completely
DA-13	I work hard at my studies when I think the material or content are interesting
DA-14	I spend a lot of my free time finding out about interesting topics which have been discussed in class
DA-17	I come to most classes with questions in mind that I want answering
DA-18	I make a point of looking at most of the materials that are suggested in class
SA-03	My aim is to pass the course while doing as little work as possible
SA-04	I only study what is given out in class
SA-07	I keep my work to the minimum for topics that I do not find interesting
SA-08	I learn some things by rote, going over and over them until I know them by heart even if I do not understand them
SA-11	I can get by in most assessments by memorizing key sections of a topic without trying to understand them
SA-12	I generally restrict my study to what is set as I think it is unnecessary to do anything extra
SA-15	I find it is not helpful to study topics in depth. It confuses and wastes time, when all you need is a passing acquaintance with topics in order to get by
SA-16	I believe that lecturers should not expect students to spend significant amounts of time studying material that everyone knows will not be examined
SA-19	I see no point in having to learn material which is not required for the examination
SA-20	The best way to pass examinations is to memorize the answers to the most likely questions

Table A3. Items of the A-CEA questionnaire (translated into English).

PR-1	When I am faced with a difficult situation, I ignore the unpleasant aspects and focus on the positive.
PR-4	When I am faced with a difficult situation during exams, I try to remember that I can do things well by myself.
PR-7	When I am faced with a difficulty while I am preparing for exams, I try to think positively.
PR-10	When I am faced with a difficult situation, I do not let the problem beat me; I try to give myself a deadline to resolve it.
PR-13	When I am faced with a difficult situation, I think objectively about it and try to keep my emotions under control.
PR-16	When I am faced with a complex situation, I generally try not to place significance on the problems.
PR-18	When I am faced with a difficult situation, for example during exams, I tend to think that things will end up fine.
PR-20	When I am faced with a difficult situation on the night before an exam, I try to remember that I am prepared to do well.
PR-22	When I am faced with a problem like feeling anxious during an exam, I try to see it as something that is natural and normal in the circumstances.
SS-2	When I am faced with a difficult situation, I express my opinions and seek support.
SS-5	When I am faced with a difficult situation, I ask a trusted family member or friend for advice.
SS-8	When I am faced with a difficult situation, I talk about the problem with other people.
SS-11	When I am faced with a difficult situation, I talk about the stressful elements with my partner, family or friends.
SS-14	When I am faced with a difficult situation, I seek advice and ask other people for help.
SS-17	When I am faced with a difficult situation, I express my feelings and opinions.
SS-21	When I am faced with a difficult situation, I talk to someone to find out more about it.
P-3	When I am faced with a difficult situation, I prioritize tasks and organize my time.
P-6	When I am faced with a difficult situation while I am preparing for exams, I plan how to study for the exams in detail.
P-9	When I am faced with a difficult situation, I come up with an action plan and I follow it.
P-12	When I am faced with a difficult situation while I am preparing for my exams, I focus on what I need to obtain the best results.
P-15	When I am faced with a difficult situation, I organize my personal resources to cope with it.
P-19	When I am faced with a difficult situation, I make a list of the tasks I have to do, I do them one by one and I do not move onto the next task until I have finished the one I am on.
P-23	When I am faced with a difficult situation, I change some things to achieve good results.

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