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RESEARCH ARTICLE

# Structural Analysis of Coping with Pre-Exam Anxiety and Uncertainty (COPEAU) in Peruvian College Students

*Análisis Estructural de la Escala de Afrontamiento ante la Ansiedad e Incertidumbre Pre-examen (COPEAU) en universitarios peruanos*

*Análise estrutural da escala de enfrentamento da ansiedade e incerteza pré-teste (COPEAU) em estudantes universitários peruanos*

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**ABSTRACT.** The objective of this research was analyze the internal structure of Coping with Pre-Exam Anxiety and Uncertainty (COPEAU) in Peruvian college students from a private institution. Participated 312 psychology students (227 women) from the first to sixth term, with age between 16 and 49 (M = 20.54; SD = 4.29). Using the structural equation modeling, five models were assessed, among which the oblique four-factor model shows greater theoretical and empirical coherence.. Also, the reliability indices were appropriate. The practical implications of the results in the context of a broader theory of coping with stress were discussed, as well as the relevance of some procedures in analytical studies-factorial approach.

***Keywords:*** coping, pre-exam anxiety, confirmatory factor analysis, validity, reliability.

**RESUMEN.** El objetivo de la presente investigación fue analizar la estructura interna de la Escala de Afrontamiento ante la Ansiedad e Incertidumbre Pre-examen (COPEAU) en universitarios peruanos de una institución privada. Participaron 312 estudiantes de la carrera de psicología (227 mujeres) del 1er al 6to ciclo, con edades entre 16 y 49 años (M = 20.54; DE = 4.29). Con la metodología de ecuaciones estructurales fueron evaluados cinco modelos, de los cuales el de cuatro factores oblicuos presenta mayor coherencia teórica y empírica. Del mismo modo, los indicadores de confiabilidad son apropiados. Las implicaciones prácticas de los resultados en el marco de una teoría más amplia de afrontamiento al estrés fueron discutidas, así como la pertinencia de algunos procedimientos en los estudios de aproximación analítico-factorial.

***Palabras clave:*** estrategias de afrontamiento, ansiedad pre-examen, análisis factorial confirmatorio, validez, confiabilidad

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**RESUMO.** O objetivo desta pesquisa foi analisar a estrutura interna da escala de enfrentamento da ansiedade e incerteza pré-teste (COPEAU) em estudantes universitários peruanos de uma instituição privada. 312 estudantes de psicologia (227 mulheres) participaram do 1º ao 6º ciclo, com idades entre 16 e 49 anos (M = 20,54; (DE = 4,29). Com a metodologia de equações estruturais foram avaliados cinco modelos, entre eles os de quatro fatores oblíquos apresenta consistência teórica e empírica. Da mesma forma, os indicadores de confiabilidade são adequados. Foram discutidas as implicações práticas dos resultado no âmbito de uma teoria mais ampla de enfrentamento ao estresse, bem como a relevância de alguns procedimentos nos estudos de aproximação analítica-fatorial.

***Palavras chave:*** enfrentamento, estratégias de pré-teste de ansiedade, análise fatorial confirmatória, validade, confiabilidade

The approach used to understand stress and that has deeply influenced research is the transactional model, which defines stress as the relationship between the subject's responses to an event perceived as threatening or exceeding the subject's resources, and that compromises his well-being (Lazarus & Folkman, 1984). This framework can be appropriately applied to the context of college education, since in this context there are events students perceive as stressful that are inherent to this training period. The common stressors that have the greatest impact are usually the excessive load of homework, final exams and the intensity of the studying required for those tasks (Damayanthi, 2014; Gazder, Ahmad & Dainsh, 2014; Martín-Monzón, 2007), and their impact increases when they interact with non-academic stressors (Gibbons & Weingart, 2001). Among stressors, exams (or any other event implying the assessment of contents or of students' abilities), oral presentations, group assignments and pre-exam anxiety have been the main focus of specialized literature.

The last stressor—pre-exam anxiety—is an individual's disposition to experience anxiety states more intensively and frequently than normal, with concerns and irrelevant thoughts that interfere with attention, concentration and taking exams (Spielberger & Vagg, 1995). All of this affects directly the academic performance of students and their well-being (Bausela, 2005; Furlán, Sánchez, Heredia, Piemontesi & Illbele, 2009; Valero, 1999; Villegas, Dominguez, Sotelo & Sotelo, 2015). The perception of this stressor as threatening may occur not only at the effective time of taking the exam, but also in the pre-exam phase, and even after having taken it, which is why understanding this response involves several periods of time related to the exam and to different assessment situations. As with any other stressor in their academic and non-academic life, subjects display coping strategies, which are efforts of an individual to cope with the stressful situation (Monat & Lazarus, 1991).

This way, three processes occur when coping with a stressful situation (Heredia, Piemontesi, Furlán & Pérez, 2008): *primary appraisal*, during which the threat is perceived; *secondary appraisal*, during which the subject evaluates a possible response to the threat perceived; and *coping*, during which the aforementioned response is performed. These components operate dynamically with prior and personal learning experiences, which are assessed according to their effectiveness (Heredia et al., 2008). Specifically, when facing the stressor that the exam represents, the *primary appraisal* considers the exam as a threat at the precise moment it has to be solved. Then, the *secondary appraisal* identifies and decides which actions can be taken by the student in order to cope with the exam. Finally, *coping* involves the fact of taking said action in order to achieve the best possible performance.

There are various approaches regarding ways of coping with stressful situations. One of them indicates that there are two major groups of strategies: *emotion-oriented coping strategies and problem-oriented coping strategies*, considered as dysfunctional and functional aspects, respectively (Folkman, & Lazarus;


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1980; Thoits, 1995). Carver, Scheier and Weintrayb (1989) propose 13 differentiated coping strategies, and Zeidner (1995) groups them in *emotion-oriented coping strategies* (seeking social and emotional support, focus on and venting of emotions, etc.), *problem-oriented coping strategies* (active coping, planning, positive reinterpretation and personal growth, suppression of competing activities, acceptance, and restraint coping) and *avoidance-oriented coping strategies* (behavioral and mental disengagement, denial, etc.).

Exams have particular characteristics that—in a certain way—separate them from most of the stressful events of the academic life and that shape a particular way of coping with them. They are scheduled beforehand by institutions based on the contents taught in the classrooms (they are rarely given unannounced), they are occasionally taken under pressure and students must wait until they know the results they obtained. In view of this, Carver and Scheier's (1994) proposal would be helpful to have a better understanding of the process: the *anticipatory* phase, the *confrontational* phase, the *waiting* phase and the *results* phase, and during each of them coping strategies are applied in order to mitigate the emotional impact of said situation.

According to what has been previously reviewed, during the *anticipatory phase*, the individual focuses on preparation and on regulating his emotions regarding the exam, and since uncertainty tends to be high, negative emotions might appear (Heredia et al., 2008). Under ideal circumstances, this situation would make the student display appropriate strategies in order to minimize the impact of the pre-exam situation by trying to maximize cognitive resources to mitigate the impact of the stress experienced and therefore obtaining a positive result in the assessment. In this sense, this refers to the way of coping with anxiety in a pre-exam situation, a trait that can be easily identified with stress coping strategies, regardless of the specific context of stressors, as it is usually measured in research works. It is reasonable that these strategies may remain relatively inter-contextually invariable in terms of intensity and conceptual structure. Hence, their measurement can be consistent with more general or of high-order strategies.

In order to evaluate this construct in the specific context of academic activity, Stöber (2004) proposed the COPEAU model (*Coping with Pre-Exam Anxiety and Uncertainty*), which is based on the transactional coping model and comprises three constructs: *task-orientation and preparation, seeking social support and avoidance*. The instrument was developed based on two internationally known scales: the COPE (Carver et al., 1989) and the Differential Test Anxiety Inventory (DAI; Rost & Scherner, 1997), from which items were taken and then modified for the specific exam situation the COPEAU measures.

There is some evidence with respect to the relationship between pre-exam coping strategies and academic behavior in this context. For instance, Stöber (2004) found that *test anxiety* is linearly and positively correlated to the pre-exam coping strategies of *seeking social support and avoidance*, and negatively correlated to the strategy of *task-orientation and preparation*. Although these relationships are not high, they indicate that this covariation may still have a practical impact and that they are theoretically consistent. More recently, another independent study (Putwain, Connors, Symes & Douglas-Osborn, 2012) used the COPEAU model and obtained similar results. Thus, this correlational pattern seems to be replicable. This is important because although the coping strategy chosen is not directly related to performance (Carver et al., 1989; Heredia et al., 2008), it does share commonalities with the anxiety level experienced in an exam situation (Putwain et al., 2012), and it can have a moderating effect of this experience, which would ultimately affect academic performance in a direct way (Heredia et al., 2008).

To date, international studies of evaluation of its psychometric properties in different cultural context seem to be few. Therefore, the replicability of the COPEAU's structure is an open question. For the initial proposal in Germany (Stöber, 2004), a main component analysis (MCA) with varimax rotation was performed, determining the extraction of three components by using a parallel analysis (Horn, 1965). Afterwards, for the Argentinian adaptation (Heredia et al., 2008), the analytical strategy used by the author was replicated, and despite the fact that four factors were determined by using a parallel analysis (two factors were


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maintained, but the factor of *seeking social support* was divided into *seeking instrumental social support* and *seeking emotional social support)*, the content and theoretical analysis led to maintain the original structure of three subscales (Stöber, 2004). In the same study, some items show minimally appropriate loads of components (< .40; Dominguez, Villegas & Padilla, 2013; Zwick & Velicer, 1986).

When compared to the factor analysis itself, the use of MCA is problematic, as this technique differs in terms of the items' scope and parameters estimation, as it is essentially a method of reduction of variables (Ferrando & Anguiano-Carrasco, 2010; Henson & Roberts, 2006) for identifying composition measurements (components) reproducing the maximum possible variance of each variable observed (Lloret-Segura, Ferreres-Traver, Hernández-Baeza & Tomás-Marco, 2014). For estimating the items' parameters, the common variance and the unique variance are not separated (combination of specific and error variance), and therefore the variance extracted contains both sources. Taking into consideration that the goal of performing a factor analysis is to know the source of the common variance (Henson & Roberts, 2006), the MCA is used without considering any underlying structure caused by latent variables (Costello & Osborne, 2005). For these reasons and with no clear justification, the MCA could not be the most appropriate alternative for exploring dimensionality (Lloret-Segura et al., 2014). Additionally, the varimax rotation used in the COPEAU studies (Heredia et al., 2008; Stöber, 2004) does not seem to be justifiable, since its use maintains the presumption that latent variables are independent (orthogonal) among them, while theoretically it may be argued that coping strategies show co-variation to some degree. These methodological issues leave still unanswered the question of which is the most precise way to estimate the COPEAU's internal validity in terms of the relationship among its constructs.

With respect to the reliability of the scores observed, the use of the α coefficient can be justified, since the six answer options of its items can satisfy the presumption of continuous variables (Lloret-Segura et al., 2014; Remthulla, Brosseau-Liard & Savalei, 2012). Nevertheless, the compliance with the tau-equivalent measurement model of the items (equal factor loads) is more critical. In this vein, in the setting coefficients of previous studies (Heredia et al., 2008), some heterogeneity can be seen regarding the structure of three factors (F1: range .535 - .832; F2: range .450 - .728; F3: range .557 - .833) as well as regarding that of four factors (F1: range .487 - .831; F2: range .437 - .685; F3: range .676 - .755; F4: range .706- . 864), and this could put into question the premise that the α coefficient is the most appropriate one (Dominguez-Lara, Merino-Soto & Navarro-Loli, 2016).

In the light of all the arguments presented and based on the shortage of instruments in Spanish directly focused on coping with pre-exam stress, the objective of this research is to evaluate the COPEAU's measurement structure by modeling structural equations in a new college context such as that of Peru in order to identify an aspect of validity and reliability evidence that may be used as a baseline for evaluating other valid sources and whose later use may allow to understand the coping behavior of students and to describe it accurately in order to target psychological and tutorial interventions.

## METHOD

### Participants

The sampling approach used was purposive and according to the access the authors had to the college participating in the study. The sample was composed by 312 college students (227 of whom were women) of the Psychology program of a private college located at the central part of the Lima Metropolitan Area (Peru), at a district of predominantly middle and low-middle socioeconomic level. Participants belonged to the following terms of study: 36.9% were 1st and 2nd-term students, 34.3% were 3rd and 4th-term students, and 25% were 5th and 6th-term students (3.8% did not enter that information). The range of age was between 16 and 49 years (M = 20.54; SD = 4.29), and the distribution regarding the gender of participants was similar (t[294] = .603; p =.547).

### Instruments

Coping with Pre-Exam Anxiety and Uncertainty (COPEAU; Stöber, 2004). It is composed by 21 items of six answer options based on the frequency of a specific


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behavior (rated from *Never* to *Always*). It is composed by the scales *task-orientation and preparation* (seven items), *seeking social support* (seven items) and *avoidance* (seven items), and independent scores are obtained for each scale. There are instructions for answering how anxiety and uncertainty are coped with when an important exam approaches. All items are oriented to the presence of a specific behavior of pre-exam coping strategies. Therefore, high scores allow to identify a higher frequency of use of these strategies. The scales' internal consistency, according to previous studies, varied between .70 and .87 (Heredia et al., 2008; Stöber, 2004). This research used the Argentinian version developed by Heredia et al. (2008).

**Procedure**

An instrumental research was conducted (Ato, López & Benavente, 2013; Montero & León, 2007) with the objective of evaluating the psychometric properties of the COPEAU's Argentinian version in the context of a private college at the Lima Metropolitan Area. After coordination with college authorities, the project was approved by the Instituto de Investigación de Psicología (Psychology Research Institute) of the college where the study was conducted, taking into consideration ethical and procedural aspects of the research. Students were evaluated during class time, and were asked to collaborate verbally as well as through an informed consent.

Once data were collected, a descriptive analysis of the items was carried out in order to evaluate their psychometric behavior and determine the compliance with some statistical assumptions. Regarding the structural analysis, a confirmatory factor analysis was carried out by using the EQS 6.2 software (Bentler & Wu, 2012) and the maximum likelihood method. Given the possibility that items may present accentuated asymmetry or kurtosis due to the ordinal nature of the items and/or of the constructs evaluated (Lei & Wu, 2012), a polychoric correlation matrix was used (Lee, Poon & Bentler, 1995), as it can efficiently estimate the continuous variables underlying ordinal items (Bentler, 2010; Dominguez, 2014; Holgado-Tello, Chacón-Moscoso, Barbero-García & Vila-Abad, 2010). Nevertheless, since, based on the sample size, undefined solutions and *Heywood* cases (with a degree of saturation greater than one unit) may result, analysis with covariance matrices were also carried out assuming that items are continuous variables, as they present six answer options (Lloret-Segura et al., 2014). In both cases, a fit to the $x^2$ test was applied to control the effect of the variables' lack of normality (Satorra & Bentler, 1994; SB-x2).

With respect to the fit values of proposed models, the *Root Mean Square Error of Approximation* (RMSEA $\leqslant$ 0.05; Steiger & Lind, 1980), the *Comparative Fit Index* (CFI $\geqslant$ 0.95; Bentler, 1990) and indexes based on the *Akaike's Information Criterion* (AIC; Akaike, 1987) and on the Consistent Akaike's Information Criterion (CAIC; Bozdogan, 1987) were used, as, when applied altogether, more information that allows to decide a model's appropriateness can be obtained (Ferrando & Anguiano-Carrasco, 2010; Hair, Anderson, Tatham & Black, 2005; Ruiz, Pardo & San Martín, 2010). In the modeling process, the models defended in previous literature were initially evaluated: Stöber's three-factor model (*task-orientation, avoidance and seeking social support*) and the four-subscale model proposed by Heredia and collaborators (*task-orientation*, *avoidance*, *seeking support for instrumental reasons* and *seeking support for emotional reasons*). Although the authors of both studies took into consideration the orthogonality level among components, in this study the obliquity of factors was evaluated in order to determine the inter-factor correlation.

Furthermore, the possible degree of factor complexity was observed by means of the inspection of the structure coefficients (Graham, Guthrie & Thompson, 2003; Thompson, 1997), since the magnitude established as appropriate by previous literature ($r > .32$; Dominguez et al., 2013; Tabachnik & Fidell, 2001) indicates that there must be a minimum of 10% shared variability among factors in order to consider them as related, but said rule has no robust conceptual basis allowing it to be applied in a general way for any construct or allowing to determine the complete independence of factors (orthogonality) if the magnitude of the setting coefficients is lower. The proposal of correlated factors (obliquity) converges with evidence that does not generally support the complete independence of coping-related areas.


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In order to determine evidence of convergent internal validity, the average variance extracted (AVE) will be used considering .50 as the cut-off point or values slightly lower, taking into account the conceptual basis of the constructs studied (Fornell & Lacker, 1981; Hair et al., 2005; Fernández, Juarez & Merino, 2015). And to determine the discriminant validity between two factors, the criterion considered will be that the AVE has to be greater than the shared variability between two factors (Dominguez & Merino, 2015a; Fernández et al., 2015).

Finally, in order to support previous conclusions, a *functionally integrated bifactor model* is proposed, in which the last two factors proposed by Heredia and collaborators (*seeking support for instrumental reasons* and *seeking support for emotional reasons*) are affected by a general factor that would be the one proposed by Stöber (*seeking social support*), which is modeled together with the first two factors included in the preliminary studies (*task-orientation* and *avoidance*). Said modeling is performed considering the factors' obliquity. This last model is proposed in order to determine whether the general factor initially mentioned (*seeking social support*) is empirically important or not (Dominguez, 2015; Reise, 2012; Reise, Moore & Haviland, 2010), which would provide additional comparative evidence between the three-factor model and the four-factor model (Domínguez-Lara, 2016). This will be performed by analyzing various coefficients: the hierarchical ω (ωh; Zinbarg, Yovel, Revelle & McDonald, 2006) for factors involved in the *functionally integrated bifactor model* using the Omega software (Watkins, 2013); the ECV (*Explained Common Variance*; Reise, Scheines, Widaman, & Haviland, 2013), which indicates the amount of common variance due to the general factor (values greater than .60 are expected, which indicates that there is little common variance among factors beyond that of the general factor); and the PUC (*Percentage of Uncontaminated Correlations*; Reise et al., 2013), which indicates the percentage of correlations not contaminated by multidimensionality (Rodriguez, Reise & Haviland, 2016).

After identifying the measurement model, the descriptive measures were reported and, among them, the standardized skew index (SSI; Malgady, 2007) for evaluating the degree of asymmetry of each of the items. Likewise, the possible *floor effect* and *ceiling effect* were estimated by using the percentage of subjects that obtained the lowest possible result and the highest possible result, respectively, considering it as a difficulty when 15% or more of the sample shows any of those characteristics (Terwee et al., 2007).

In respect of the internal consistency analysis of the scores observed, it was carried out using the α coefficient (Cronbach, 1951), and regarding the reliability of the construct, the ω coefficient (McDonald, 1999) was used for each of the factors obtained. Finally, the confidence intervals of the α coefficient will be included with the aim of obtaining the estimation at the population level (Romano, Kromrey & Hibbard, 2010; Romano, Kromrey, Owens & Scott, 2011) by using the Fisher method (1950) through the *ICAlfa* module (Dominguez & Merino, 2015b).

## RESULTS

### Data descriptive analysis and initial exploration

All items showed similar asymmetry and in levels that can be considered between trivial and moderate (SSI < .25), but when the Mardia coefficient (1970) was evaluated, noncompliance with the assumption of multivariate normality was observed (85.614), which exceeds the limits considered appropriate (> 70; Rodríguez & Ruiz, 2008) and could affect estimations based on the maximum likelihood method. Therefore, the argument for the decision of using the SB-$x^2$ correction would be appropriate for these data. Furthermore, some items show *ceiling effect* or *floor effect*, which suggests that the response range tends to be truncated.

### Evidence of internal structure

The original model proposed by Stöber ($M_1$, three orthogonal factors) produced low fit indexes in the analysis with polychoric matrices as well as in the analysis with covariance matrices (Table 2). An analysis of each item revealed that item 7 (*"I convince myself that not everything is wrong"*) shows a setting coefficient near zero (λ7= .022) in the corresponding factor (*avoidance*) and, for this reason, it was decided to evaluate an alternative model that does not include it ($M_2$), but the


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Table 1
*Statistical descriptions of the COPEAU's items*

| | M | SD | g1 | g2 | SSI | % Min | % Max |
|---|---|---|---|---|---|---|---|
| **Item 1** | 2.77 | 1.28 | .505 | -.220 | .155 | 17.9 | 2.6 |
| **Item 2** | 3.97 | 1.22 | -.233 | -.610 | -.078 | 2.2 | 9.3 |
| **Item 3** | 3.13 | 1.40 | .408 | -.529 | .104 | 12.2 | 7.4 |
| **Item 4** | 2.96 | 1.22 | .531 | -.077 | .179 | 9.6 | 3.2 |
| **Item 5** | 3.16 | 1.43 | .332 | -.617 | .082 | 13.1 | 8.0 |
| **Item 6** | 4.24 | 1.27 | -.400 | -.536 | -.123 | 2.2 | 17.6 |
| **Item 7** | 4.20 | 1.38 | -.466 | -.563 | -.123 | 4.5 | 19.2 |
| **Item 8** | 2.88 | 1.36 | .471 | -.513 | .127 | 16.7 | 3.8 |
| **Item 9** | 3.11 | 1.42 | .445 | -.522 | .11 | 12.8 | 8.0 |
| **Item 10** | 3.96 | 1.47 | -.061 | -1.165 | -.014 | 2.9 | 20.5 |
| **Item 11** | 4.02 | 1.26 | -.013 | -.757 | -.004 | 1.6 | 15.4 |
| **Item 12** | 3.31 | 1.34 | .339 | -.602 | .094 | 7.1 | 7.4 |
| **Item 13** | 3.79 | 1.34 | .077 | -.975 | .021 | 2.2 | 12.2 |
| **Item 14** | 2.88 | 1.30 | .571 | -.175 | .169 | 13.5 | 4.5 |
| **Item 15** | 2.80 | 1.41 | .676 | -.429 | .17 | 16.7 | 5.1 |
| **Item 16** | 2.81 | 1.35 | .542 | -.364 | .148 | 17.9 | 4.2 |
| **Item 17** | 3.45 | 1.37 | .078 | -.698 | .021 | 8.3 | 7.7 |
| **Item 18** | 3.89 | 1.36 | -.143 | -.941 | -.039 | 3.5 | 11.9 |
| **Item 19** | 2.80 | 1.27 | .705 | .010 | .22 | 12.8 | a3.5 |
| **Item 20** | 4.36 | 1.27 | -.531 | -.261 | -.165 | 2.6 | 20.8 |
| **Item 21** | 3.97 | 1.35 | -.034 | -.889 | -.009 | 2.9 | 17 |

**Note:** *N= 312; M: arithmetic mean. SD: standard deviation. g1: Fisher's asymmetry. g2: Fisher's kurtosis. SSI: Standardized Asymmetry Index. % Min: Percentage of people who obtained the minimum value. % Max: Percentage of people who obtained the maximum value.*

Table2
*Fit indexes of the COPEAU's measurement models*

| Models | SB-$x^2$ (gl) | CFI | RMSEA (IC 90%) | AIC | CAIC |
|---|---|---|---|---|---|
| $M_1^a$ | 488.241** (189) | .917 | .072 (.064, .080) | 116.24 | -765.957 |
| $M_1^b$ | 583.426** (189) | .797 | .082 (.074; .089) | 205.43 | -.691.002 |
| $M_2^a$ | 452.70** (170) | .919 | .073 (.065, .081) | 112.70 | -693.612 |
| $M_2^b$ | 521.078**(170) | .816 | .081 (.073; .089) | 181.08 | -625.232 |
| $M_3^a$ | 433.3134** (170) | .924 | .071 (.062, .079) | 93.31 | -712.997 |
| $M_3^b$ | 480.308** (170) | .837 | .077 (.068; .085) | 140.31 | -666.003 |
| $M_4^a$ | 314.494** (164) | .957 | .054 (.045, .063) | -13.51 | -791.358 |
| $M_4^b$ | 352.237** (164) | .901 | .061 (.051; .069) | -24.24 | -753.616 |
| $M_5^a$ | 269.281** (160) | .969 | .047 (.037; .056) | -50.72 | -809.599 |
| $M_5^b$ | 306.160** (160) | .923 | .054 (.045; .063) | -13.84 | -772.721 |

**Note:** *M1: three orthogonal factors (Stöber, 2004); M2: M1 without items 7; M3: four orthogonal factors (Heredia et al., 2008); M4: four oblique factors; M5: functionally integrated bifactor model. a: indexes obtained with the polychoric matrix; b: indexes obtained with the covariance matrix; ** p < .001.*

fit indexes did not improve significantly. Afterwards, the four-factor model proposed by Heredia et al. (2008) was evaluated, considering them as being orthogonal ($M_3$) as well as oblique factors ($M_3$). The proposal that defends orthogonality ($M_3$) is not well supported in the results in any of the conditions that were analyzed (polychoric and covariance matrices). Furthermore, the oblique factor model ($M_4$) shows a more satisfying fit with the polychoric matrices in contrast with the results obtained with the covariance matrices (Table 2). Since neither *Heywood* cases nor any other anomalies are produced in the results of the analysis with polychoric matrices, these will be considered as the most appropriate results so far (Table 2).

With respect to the pattern coefficients, or factorial loading (λc) observed in $M_4$, appropriate magnitudes are observed (average λc = .709, .532, .754 and .765 for each factor, respectively). Additionally, structure coefficients of factors are reported (λe; Graham et al., 2003; Thompson, 1997) in order to evaluate the relationship between the items and the other factors (Table 3), and it was observed that the items *task-orientation* (F1) and *avoidance* (F2) strongly converge with their own factors and also remain discriminatory with regard to the other factors (low λc, around < .27).
In order to evaluate the internal discriminant validity (Table 3), the average variance extracted (AVE) was compared to the variance shared among factors ($R^2$). Factor F1 and F4 show less shared variance that the rest, showing a good discriminatory validity. Furthermore, regarding the last two factors of Heredia's proposal (*seeking support for instrumental reasons* and *seeking support for emotional reasons*), it was observed that the factor seeking support for instrumental reasons shows an AVE of .57, whereas the factor seeking support for emotional reasons shows an AVE of .60, and since they show a shared covariance ($R^2$) of .42, a certain degree of empirical independence would be considered, which is an argument aligned with the theoretical framework supporting the instrument (Carver et al., 1989) that considers both processes as related but independent.

The second analysis carried out points towards a functionally integrated bifactor model (M5), modeling it in such a way so that items belonging to the last two factors proposed by Heredia et al. (2008) (*seeking support for instrumental reasons* and *seeking support for emotional reasons*) are mainly affected by a general factor (Figure 1), which would be the one proposed by Stöber (2004) (*seeking social support*). This procedure is carried out together with the first two factors included in the preliminary studies (*task-orientation and avoidance*).

When carrying out the modeling taking into consideration the general factor's obliquity (*seeking social support*) with the other two (*task-orientation and avoidance*), in the analysis carried out with the polychoric matrix, a Heywood case as well as a positive undefined matrix were produced. For this reason, it was decided to consider data from the analysis performed with the covariance matrix, and even though fit indexes are not entirely satisfying, they are close to what is proposed by specialized literature (Table 2).

According to the results obtained (Table 4), the general factor (*seeking social support*) shows a greater influence on the seven items evaluated in comparison with the other two factors presented (*seeking support for instrumental reasons* and *seeking support for emotional reasons*): the average λc of each factor (.547 and .214, respectively) are lower than those of the general factor (.643) as well as the AVE, and the $\omega_h$ reliability of the general factor in comparison with the $\omega_h$ of the factors suggest than items go in the direction of the general factor. Likewise, the ECV favors the general factor.

Despite the evidence presented, items do not show a stable pattern of belonging: some show λc of greater magnitude in the general factor than in the specific factors and vice versa, others (e.g. item 3) even show setting coefficients of a not insignificant magnitude in both factors (specific and general), which poses difficulties for interpreting each of them. Hence, considering the interpretability of factors obtained in $M_4$ as well as in $M_5$, and the use that will be given to the instrument, the solution of four oblique factors ($M_4$) proves to be more parsimonious due to its empirical coherence and conceptual bases.

In this vein, the internal evidence of convergent validity of the oblique four-factor model ($M_4$) was evaluated


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Table 3

*Statistical descriptions, parameters of the oblique model's items (M4), internal evidence of convergent and discriminant validity, and reliability*

| Item | F1 | F2 | F3 | F4 | $h^2$ |
|---|---|---|---|---|---|
| Item 2 | **.573** | -.105 | .189 | .189 | .328 |
| Item 6 | **.712** | -.131 | .234 | .234 | .507 |
| Item 11 | **.592** | -.109 | .195 | .195 | .350 |
| Item 13 | **.720** | -.132 | .237 | .237 | .518 |
| Item 18 | **.824** | -.152 | .271 | .271 | .679 |
| Item 20 | **.764** | -.141 | .251 | .251 | .584 |
| Item 21 | **.777** | -.143 | .256 | .256 | .604 |
| Item 4 | -.068 | **.370** | .117 | .072 | .137 |
| Item 10 | -.069 | **.375** | .118 | .073 | .141 |
| Item 12 | -.080 | **.433** | .136 | .084 | .187 |
| Item 14 | -.095 | **.515** | .162 | .100 | .265 |
| Item 15 | -.140 | **.762** | .240 | .149 | .581 |
| Item 19 | -.136 | **.739** | .233 | .144 | .546 |
| Item 5 | .245 | .235 | **.746** | .483 | .557 |
| Item 16 | .268 | .257 | **.815** | .528 | .664 |
| Item 17 | .230 | .221 | **.700** | .454 | .490 |
| Item 1 | .184 | .126 | .419 | **.647** | .419 |
| Item 3 | .243 | .167 | .553 | **.854** | .729 |
| Item 8 | .183 | .125 | .417 | **.643** | .413 |
| Item 9 | .261 | .179 | .594 | **.916** | .839 |
| AVE | .51 | .31 | .57 | .60 | |
| F1 | 1 | .034 | .108 | .081 | |
| F2 | -.184 | 1 | .099 | .038 | |
| F3 | .329 | .315 | 1 | .420 | |
| F4 | .285 | .195 | .648 | 1 | |
| ω | .88 | .71 | .80 | .85 | |
| α | .87 | .69 | .78 | .84 | |
| CI 95% α | .84 - .89 | .62 - .74 | .73 - .82 | .80 - .87 | |
| M | 28.24 | 18.712 | 9.42 | 11.888 | |
| SD | 6.78 | 5.00 | 3.45 | 4.49 | |
| g1 | -.148 | .421 | .42 | .357 | |
| g2 | -.474 | -.085 | -.25 | -.27 | |

**Note:** *F1: Task-orientation; F2: Avoidance; F3: Seeking support for instrumental reasons; F4: Seeking support for emotional reasons; Setting coefficients appear in bold. Structure coefficients appear in italics. AVE: Average Variance Extracted. Covariances among factors can be found in the lower part of the diagonal. Factors' shared variance can be found in the upper part of the diagonal. ω: omega coefficient. α: alpha coefficient. CI: confidence interval; M: arithmetic mean. SD: standard deviation. g1: Fisher's asymmetry. g2: Fisher's kurtosis.*


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reviewing the t values corresponding to the setting coefficients. This way, the t values obtained were 9.999, 10.374, 14.805, 17.060, 20.836, 22.614 and 28.361 for F1 (*task-orientation*); 4.924, 5.658, 6.366, 7.351, 14.134 and 14.597 for F2 (*avoidance*); 15.078, 17.544 and 24.100 for F3 (*seeking support for instrumental reasons*); and 13.459, 13.630, 32.006 and 46.961 for F4 (*seeking support for emotional reasons*). All values are statistically significant ($p < .001$).

Finally, in the internal consistency analysis, the scores' α and ω coefficients showed similar values (Table 3) and of appropriate magnitudes (Merino, Navarro & García, 2014).

## DISCUSSION

Based on the evidence presented, the model showing a better fit and better conceptual foundations, and that would facilitate the understanding of pre-exam coping is that of the four related factors. While the instrument's author (Stöber, 2004) conceived its third factor (*seeking social support*) as a single factor, empirical evidence found in the Argentinian study (Heredia et al., 2008) as well as in the theoretical

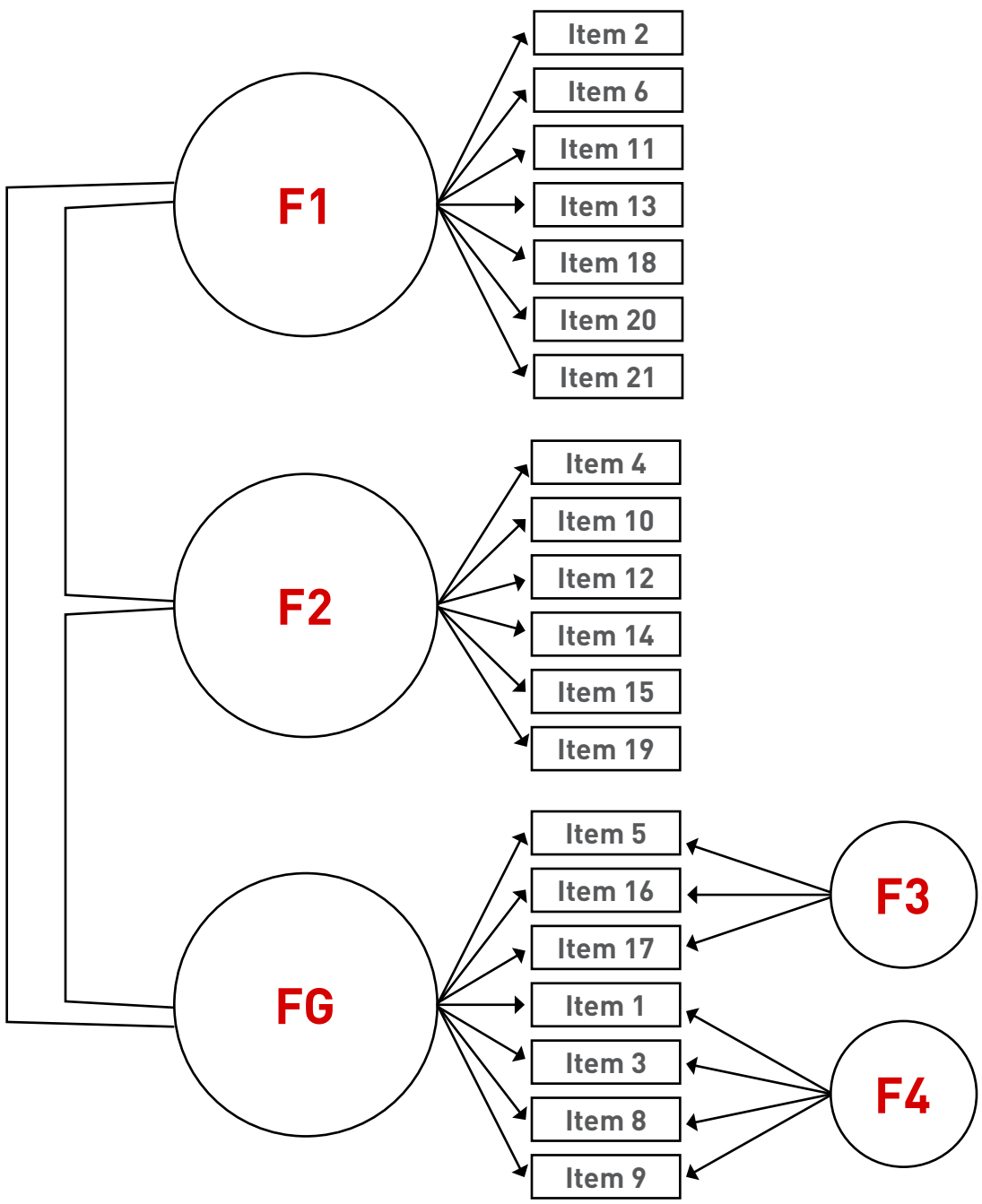


Figure 1: *COPEAU's functionally integrated bifactor measurement model (M5). F1: Task-orientation; F2: Avoidance; F3: Seeking support for instrumental reasons; F4: Seeking support for emotional reasons; FG: Seeking support*


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framework (Carver et al., 1989) say that even if *seeking support for instrumental reasons* and *seeking support for emotional reasons* can occur simultaneously, they are conceptually different, which would justify a certain degree of empirical independence. Besides, it does not seem to stem from the factors' orthogonality, as covariances found among factors are of moderate magnitude, and considering them completely independent among each other could lead to interpretation errors regarding the relationship among factors (Graham et al., 2003; Thompson, 1997). It is important to point out that this is the first COPEAU study conducted using the SEM methodology, which provided the conditions to evaluate the fit of both models and determine the appropriateness of one of them, at least for this sample. The orthogonal three-factor model proposed by the instrument's author and subscribed by Heredia and collaborators (2008) was tested, which showed a poor fit, and even though an item whose setting coefficient was not significant was removed (item number seven), that did not improve said model. Once that was ruled out, the oblique four-factor model showed a reasonable fit, although a moderate covariation was observed between two factors (*seeking support for instrumental reasons* and *seeking support for emotional reasons*).

It is known that for elaborating instruments that evaluate different dimensions of a complex construct, the factors' conceptual and empirical differentiation is needed, as, while a moderate covariation can lead to the assumption of the existence of a higher hierarchy factor (Reise, 2012; Thompson, 1997), each of them has to maintain its individuality so that the findings are interpretable regarding the factor being analyzed. This way, three elements may provide evidence of such differentiation: the AVE (*average variance extracted*) comparison of a factor with the variance shared with other factor (closely related to multicollinearity), the evaluation of a hierarchical bifactor model and the analysis of the instrument's theoretical foundations. On the basis of that analysis, evidence supporting the four-factor model—and not the three-factor model—was obtained, which would support Carver's original postulate regarding the fact that seeking help for emotional as well as for instrumental reasons are separate processes.

It is worth highlighting the methodological improvements achieved in comparison with previous studies, which, by using the SEM methodology, seek more appropriate procedures for analyzing COPEAU's items. Said procedures allow to know aspects that might have had an influence on the results obtained, either in favor of them or against them. For instance, the items' descriptive analysis in this study allowed to explore the presence of *ceiling effect* and of *floor effect*, which were present in some items. Furthermore, a closer analysis of the item's asymmetry level as well as an analysis of the items' multivariate normality allowed to implement procedures that minimized the impact of such circumstances, especially in cases where the items' normality is assumed and procedures working appropriately under that condition were used (e.g. Pearson product-moment correlation). Moreover, calculating a reliability coefficient that is not too restrictive in terms of its conditions, such as the α coefficient, was necessary, and it was the right decision. Finally, a methodological analysis of the factor extraction process carried out by the authors of preliminary studies was necessary (Heredia et al., 2008; Stöber, 2004), which was clearly of little relevance.

Having a validated version of the COPEAU—with main focus on college mentorship—in the local population will be of great use for students' assessment and orientation processes, within the framework of an orientation towards managing emotions in assessment situations, as they are associated with low academic performance (Bausela, 2005; Furlán et al., 2009; Valero, 1999; Villegas et al., 2015). Regarding this point, it would be fitting to act in a preventive manner. In this sense, the COPEAU would allow to identify students with inappropriate coping strategies in the pre-exam phase. Furthermore, research oriented to evaluate the relationship between pre-exam coping and other variables could be carried out in order to know their determinants and be able to take actions regarding them. Moreover, explanatory models could even be proposed.

This study had some limitations, mainly regarding the composition of the sample (psychology students and mostly women), so it would be interesting to


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Table 4
*Functionally integrated oblique bifactor model (M5)*

| Item | F1 | F2 | F3 | F4 | FG | $h^2$ |
|---|---|---|---|---|---|---|
| Item 2 | .554 | | | | | .307 |
| Item 6 | .689 | | | | | .474 |
| Item 11 | .584 | | | | | .341 |
| Item 13 | .705 | | | | | .497 |
| Item 18 | .814 | | | | | .663 |
| Item 20 | .754 | | | | | .569 |
| Item 21 | .766 | | | | | .587 |
| Item 4 | | .343 | | | | .118 |
| Item 10 | | .409 | | | | .167 |
| Item 12 | | .446 | | | | .199 |
| Item 14 | | .474 | | | | .225 |
| Item 15 | | .717 | | | | .514 |
| Item 19 | | .712 | | | | .507 |
| Item 5 | | | .383 | | .566 | .467 |
| Item 16 | | | .740 | | .500 | .798 |
| Item 17 | | | .517 | | .449 | .469 |
| Item 1 | | | | .001 | .708 | .501 |
| Item 3 | | | | .690 | .724 | 1.000 |
| Item 8 | | | | -.190 | .779 | .642 |
| Item 9 | | | | .354 | .777 | .729 |
| AVE | .491 | .288 | .321 | .159 | .43 | |
| F1 | 1 | .015 | - | - | .102 | |
| F2 | -.124 | 1 | - | - | .050 | |
| F3 | - | - | 1 | - | - | |
| F4 | - | - | - | 1 | - | |
| FG | .320 | .224 | - | - | 1 | |
| ω | .827 | .656 | .797 | .896 | .908 | |
| $\omega_h$ | - | - | .430 | .068 | .777 | |
| ECV | - | - | - | - | .653 | |
| PUC | - | - | - | - | .572 | |

*F1: Task-orientation; F2: Avoidance; F3: Seeking support for instrumental reasons; F4: Seeking support for emotional reasons; FG: Seeking support; AVE: Average variance extracted; Covariances among factors can be found in the lower part of the diagonal. Factors' shared variance can be found in the upper part of the diagonal; ω: omega coefficient; ωh: hierarchical omega coefficient.*


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evaluate measurement invariance models later on by undergraduate program and by sex, but with larger samples. Furthermore, it would be fitting to integrate those constructs into a broader model that allows to understand their interaction with other constructs equally relevant for academic performance, such as academic self-efficacy, academic procrastination, etc.

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