Duazary / Vol. 16, No. 2 - 2019 / 205 - 218
Doi: http://dx.doi.org/10.21676/2389783X.2744

Psychometric properties of the revised two-factor study process questionnaire - R-SPQ-2F. Spanish version

Propiedades psicométricas del cuestionario de procesos de estudio revisado 2-factores CPE-R-2F en español

Clara Vergara-Hernández[1], Miguel Simancas-Pallares[2], Zoila Carbonell-Muñoz[3]

Typolgy: Article of Scientific and technological research articles
To cite this article: Vergara-Hernández C, Simancas-Pallares M, Carbonell-Muñoz. Psychometric properties of the revised two-factor study process R-SPQ-2F Spanish version. Duazary. 2019 may; 16(2): 205-218. Doi: http://dx.doi.org/10.21676/2389783X.2744

Received on January 30, 2018
Accepted on December 27, 2018
Published online february 20, 2019

ABSTRACT

The aim of this research was to evaluate the psychometric properties (construct validity and internal consistency) of the Revised Two-Factor Study process questionnaire (R-SPQ-2F) in health science students from Cartagena, Colombia. We performed a validation study without a standard in by 587 health science students. The number of factors that explained the construct was determined using an exploratory factor analysis. Confirmatory factor analysis determined construct validity, and internal consistency was determined by Cronbach's Alpha. R-SPQ-2F showed a mean value of 66.01 ±12.3 with a minimum of 36 and a maximum of 99. EFA showed a two-factor solution that accounted for the 42.5% of the explained variance. However, CFA showed the following fit indices $X^2 = 962.783$; *df* = 166; RMSEA = 0.075 (90% CI: 0.070-0.079); CFI = 0.833; TLI = 0.866. R-SPQ-2F is a scale with acceptable internal consistency and a two-factor structure with questionable construct validity. Nevertheless, it shows a practical utility on research related to learning strategies for higher education. Additional research on psychometric properties in other similar samples is recommended for future research.

Keywords: factor analysis; reproducibility of results; higher education; health occupation students.

RESUMEN

El objetivo del presente estudio fue evaluar las propiedades psicométricas del cuestionario de procesos de estudio revisado – 2 factores (CPE-R-2F) en estudiantes de ciencias de la salud en Cartagena, Colombia. Estudio de validación de escalas, sin patrón de referencia en 857 estudiantes que respondieron el CPE-R-2F. Para determinar el número de factores que explicaban el constructo se condujo análisis de factores (exploratorio). El análisis de factores confirmatorio determinó la validez de constructo y el alfa de Cronbach la consistencia interna del instrumento. El

1. Universidad de Cartagena. Cartagena, Colombia. Email: cvergarah@unicartagena.edu.co - http://orcid.org/0000-0002-6834-813X
2. University of North Carolina. Chapel Hill, Estados Unidos de América; Universidad de Cartagena. Cartagena, Colombia. Email: msimancasp@unicartagena.edu.co - http://orcid.org/0000-0003-2292-416X
3. Universidad de Cartagena. Cartagena, Colombia. Email: zcarbonellm@unicartagena.edu.co - http://orcid.org/0000-0003-4487-0350

CPE-R-2F mostró un puntaje medio de 66,01±12,38 con mínimo 36 y máximo 99. El AFE mostró una solución de dos factores que explicó el 42,56% de la varianza total. El AFC mostró como índices de ajuste χ2: 962.783; gl: 166; RCEMA: 0,075, IC 90%: 0,070 – 0,079); ICA: 0,883 e ITL: 0,866. CPE-R-2F es una escala con aceptable confiabilidad y estructura factorial bidimensional de cuestionable validez de constructo que muestra utilidad en estudios relacionados con el análisis de estrategias de aprendizaje en educación superior. Es recomendable seguir investigando sobre sus propiedades psicométricas en el futuro en otras poblaciones similares.

Palabras clave: análisis factorial; reproducibilidad de resultados; educación superior; estudiantes del área de la salud.

INTRODUCTION

Learning is a complex process that incorporates diverse phases and wherein personal variables and interconnected contexts intervene[1]. On top of this, in searching for the development of the teaching-learning process (TL-P), the educational Colombian system in Colombia is based on the participation of two protagonists: the teacher and the student[2]. However, it is the student who is typically immersed in this process being the one directly involved by interest in his or her own formation and reaching his or her goals. This is the reason why the pedagogical approaches employed by universities do not center on the professor. The student plays a fundamental role being the most important part in the construction of knowledge.

This being how things are, Education should be understood as a natural process that emerges from within an individual and not an imposition. It is a process that seeks the student's personal growth and thus the development of all of the student's capabilities for the achievement of one final goal: learning. It also demands a commitment on the part of the pupil so that a real transformation, which includes the social and human self to the benefit of others, can exist.

In this way, the Teaching-Learning Process (TLP) will find itself influenced by diverse learning approaches (LA). LA are considered a form of the student learning style, learning styles being understood as an expression of cognitive style and personality, linked to specific and situational motives and strategies[3]. Likewise they encompass the student's intention to learn and how the student learns (process)[1]. This is how the Students' Approaches to Learning (SAL) theory conceives learning as a design of Students and Teachers, taking into account the educational and cultural context where the process develops[4]. This theory, proposed by Biggs in 1989[5], assumes three intervening factors in the learning approach that a student adopts: promise, precess, and product (3P). In *premise,* factors related to the student known as preferential learning approaches (previous knowledge and abilities), as well as others related to the Teacher (objectives, evaluation, environment, institutional teaching processes) intervene. *Processes*, for their part, are focused on activities related to learning (developed approaches to learning). Finally, *product* describes the results of learning (deeds, competencies and obtained grades) and can be recognized as a contextual learning approach[5].

Some recent investigations suggest modifications to this 3P theory (Biggs' ecological theory), referencing the existence of two approaches to learning: one oriented towards comprehension and meaning (deep), another towards superficiality and reproduction (superficial)[5]. The deep

Duazary / ISSN: 1794-5992 / Vol. 16, No. 2, mayo - agosto de 2019
Doi: http://dx.doi.org/10.21676/2389783X.2744

approach generally conveys a "transformation of knowledge" with the end goal of improving material learning, generating a dynamic interaction with the contents, introducing new knowledge, and lastly experiences that relate the evidence with the conclusions. For its part, the one in charge of generating "reproduction of information" is the superficial approach, primarily through the memorization of contents but inability to identify background contexts of the text[5-8]. It is natural, therefore, for students to be able to transition between the two approaches but it is incorrect to label students as either superficial or deep[7].

One of the most tools to quantify these learning approaches has been the Study Process Questionnaire (SPQ) that was originally developed from the Behavior in Learning Questionnaire represented in 10 steps. Higher order analyses suggest that these 10 steps can be interpreted in terms of the three aforementioned factors (3P). However, the necessity of instruments that allow for measuring the phenomenon with the same operational performance but greater agility, led to the revised two factor instrument (Revised Study Process Questionnaire - 2 Factors - R-SPQ-2F) focusing on aforementioned two approaches to learning model (deep and superficial)[7].

Several studies have used the R-SPQ-2F in order to describe the learning approaches that the TLP entails in university students, including in Colombia[2,4,9]. Others have evaluated the validity and reliability of the R-SPQ-2F replicating the two factor structure originally proposed by Biggs[7]. In a sample of 2251 university students in Spain, Hernandez-Pina *et al*[10] evaluated the psychometric properties of this instrument. The study was able to show that the best factorial solution was given by the presence of the two factors (the deep approach and the superficial approach) in a consistent manner with Biggs's original findings[7].

Despite the diverse efforts to find an universal factorial solution, but still having in mind the recommendation in validation of scales over the necessity of having evidence on the psychometric properties of an instrument in each context of investigation, we do not have this type of evidence in Colombia for the R-SPQ-2F. Thus, we sought to assess the psychometric properties (construct validity and internal consistency) of the R-SPQ-2F in health science students of a state Universidad de Cartagena, Colombia.

MATERIALS AND METHODS

Type of study

A validation of scales study without reference criterion was developed. This study developed *ad hoc* to the observational study titled "Enfoques de aprendizaje en estudiantes de Ciencias de Salud de la Universidad de Cartagena, Colombia" ("Learning approaches in Health Science students of the Universidad de Cartagena, Colombia") and was approved by the Institutional Review Board of the University of Cartagena.

Population and Sample size

The population was composed by students from the health science campus (Medicine, Dentistry, Pharmacy, and Nursing) during the second semester of 2015. The sample size was calculated in the Sample Size v.1.1 informational package using as computation parameters a cross-sectional observational design as parameters and a

dependent variable of a continuous nature (total score of the scale), type I error 0.05, standard deviation 0.69812, distance from the population mean 0.05, and a two-tailed calculation for a total of 749 students. Anticipating a 15% sampling error, a final sample size of 861 students was estimated. For the specific purposes of this study (validation of scale), the sample size was considered adequate according to the universal recommendations for sample sizes on these types of investigations: 10 participants for every scale's item[11].

Sampling Protocol

A multistep and probability sampling was employed. On the first stage a stratified sampling approach with proportional affixation (each stratum was represented by each of the Faculties) was performed where the number of students necessary per Faculty was determined. Subsequently, through another stratified sample with proportional affixation (each stratum was represented by each academic cycle of each Faculty) the number of students necessary per academic cycle was calculated. Lastly, through a simple randomization sample with replacement, we determined which students would be invited to participate in the study.

Location and characteristics of the population

Students from the health sciences campus of the Universidad de Cartagena, Colombia were invited to participate. The inclusion criteria were as follows: students that voluntarily agreed to participate voluntarily, were registered and academically active in the second academic period in 2015[12].

Instrument

R-SPQ-2F is a tool that consists of 20 items expressed in an affirmative fashion that inquire about the frequency of use of each learning approach, such as *"Studying provoques a sense of deep satisfaction"* or *"I learn some things mechanically, reviewing them again and again until I know them by memory, even if I do not understand them*", measured on two factors: deep learning approach and superficial learning approach. The total time required for the application of the scale was from four to five minutes. The recording of their Likert type responses allows the frequency of appearance of these aspects to be known. The responses varied on a scale from 1 (it never occurs) to 5 (it always occurs) its score is considered dimensional so it has no cut-off point. Overall, scores oscillate from 20 - the least intensity- to 100 -the most intensity of the construct-[7]. Since its origin in 2001, the questionnaire hypothesized the presence of two main sub-scales (domains/factors) called approaches: deep and superficial. Likewise and in accord with the ecological theory of Biggs, each approach has its motivations: situations that awaken interest in the Student and its strategies: means that added to the interest of each Student allow for the achievement of the product[10]. In this manner each principal domain (approaches) is conformed by two secondary sub-domains (strategies and motivations).

In its its original proposal, the deep approach was formed by the simple sum of the scores of items 1, 2, 5, 6, 9, 10, 13, 14, 17, and 18 and the superficial approach is composed by the remaining items. In each of these domains the minimum score

Duazary / ISSN: 1794-5992 / Vol. 16, No. 2, mayo - agosto de 2019
Doi: http://dx.doi.org/10.21676/2389783X.2744

possible is 1 and the maximum is 50. A higher score indicates more usage of this approach on the part of the Student. The deep and superficial motivations are represented by items 1, 5, 9, 13, 17 and 3, 7, 11, 15, and 19 respectively. For their part, the deep strategies are represented by items 2, 6, 10, 14, and 18 while the superficial strategies are represented by items 4, 8, 12, 16, and 20[7]. Scores for these four motivations and strategies can oscillate between 1 and 25.

The version in Spanish utilized in this study is derived from a previous version already published and validated and in which a transcultural adaptation process was applied that included English-Spanish translation and later on Spanish-English by qualified personel[10] for which it was unnecessary to perform this phase in this study.

Statistical Analysis

Descriptive statistics were used for the univariate analysis for each of the items. Proportions and 95% confidence intervals were calculated to 95% for qualitative variables and mean/median and standard deviation/interquartile range upon the normal distribution of the data. The psychometric properties evaluated included validity (of construct) and reliability (internal consistency). Every statistical analysis for determining psychometric properties was carried out by one of the authors following the statistical approach employed in previous similar studies[12-16].

Using Cronbach's alpha coefficient, the internal consistency was estimated overall and according to sub-scales: each factor/domain of the R-SPQ-2F. The measurements of internal consistency were evaluated utilizing the criteria proposed by Kline[17] in this manner: acceptable (0.60 - 0.70), good (0.70 - 0.90) and excellent (>0.90). Before proceeding with the evaluation of validity, the factorisablity of the matrix (Bartlett's test of sphericity) and the sample adequacy (Kaiser-Meyer-Olkin test: KMO) were assessed. Bartlett's test of sphericity was considered acceptable with a high X^2 and a p-value <0.05, while >0.70 KMO values were considered acceptable.

The exploratory factor analysis (EFA) was carried out using the maximum likelihood extraction method and oblique rotation (*promax*) due to the possible correlation between the factors. The number of factors after extraction was determined through a parallel analysis due to it is a better criterion in respect to Kaiser's criteria[18]. Each factor/domain was comprised of at least three items and each item showed a minimum item-factor loading of ≥0.40.

The multivariate normality was checked through Mardia's test as a pre-requisite before being able to conduct confirmatory factorial analysis (CFA). Even when no multivariate normality was not confirmed, the CFA is robust for this statistical assumption when the sample size is ≥200[19]. Using diagonally weighted least squares (WLSMV) as estimation method, CFA was conducted and the following fit indices were obtained: X^2 and and its p-value, degrees of freedom (*df*), Root Mean Square Error of Approximation -RMSEA and its 90% comparative fit index (CFI) and Tucker-Lewis index - TLI. Model fit was assessed using the universally employed criteria proposed by Hu & Bentler: p-value for X^2>0.05, RMSEA≤0.06, CFI and TLI>0.95[20].

The descriptive statistics, the EFA and the internal consistency were calculated using Stata v. 13.2 for Windows (StataCorp., TX., USA) and the CFA was carried out in Mplus v.7.31 for Windows (Muthen & Muthen., Los Angeles, CA., USA).

Declaration of ethical aspects

This study was classified according to the current national legislation (Resolution 8430 of 1993 of Colombia's Ministry of Health) and international legislation (Helsinky Statement) as a no-risk study. Participants agreed to participate in a voluntary basis by signing a written informed consent, after a detailed explanation of the study objective, risks, benefits, and alternative options. Study protocol was approved by the University of Cartagena Institutional Review Board.

RESULTS

We included 857 participants, slightly more than a half were women (57.7%). The overall average for age was 20.2 ± 2.51 years-old. The Faculty that had the most representation was Medicine (35.3%), followed by Dentistry (25.6%), Nursing (24.1%), and Pharmacy (14.8%). Overall, the R-SPQ-2F reached an average score of 66.01 ± 12.3, and the subscales (deep and superficial motivation) average scores were 36.5 ± 6.35 and 29.5 ± 9.1 respectively. The descriptive statistics for each item is shown on Table 1.

Table 1. Descriptive statistics for each R-SPQ-2F item.

	Item	Mean	S.D.*
1	Studying provides me with a deep sense of satisfaction	3.64	0.96
2	When I study something I feel that I should work on it a lot so I can form my own conclusions and become completely satisfied that way	3.78	0.95
3	My objective is to pass the course with the least amount of effort	2.81	1.38
4	I only seriously study what is lectured on in class or is in the course syllabus	3.26	1.09
5	I think that any topic can be interesting once you submerge yourself in it	3.88	0.94
6	I find most of the content interesting and sometimes dedicate additional time to add to it searching for more information on it	3.50	0.98
7	I do not think the course I am taking is very interesting so I only do the minimum amount of work	2.73	1.48
8	I learn some things mechanically, reviewing them again and again until I know them by memory, even if I do not understand them	3.24	1.17
9	I think that studying academic topics can at times be as interesting as reading a good book or watching a good movie	3.60	1.06
10	I quiz myself on topics I think are most important until I am sure that I completely understand them	3.79	0.98
11	I think that I can pass most exams by memorizing the important parts instead of trying to understand them	3.09	1.17
12	Normally I only limit myself to studying what I am assigned in class because I do not think it is necessary to do additional work	2.93	1.17
13	I put a lot of effort into my studies because I think the content is interesting	3.79	0.95
14	I spend a good chunk of my time finding out more about interesting topics that have been covered in class	3.40	1.04

Duazary / ISSN: 1794-5992 / Vol. 16, No. 2, mayo - agosto de 2019
Doi: http://dx.doi.org/10.21676/2389783X.2744

Table 1. Continuation.

Item		Mean	S.D.*
15	I do not think it helps to study topics thoroughly. This confuses me and makes me waste my time, so the only thing is learning an overview of the contents	2.51	1.32
16	I think that professors should not expect for their students to dedicate much time studying content that everyone knows is not going to be on the exam	2.82	1.33
17	I attend most classes with doubts that I would like resolved	3.56	1.03
18	I try to take a look at most readings that professors recommend in class	3.51	1.02
19	I do not think it makes sense to learn material that is likely to not be on the exam	2.91	1.33
20	I think that the best way to pass exams is to answer questions that might appear on them	3.17	1.21

***S.D**: Standard Deviation

Internal consistency

In relation to internal consistency, the R-SPQ-2F showed an overall Alpha coefficient of 0.868. For the two primary sub-scales: deep and superficial estimates were 0.836 and 0.895 respectively.

Dimensionality

The KMO statistic was 0.98 the Bartlett's test of sphericity showed a <0,001 p-value. The best factorial structure showed two domains that explained the 42.56% of the variance. The first (recognized as the deep approach) was composed of of items 1, 2, 5, 6, 9, 10, 13, 14, 17, and 18 and the second by the remaining items (recognized as the superficial approach). The first domain was recognized as the deep approach and the second as the superficial approach. Communalities ranged from 0.33 up to 0.69 and no <0.40 item loadings were seen between 0.3352 and 0.6912 and no factorial loads <0.40 were found. Table 2 shows the communalities and the loadings for each item for each item.

Construct Validity

The two factor model delivered the following fit indices after applying three modification indices (correlation of the error of the covariances): X^2: 962.783; *gl*: 166; RMSEA: 0.075. 90% CI: 0.070 - 0.079); CFI: 0.883 and TLI: 0.866. The pathway diagram for this factor structure is shown in Figure 1.

Table 2. Item-factor loadings and communalities for the R-SPQ-2F.

Item		Factor 1	Factor 2	Communality
1	Studying provides me with a deep sense of satisfaction	0.5708		0.308
2	When I study something I feel that I should work on it a lot so I can form my own conclusions and become completely satisfied that way	0.5263		0.261
3	My objective is to pass the course with the least amount of effort		0.7138	0.499

Table 2. Continuation.

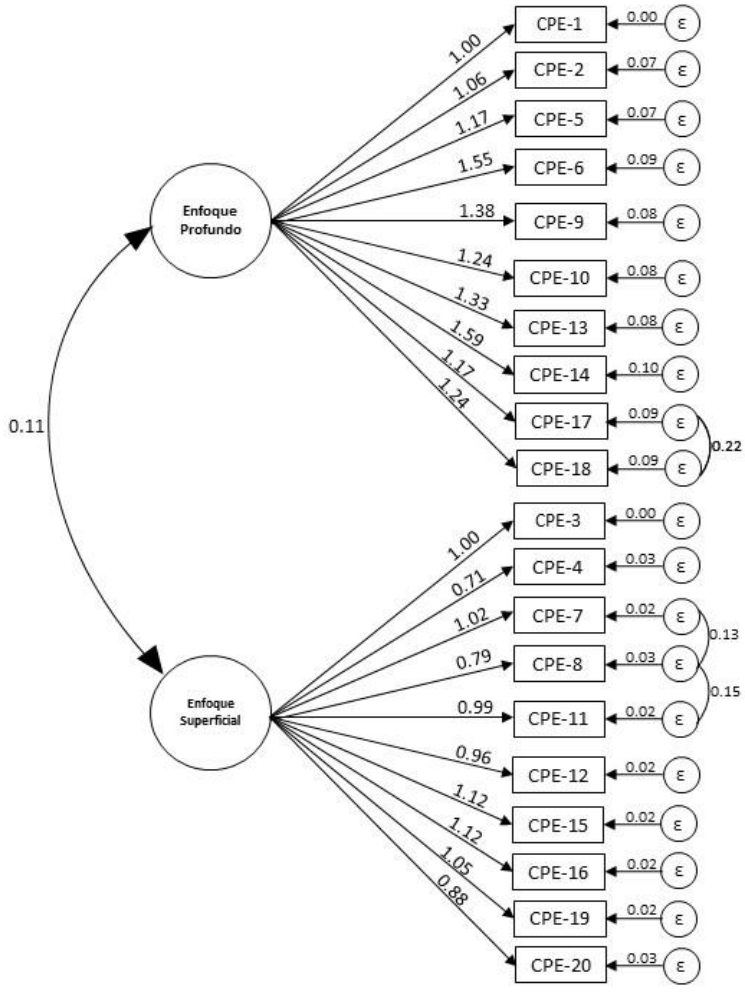
Item		Factor 1	Factor 2	Communality
4	I only seriously study what is lectured on in class or is in the course syllabus		0.4745	0.234
5	I think that any topic can be interesting once you submerge yourself in it	0.5914		0.328
6	I find most of the content interesting and sometimes dedicate additional time to add to it searching for more information on it	0.6721		0.482
7	I do not think the course I am taking is very interesting so I only do the minimum amount of work		0.7141	0.523
8	I learn some things mechanically, reviewing them again and again until I know them by memory, even if I do not understand them		0.4893	0.358
9	I think that studying academic topics can at times be as interesting as reading a good book or watching a good movie	0.6462		0.414
10	I quiz myself on topics I think are most important until I am sure that I completely understand them	0.6186		0.365
11	I think that I can pass most exams by memorizing the important parts instead of trying to understand them		0.6681	0.511
12	Normally I only limit myself to studying what I am assigned in class because I do not think it is necessary to do additional work		0.6910	0.741
13	I put a lot of effort into my studies because I think the content is interesting	0.7041		0.477
14	I spend a good chunk of my time finding out more about interesting topics that have been covered in class	0.6388		0.471
15	I do not think it helps to study topics thoroughly. This confuses me and makes me waste my time, so the only thing is learning an overview of the contents		0.8346	0.668
16	I think that professors should not expect for their students to dedicate much time studying content that everyone knows is not going to be on the exam		0.8152	0.632
17	I attend most classes with doubts that I would like resolved	0.4152		0.264
18	I try to take a look at most readings that professors recommend in class	0.4461		0.298
19	I do not think it makes sense to learn material that is likely to not be on the exam		0.7703	0.568

Duazary / ISSN: 1794-5992 / Vol. 16, No. 2, mayo - agosto de 2019
Doi: http://dx.doi.org/10.21676/2389783X.2744

Table 2. Continuation.

Item		Factor 1	Factor 2	Communality
20	I think that the best way to pass exams is to answer questions that might appear on them		0.5834	0.384
Eigenvalue		3.0287	5.4839	
Variance explained (%)		15.14	27.42	
Between-factors correlation		0.2458		
Cronbach's Alpha		0.8369	0.8959	

Figure 1. Pathway diagram obtained from CFA.



The two bigger circles on the left represent the two underlying factors to the latent variable (learning approaches). The arrows to each item indicate the estimators (values on top of the arrow). The name of each item appears in the rectangles, respectively. The Greek letter *epsilon* (ε) inside the small circles on the right denotes the associated error to each estimator. The interconnected circles to the right represent the correlation of the error to the covariance (modification indexes) between the items.

DISCUSSION

During the last few decades, the analysis of learning approaches in Health Science students has become a valuable tool for the understanding of "how students construct knowledge". Knowing the approach that a student predominantly uses will allow -as far as of what is possible and when necessary- suggest about early interventions in the search for an effective and persistent learning on the part of the student improving. This will turn into improvement into the Student's future professional skills[21].

In Colombia, there are few studies about learning approaches on higher education Students that have employed the R-SPQ-2F. However, their results consistently indicate that students predominantly acquire knowledge using a deep approach which indicates that their motivation is intrinsic- the student has much interest in the course and wishes to accomplish learning that has a personal significance. The strategies that these students employ are used to achieve comprehension and satisfy their personal curiosity[4,9,22].

To the best of our knowledge, this is the first Colombian study to explore the psychometric properties (internal consistency and construct validity) of this instrument and furthermore also employing EFA and CFA techniques (factorial validity). In this way and by taking into account this investigation's objective, the results of this study show evidence that the R-SPQ-2F is a dependable questionnaire but has a limited construct validity in the sample in which it was used due to the poor derived adjustment of the CFA. The overall internal consistency and those according to sub-scales reflected in the current study is understood to be good and is consistent with the findings of other investigations conducted in other languages such as Spanish in Spain[10], Dutch (α=0.84-0.81)[23], Arabic (α=0.90-0.93)[24], and Ghanaian (α=0.76)[25] as well as the original version proposed by Biggs[7] (α=0.73-0.64). This reflects the adequate degree to which the items or reactants that make up the R-SPQ-2F correlate with each other, this is, the extension in which they measure the construct, the magnitude in which the same evaluated construct is measured[26].

On the other hand, our dimensionality results suggests that two factors are sufficient to explain the construct. This is also consistent with findings from previous of previous studies[10,24,25] and with the original version proposed 15 years ago[7]. Even so, a study that tested the psychometric properties of the R-SPQ-2F in Holland[23] using CFA suggested that scales' construct is represented in four factors: *studying is best interesting, invest extra time, minimal efforts, and learning "by heart"* which are not consistent with what was previously reported and with the findings of our study. It is important to note that over the, the CFA has become into such a valuable statistical approach in the social sciences field to assess measures' construct validity[27]. However, the inconsistent use of fit indices to assess model adjustment, generate considerable differences in the models a study would offer. Thus, one of most universally accepted criteria in the scientific literature for evaluation of the adjustment of

Duazary / ISSN: 1794-5992 / Vol. 16, No. 2, mayo - agosto de 2019
Doi: http://dx.doi.org/10.21676/2389783X.2744

proposed models by CFA techniques and their specific application -scales validation- was proposed by Hu and Bentler[20]. This situation can partially explain the discrepancies between the Dutch version of the R-SPQ-2F and our study. The results of the model proposed by Stes *et al*[23] in Holland indicates the use of: index of goodness of fit -IGF, corrected index of goodness of fit -C-IGF, the comparative fit index - CFI, and the rRoot Mean Square Error of Approximation -RMSEA, suggesting values ≥0.90 for the first three and ≤0.05 for the last one[29]. The criteria of Hu and Bentler[20] propose the Tucker -Lewis index -TLI, the the comparative fit index-CFI and the RMSEA, for considering a model as acceptable when the first two are ≥0.95 and last one is ≤0.06[20]. With that being said,, it is likely that more flexible criteria like those used by the Dutch study suppose the acceptance of a false model that explains the factor structure of the construct. Additionally, the authors did not follow a standardized methodological process for the translation and transcultural adaptation of the instrument as in recommended for validation studies, a situation that can also influence the results of the interpretation of the results provided by the factor analysis[30,31].

Consistent with what was previously discussed, major investigation is needed on some of the instrument's items that can be unrelated to the construct despite finding the same results in the exploratory phase of the factor analysis. This is therefore the justification for conducting modification indices in order to improve specific areas of strain within the model, which is hence reflected on better psychometric properties of the instrument[29]. The justification for the application of these MIs between items 7 *"I do not think the course I am taking is very interesting so I only do the minimum amount of work"* and 8 *"I learn some things mechanically, reviewing them again and again until I know them by memory, even if I do not understand them"* is so that Learners can be conceptually related by how much item 7 indicates a minimal amount of work in class and 8 indicates learning things mechanically which could be a product of a minimal amount of work in class, as well as belonging to the same domain (the superficial approach). For their part, in the case between items 8 and 11: *"I think that I can pass most exams by memorizing the important parts instead of trying to understand them"*[8] apart from being actions that are linked together, they also belong to the same domain (the superficial approach) as in the previous case. Finally, in the case of items 17 *"I attend most classes with doubts that I would like to be resolved"* and 18 *"I try to take a look at most readings that professors recommend in class"*, as in the previous two cases, they belong to the same domain (the deep approach) and are also actions that are related to the student attending the majority of classes, with the student's extracurricular activities implying he or she also reviews the recommended contents. In these two items way these pairs of reactants can share the covariance error, which was the MI applied to the CFA model that was tested[28].

This study has certain strengths and limitations. Among its strengths we can list our the sample size used, surpassing the minimum required to conduct factor analysis, and the employment of powerful statistical techniques for the assessment of the construct validity - confirmatory factor analysis. Even so, among one limitation weaknesses is that we did not perform a trans-cultural adaptation process for this measure a process for transcultural adaptation from Spanish from Spain to Colombian Spanish, and the lack of research into other psychometric properties such as convergent validity or the scale's *test re-test* reliability.

The use of structured questionnaires like the R-SPQ-2F consolidates them as important tools in trying to evaluate these recently pro-

posed constructs such as learning approaches. As a matter of fact, there are Universities on the northern coast of Colombia that offer services like the "Resource Center for Student Success" that support its strategies like the *Academic Gymnasium* on tools like the R-SPQ-2F so that the student, through self-evaluation processes, learns what approach, motivations, and strategies is employing as well as introspects his or her current academic performance in order to make adjustments to their learning process, if needed[32].

Our findings highlights the importance of conducting additional studies about the psychometric properties of the instrument or even explore additional measures for this population and that give an account of suitable psychometric properties. In applying instruments with better psychometric properties, the quality of the measurements will improve and, accordingly, so will the study ability to generalize results. It is also important to strengthen the line of investigation into approaches to, and processes of, study in Colombia in order to account on better indicators on an educational level. This will allow government entities to be properly addressed on the efforts in curriculum.

ACKNOWLEDGEMENTS

The authors would like to thank Drs. Ana Orozco and Eduardo Roqueme for their support during the study development.

DECLARATION OF CONFLICTS OF INTEREST

The authors declare not having any conflicts of interest.

BIBLIOGRAPHIC REFERENCES

1. López-Aguado M, López-Alonso AI. Los enfoques de aprendizaje. Revisión conceptual y de investigación. Revista Colombiana de Educación. 2013(64):131-53. Retrieved from: https://doi.org/10.17227/01203916.64rce131.153.

2. Klimenko O, García-Jiménez HA, Ramírez BL, Muñoz N. Estudio sobre las prácticas de enseñanza y los enfoques de aprendizaje en algunas facultad de la Universidad Cooperativa de Colombia, Seccional Medellín. Revista Virtual de Ciencias Sociales y Humanas "PSICOESPACIOS". 2012;6(9):58-92. Retrieved from: https://doi.org/10.25057/21452776.90.

3. Corominas E, Tesouro M, Teixeidó J. Vinculación de los enfoques de aprendizaje con los intereses profesionales y los rasgos de la personalidad. Aportaciones a la innovación del proceso de enseñanza y aprendizaje en la educación superior. Revista de Investigación Educativa. 2006;24(2):2006. Retrieved from: http://www.redalyc.org/articulo.oa?id=283321897008.

4. Montealegre G, Núñez ML, Salgado D. Enfoques de aprendizaje de orden sociocultural en estudiantes de una institución de educación superior en Colombia. Acta Médica Colombiana. 2014;39(4):368-77. Retrieved from https://doi.org/10.1016/j.resu.2015.10.001.

5. Biggs J. Approaches to the enhancement of tertiary teaching. Higher Education Research and Development. 1989;8(1):7-25. Retrieved from: https://doi.org/10.1080/0729436890080102.

6. Barca A, Peralbo M, Brenlla JC. Atribuciones causales y enfoques de aprendizaje: la escala SIACEPA. Psicothema. 2004;16(1):94-103. Retrieved from: <http://www.redalyc.org/articulo.oa?id=72716116.

7. Biggs J, Kember D, Leung DY. The revised two-factor Study Process Questionnaire: R-SPQ-2F. Br J Educ Psychol. 2001;71(Pt 1):133-49. Retrieved from: https://doi.org/10.1348/000709901158433.

8. Chung EK, Elliott D, Fisher D, May W. A comparison of medical students' learning approaches between the first and fourth years. South Med J. 2015 Apr;108 (4):207-10. Retrieved from: doi: 10.14423/SMJ.0000000000000260.

9. Gargallo-López B, Garfella-Esteban PR, Pérez-Pérez C. Enfoques de aprendizaje y rendimiento académico en Estudiantes Universitarios. Bordón. 2006;58(3):45-61. Retrieved from: https://www.uv.es/~gargallo/Enfoques.pdf.

10. 1Hernández-Pina F, García-Sánz M, Maqulón J. Análisis del cuestionario de procesos de estudio - 2 Factores de Biggs en estudiantes universitarios Españoles. Sources: Revista de la Facultad de Ciencias de la Educación. 2005;6:117-38. Retrieved from: https://revistascientificas.us.es/index.php/fuentes/article/view/2394.

11. Costello AB, Osborne JW. Best practices in Exploratory Factor Analysis: four recommendations for getting the most from your analysis. Practical Assessment, Research & Evaluation. 2005;10(7):1-9. Retrieved from https://pareonline.net/pdf/v10n7.pdf.

12. Simancas-Pallares M, Díaz-Cárdenas S, Barbosa-Gómez P, Buendía-Vergara M, Arévalo-Tovar L. Propiedades psicométricas del Índice de Bienestar General-5 de la Organización Mundial de la Salud en pacientes parcialmente edéntulos. Revista de la Facultad de Medicina. 2016;64(4):701-5. Retrieved from: http://dx.doi.org/10.15446/revfacmed.v64n4.52235.

13. Simancas-Pallares M, Arrieta KM, Arévalo LL. Validez de constructo y consistencia interna de tres estructuras factoriales y dos sistemas de puntuación del cuestionario de salud general de 12 ítems. Biomédica. 2017;37:308-14. Retrieved from: https://doi.org/10.7705/biomedica.v37i3.3240.

14. Simancas-Pallares MA, Mesa NF, Martínez FDG. Validity and internal consistency of the Maslach Burnout Inventory in dental students from Cartagena, Colombia. Revista Colombiana de Psiquiatría (English ed). 2017;46(2):103-9. Retrieved from: https://doi.org/10.1016/j.rcpeng.2017.05.009.

15. Díaz-Cárdenas S, Simancas-Pallares MA. Propiedades Psicométricas de la Versión en Español del Índice General De Valoración de Salud Bucal GOHAI en Pacientes Adultos de Cartagena, Colombia. Salud Uninorte. 2017;33(3). Retrieved from: http://dx.doi.org/10.14482/sun.33.3.10887.

16. Díaz-Cárdenas S, Tirado-Amador L, Simancas-Pallares M. Validez de constructo y confiabilidad de la APGAR familiar en pacientes odontológicos adultos de Cartagena, Colombia. Revista de la Universidad Industrial de Santander Salud. 2017;49:541-8. Retrieved from: http://dx.doi.org/10.18273/revsal.v49n4-2017003.

17. Kline P. Handbook of psychological testing: Routledge; 2013. Retrieved from: https://www.routledge.com/Handbook-of-Psychological-Testing-2nd-Edition/Kline/p/book/9780415211581.

18. Stawski RS. Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling. Structural Equation Modeling: A Multidisciplinary Journal. 2013;20(3):541-50. Retrieved from: https://doi.org/10.1080/10705511.2013.797841.

19. Brown TA. Confirmatory factor analysis for applied research. 2nd ed. New York, NY: The Guilford Press; 2015. Retrieved from: https://www.guilford.com/books/Confirmatory-Factor-Analysis-for-Applied-Research/Timothy-Brown/9781462515363.

20. Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Structural Equation Modeling: A multidisciplinary Journal. 1999;6(1):1-55. Retrieved from: https://doi.org/10.1080/10705519909540118.

21. Leung SF, Mok E, Wong D. The impact of assessment methods on the learning of nursing students. Nurse Educ Today. 2008;28(6):711-9. Retrieved from: https://doi.org/10.1016/j.nedt.2007.11.004.

22. Riveros-Pérez E, Bernal M, González N. Prevalencia de los enfoques de aprendizaje en estudiantes de Fisiología Médica: cuestionario de procesos de estudio revisado de dos factores (R-SPQ-2F). Biosalud. 2011;10(2):37-47. Retrieved from: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S1657-95502011000200005&lng=en.

23. Stes A, De Maeyer S, Van Petegem P. Examining the cross-cultural sensitivity of the Revised Two-Factor Study Process Questionnaire (R-SPQ-2F) and validation of a Dutch version. PLoS One. 2013;8(1):e54099. Retrieved from: http://10.1371/journal.pone.0054099.

24. Munshi FM, Al-Rukban MO, Al-Hoqail I. Reliability and validity of an Arabic version of the revised two-factor study process questionnaire R-SPQ-2F. J Family Community Med. 2012;19(1):33-7. Retrieved from: doi: 10.4103/2230-8229.94010.

25. Mogre V, Amalba A. Assessing the reliability and validity of the Revised Two Factor Study Process Questionnaire (R-SPQ2F) in Ghanaian medical students. J Educ Eval Health Prof. 2014;11:19. Retrieved from: doi: 10.3352/jeehp.2014.11.19.

26. Campo-Arias A, Oviedo HC. Psychometric properties of a scale: internal consistency. Rev Salud Publica (Bogota). 2008;10(5):831-9. Retrieved from: http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S0124-00642008000500015&lng=en.

27. Jackson DL, Gillaspy JJ, Purc-Stepheson R. Reporting practices in confirmatory factor analysis: an overview and some recommendations. Psychological Methods. 2009;14(1):6-23. Retrieved from: http://dx.doi.org/10.1037/a0014694.

28. 28. Harrington D. Confirmatory Factor Analysis. 1st ed. Press OU, editor. New York, NY: Oxford University Press; 2008. 122 p. Retrieved from: http://libproxy.lib.unc.edu/login?url=http://dx.doi.org/10.1093/acprof:oso/9780195339888.001.0001.

29. Hoyle RH. Structural equation modeling: concepts, issues and applications. 1st ed. Hoyle RH, editor. Thousand Oaks, CA: SAGE Publications; 1995. 291 p. Retrieved from: https://us.sagepub.com/en-us/nam/structural-equation-modeling/book4796.

30. Beaton DE, Bombardier C, Guillemin F, Ferraz MB. Guidelines for the process of cross-cultural adaptation of self-report measures. Spine (Phila Pa 1976). 2000;25(24):3186-91. Retrieved from: 10.1097/00007632-200012150-00014.

31. Eremenco SL, Cella D, Arnold BJ. A comprehensive method for the translation and cross-cultural validation of health status questionnaires. Eval Health Prof. 2005;28(2):212-32. Retrieved from: https://doi.org/10.1177/0163278705275342.

32. Gimnasio Académico - Centro de Recursos para el Éxito Estudiantil Barranquilla, Colombia: Universidad del Norte; 2016 cited 2016 Octubre 31, 2016. Retrieved from: http://www.uninorte.edu.co/documents/71051/0/EnfoquesGAC.