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Psychometric analysis of PANAS in Brazil
Análise psicométrica da PANAS no Brasil
Análisis psicométrico de la PANAS en Brasil

Lucas Yukio Otsuka Nunes[1], ORCID 0000-0001-7971-867X
Daniel Campos Lopes Lemos[2], ORCID 0000-0002-4882-1559
Rodolfo de Castro Ribas Júnior[3], ORCID 0000-0001-6119-6754
Cláudia Brandão Behar[4], ORCID 0000-0003-2488-6427
Pedro Paulo Pires dos Santos[5], ORCID 0000-0001-8831-9056

[1,2,3]*Universidade Federal do Rio de Janeiro. Brasil*
[4]*Universidade Estácio de Sá. Brasil*
[5]*Universidade Federal Fluminense. Brasil*

Abstract: The Positive and Negative Affect Schedule (PANAS) is presently one of the most used instruments in the investigation of affective states, both in adults and children. The present study was carried out with the objective of evaluating, from the psychometric point of view, a Brazilian version of this scale in a national sample. Besides the psychometric properties, the convergent validity of the instrument was also evaluated. Altogether, 2648 university students enrolled in the Psychology and Engineering courses of a private university participated in this research, in 15 Brazilian cities, responding to the electronic questionnaire made available on the Internet. Participants also answered the Visual Analogue Scale of Psychological Well-being (FACES), the Subjective Happiness Scale (SHS) and the Mental Health Index Scale (MHI-5). The analysis of the results indicates that PANAS presents satisfactory psychometric properties that authorize its use in Brazil.

Key words: psychometry, Panas, scale, factorial analysis, emotion

Resumo: A Escala de Afetos Positivos e Afetos Negativos (PANAS) é hoje um dos instrumentos mais utilizados na investigação de estados afetivos, tanto em adultos quanto em crianças. O presente estudo foi realizado com o objetivo de avaliar, do ponto de vista psicométrico, uma versão brasileira dessa escala em uma amostra nacional. Além das propriedades psicométricas, foi ainda avaliada a validade convergente do instrumento. Ao todo, participaram desta pesquisa 2648 estudantes universitários, matriculados nos cursos de Psicologia e Engenharia de uma universidade particular, em 15 cidades brasileiras respondendo ao questionário eletrônico disponibilizado na Internet. Os participantes responderam ainda a Escala Analógica Visual de Bem-estar Psicológico (FACES), a Escala de Felicidade Subjetiva (SHS) e a Escala Índice de Saúde Mental (MHI-5). Os resultados das análises indicam que a PANAS apresenta propriedades psicométricas satisfatórias que autorizam sua utilização no Brasil.

Palavras-chave: psicometria, Panas, escala, análise fatorial, emoção

Resumen: La Escala de Afectos Positivos y Afectos Negativos (PANAS) es hoy uno de los instrumentos más utilizados en la investigación de estados afectivos, tanto en adultos como en niños. El presente estudio fue realizado con el objetivo de evaluar, desde el punto de vista psicométrico, una versión brasileña de esa escala en una muestra nacional. Además de las propiedades psicométricas, se evaluó la validez convergente del instrumento. En total, participaron de esta investigación 2648 estudiantes universitarios, matriculados en los cursos de Psicología e Ingeniería de una universidad privada, en 15 ciudades brasileñas respondiendo al cuestionario electrónico disponible en Internet. Los participantes respondieron a la Escala Analógica Visual de Bienestar Psicológico (FACES), la Escala de Felicidad Subjetiva (SHS) y la Escala Índice de Salud Mental (MHI-5). Los resultados de los análisis indican que el PANAS presenta propiedades psicométricas satisfactorias que autorizan su utilización en Brasil.

Palabras clave: psicometría, Panas, escala, análisis factorial, emoción

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Contact information: Lucas Yukio Otsuka Nunes, Universidade Federal do Rio de Janeiro Av. Pasteur, 250 - fundos. Botafogo, Rio de Janeiro – RJ, CEP 22290-902. Brasil, email: lucasyukion@gmail.com. Daniel Campos Lopes Lemos, email: anilemonrj@gmail.com. Rodolfo de Castro Ribas Júnior, email: rodolfo.c.ribas@gmail.com. Cláudia Brandão Behar, Universidade Estácio de Sá Avenida Ayrton Senna, 2800, Barra da Tijuca, Rio De Janeiro - RJ, CEP: 22775-003, email: claudia.behar@estacio.br. Pedro Paulo Pires dos Santos, Universidade Federal Fluminense Block N - Rua Prof. Marcos Waldemar de Freitas Reis - Gragoatá, Niterói - RJ CEP 24210-201, email: ppires85@gmail.com

Introduction

The Positive Affect and Negative Affect Schedule (PANAS, Watson, Clark & Tellegen, 1988) is presently one of the most used instruments in the investigation of affective states, both in adults and children (eg, Allan, Lonigan & Phillips, 2015, Damásio, Pacico, Poletto & Koller, 2013; González Arratia López Fuentes & Valdez Medina, 2015).

Indeed, a significant volume of validation and adaptation studies indicate that PANAS has been used in countries such as Brazil, Mexico, Spain, Colombia, Portugal, Tunisia and Pakistan (e.g Carballeira, González & Marrero, 2015; Galinha & Ribeiro, 2005; Mnadla, Elloumi, Hajji & Bragazzi, 2017; Moriondo, Palma, Medrano & Murillo, 2012). This article presents a study of a psychometric evaluation and validation of a Brazilian version of this scale in a national sample.

In two of the most cited papers in the recent history of psychology (Diener, Suh, Lucas and Smith, 1999), Ed Diener presents relatively similar considerations about what subjective well-being would be and, hence, how this construct could be measured properly.

In "Subjective Well-Being," Diener (1984) points out that research on subjective well-being tends to focus on both the assessments people make about their day-to-day emotional experiences and assessments, cognitive or calculative, the assessments that people make about their satisfaction with life itself. Recognizing the contribution of Andrews and Inglehart (1979), Diener points out that subjective well-being would then consist of three general components: 1) judgments that individuals make about their satisfaction with their own life, 2) experiencing positive affects 3) experiencing negative affects.

In "Subjective wellness: Three decades of progress", Diener, Suh, Lucas and Smith (1999) point out that subjective well-being can be considered as a broad category of phenomena that would include a person's emotional responses, his satisfaction with specific domains of his life and his evaluation of his satisfaction with his life in a more general way.

It is possible to affirm that contributions such as those mentioned above have had a great impact on recent studies on happiness and related constructs. In the first place, it can be recognized that subjective well-being, understood as 1) cognitive evaluation about satisfaction with one's own life, 2) experiencing positive affects and 3) experiencing negative affects, is nowadays one of the most studied constructs in positive psychology. Secondly, as a consequence of the previous finding, a great number of instruments of psychological evaluation have been developed or tested in order to evaluate the different components of subjective well-being.

The development of the Positive Affects and Negative Affects Schedule (PANAS)

In another highly cited review paper, Watson and Tellegen (1985) reanalyzed several studies involving self-report measures,

focusing on affective states, and concluded that exploratory factorial analyzes consistently indicated the existence of two factors: 1) Positive Affects and 2) Negative Affects.

The authors also observed that this two-dimensional configuration would also be systematically identified in other important lines of research on topics such as humor or affective states and that the findings of such research, which would provide important evidence on the structure of human affective experience, would have relevance in various fields of Psychology, such as Clinical Psychology.

Considering the conclusions presented by Watson and Tellegen (1985), Watson, Clark and Tellegen (1988) developed a new instrument for evaluating the experience of positive and negative affects. Among other aspects, these authors justified the need for the development of a new scale, stating that many of the measures used at the time, for affection evaluation, were inadequate because they had low reliability or limited convergent or discriminant validity.

The developed instrument, a relatively brief measure with 20 items (The PANAS Scales, Positive Affective Scales and Negative Affects, PANAS) has become one of the most widely used instruments for assessing affect throughout the history of psychology. According to the Web of Science, no less than 1,2608 papers have cited the work of Watson, Clark and Tellegen (1988).

The development of the Positive Affect and Negative Affect Scales (PANAS) can be summarized as follows: For a broad and representative sample of mood descriptors, Watson, Clark, and Tellegen (1988) took as their starting point a list of 60 terms which had already been included in previous factorial studies (eg, Zevon & Tellegen, 1982). The authors reported that their concern was to select relatively pure terms. These terms should be clearly classified into one of two factors (positive affect and negative affect). Thus, terms related, for example, to positive affects should have a high factor load on this factor and a loading level practically null on the other factor (negative affects). The authors

have specified, for example, that an item should have a factorial load equal to or greater than 0.40 in its factor and should not have a load on the other factor above | .25 |.

Reanalyzing data from Zevon and Tellegen (1982), in a study involving three samples (164, 50 and 53 participants), the authors came up with a list of 10 terms that would describe positive experiences, (attentive, interested, alert, excited, enthusiastic, inspired, proud, determined, strong and active) and 10 terms that would describe negative affective experiences. These 10 terms would cover 5 emotional states: distressed, upset (distressed); hostile, irritable (angry); scared, afraid (fearful); ashamed, guilty (guilty); and nervous, jittery (jittery).

Accordingly, the authors applied this scale with the 20 items using a 5-point Likert scale ("very slightly or not at all", "a little", "moderately", "quite a bit" and "very much"). Participants were asked to answer the question "How did you feel" or "do you feel." Six different temporal instructions were used in the questions: (a) "right now (that is, at the present moment)"; (b) "today" (today); (c) "during the past few days" (past few days);(d) "during the past week" (week); (e) "during the past few weeks" (past few weeks); (f) "during the past year" (year); and(g) "in general, that is, on the average" (general)....".

The number of participants in each of the time references was: 660 (moment), 657 (today), 1002 (last days), 586 (last weeks), 649 (last year). The scales were applied and reapplied after an interval of, for example, 8 weeks. For each sample, normative data (e.g. M and DP), as well as internal consistency and factor structure were computed.

Watson, Clark and Tellegen (1988) reported reliability coefficients (Cronbach's alpha) between 0.86 and 0.90 in all situations. The correlations between the positive affect and negative affects ranged from -0.12 to -0.23. The test-retest reliability coefficient for a 8-week interval ranged between (temporal stability, r), 0.39 and 0.71, all significant at p <0.05. Watson, Clark and Tellegen also reported correlations between PANAS scores and scores of other scales involving

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measurement of affects (e.g., Bradburn Scale, 1969).

Finally, considering that the prevalence of positive and negative affects has been associated with distress and psychological disorders, Watson, Clark and Tellegen (1988) evaluated correlations between PANAS and three scales widely used in clinical evaluations: the Hopkins Symptom Checklist - HSCL (Derogatis, 1974), the Beck Depression Inventory - BDI (Beck, 1988) and the State Anxiety Inventory - STAI (Spielberger, 1970). Several significant and strong correlations were identified.

Several studies have evaluated properties of the Positive Affect and Negative Affect Schedule (PANAS) in Brazilian samples. Pires, Figueiras, Ribas and Santana (2013), for example, evaluated the psychometric properties of a PANAS version developed by Pereira, Calvano and Cunha (1992).

The study involved 354 participants, adults of both sexes. Exploratory factorial analyzes and confirmatory factorial analyzes (Partial Credit Model) were conducted. In general, it can be said that the researchers reported excellent psychometric properties that authorize the use of scale in Brazil. However, some problems were identified. For example, the item "I feel alert" that in the original scale would be an item related to positive affects, did not behave that way in the study. In fact, the loading factor observed for this item was only 0.09.

In another study, Pires, Filgueiras, Ribas and Santana (2013) used the Differential Functioning of Items (DIF) to evaluate the behavior of PANAS when regarding sex. Again, the authors identified very good psychometric properties, but also some indications that certain items might have different properties according to respondent's gender.

Carvalho and colleagues (2013) conducted the most extensive study in Brazil with PANAS until the preparation of this work. These authors evaluated the psychometric properties of PANAS in a representative sample of 3,728 individuals living in the cities of São Paulo and Rio de Janeiro, using an exploratory factorial analysis and modeling with structural equations. The analyzes corroborated the two-dimensionality of the PANAS, with positive Affects accounting for 32.99% of the variance and negative affections accounting for 17.06% of the variance.

According to the authors' report, 9 of the 10 items of the original Positive Affect scale were retained (the "proud" item did not load in any factor properly, loading factor <0.3) and all 10 items of the Negative Affect scale were retained. The items behaved much like in the original study designed by the creators of the scale (Watson, Clark & Tellegen, 1988) with high levels of factor loading in their own factor and low loading levels on the other factor. Cronbach's alfas for negative and positive affects reported were 0.87 and 0.88, respectively.

A validation of PANAS was presented in the compendium of measures in Positive Psychology organized by Hutz (2008). It may further be mentioned that other versions of PANAS have been developed, for example, for assessing affective states in children (e.g., Damasio, Pacico, Poletto & Koller, 2013).

The present study may contribute to the understanding of PANAS properties in Brazil, since the study involved a sample of participants from all regions of the country.

Method

Ethical considerations

The present research is in line with current legislation regarding research involving human beings (Conselho Nacional de Saúde, 2008). The research was approved by the Committee of Ethics in Research (CER) of Estácio de Sá University. Approval number 57488816.4.0000.5284.

Study participants

In total, 2648 university students (1505 females, 1065 males and 88 did not report sex), enrolled in Psychology and Engineering courses at a private university with campuses in 15 Brazilian cities (Brasília, Campo Grande,

Goiânia, Aracaju , Fortaleza, João Pessoa, Recife, Salvador, São Luiz, Boa Vista, Macapá, Juiz de Fora, Niterói, Rio de Janeiro and Florianópolis) participated in the survey, responding to an electronic questionnaire that was made available on the Internet.

The participants had a balanced division between the two courses (Psychology = 45.6%, Engineering = 46.9%), aged between 18 and 60 years (m = 27.1), most of whom were single (61.05% of the sample total). The participants' family income ranged from a minimum wage (R$ 880) to more than eleven minimum wages.

Instruments

- *Positive Affects and Negative Affects.* The Positive Affects and Negative Affects Schedule (PANAS), has been described previously. We can highlight that in this study the version validated by Pires, Figueiras, Ribas and Santana (2013), originally developed by Pereira, Calvano and Cunha (1993) was used.

The authors conducted exploratory factorial analysis and item response theory (Partial Credit Model), obtaining the results for the Positive Scale: KMO = 0.89, Cronbach's Alpha (α) = 0.84, a factor responsible for 46% of the variance and for the Negative Scale: KMO = 0.88, Cronbach's Alpha (α) = 0.90, a factor responsible for 47.05% of the variance.

- *Analog Visual Scale of Psychological Well-Being (FACES).* The Visual Analog Welfare Scale (Faces Scale, Andrews & Withey, 1976) is a single response scale. In the work of Andrews and Withey (1976) the scale was presented as one of the questions of a large questionnaire. In this item, the interviewee is asked to evaluate how he feels about his life as a whole (Which face comes closest to expressing how you feel about your life as a whole?), using seven schematic faces whose expressions range from very unhappy (face with mouth corners all the way down) to very happy (with the corners of the mouth lifted up).

The respondent is instructed to indicate which of the faces presented best represents the way he or she feels through a single item (Andrews and Withey, 1976). This is the only scale that evaluates how a person feels about their life in the present moment and feels in relation to their life as a whole.

Souza and colleagues (2012) used the Analog Visual Welfare Scale to evaluate factors associated with psychological well-being in 1621 young people aged 18 to 24 living in Pelotas, Rio Grande do Sul. Psychological well-being may be associated with non-use of illicit drugs, paid work, religious practice, socioeconomic classes A and B, high schooling and the absence of psychiatric disorders.

- *Scale of Subjective Happiness.* A Portuguese version of the Subjective Happiness Scale (SHS, Lyubomirsky & Lepper, 1999) was adapted and validated by Damásio, Zanon, & Koller (2014). Subjective Happiness Scale is composed of only four items (1. "In general, I consider myself"; 2. "Compared to most of my colleagues / friends, I consider myself"; 3. "Some people, in general, are very happy. They enjoy life regardless of what is happening, getting the most out of each situation. To what extent does this characterization describe you? "; 4. "Some people, in general, are not very happy. Although they are not depressed, they never seem as happy as they could be. To what extent does this characterization describe you? ") that are evaluated on 7-point Likert scales. A high score indicates a high level of happiness.

The validation and analysis of the psychometric properties of the Brazilian version of the Subjective Happiness Scale involved a sample of 600 participants (Damásio, Zanon & Koller, 2014). Exploratory and confirmatory factorial analyzes revealed excellent psychometric properties. The analyzes identified a single factor, responsible for 64.21% of the variance and alpha = 0.84. In the present study, the observed alpha was 0.73.

- *Mental Health Index Scale.* Several instruments have been developed with the aim of contributing to the diagnosis, treatment, prevention of disorders or even the promotion

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of mental health. The Five-item Mental Health Index (MHI-5, McHorneye & Ware, 1995) is one of the most widely used scales for identifying individuals with significant levels of depression or anxiety. Composed of five items, the MHI-5 is a subscale of SF-36 (36-item Short Form SF-36), an instrument used to measure health related to quality of life (Damásio, Borsa & Koller, 2014).

In this instrument there are five questions about how the person felt during the last four weeks ("How long have you felt a very nervous person?", "How long have you been so depressed that nothing can cheer you up ? ", "How long have you been feeling calm or relaxed?", "How long have you been feeling discouraged and depressed?" And "How long have you felt a happy person? "). For each question, 5 response options are offered:" All the time "," Most of the time "," Some part of the time "" A small part of the time "and" Never ".

In the present study, the Portuguese version developed by Damásio, Borsa and Koller (2014) was used. These authors conducted exploratory and confirmatory factor analyzes that corroborated a single-factor solution, with all 5 items loaded on the expected factor, and excellent psychometric indicators. Cronbach's alpha reported was 0.86. In the present study, the observed alpha was 0.86.

- *Sociodemographic data.* A questionnaire was also used to collect information such as gender, age, state of study, type of university course (psychology, engineering, others), and the family income of the participant.

Procedures

Data collection

Participants received, by e-mail, an invitation to participate in the study. Those interested had to follow a link to access the online questionnaire. The first page of the questionnaire provided an explanation of the research. Participants were informed that participation was absolutely voluntary. In order to access and be able to answer to the

questionnaire itself, participants had to respond that they understood the purpose of the study and agreed to participate voluntarily.

Statistical analysis

Before any analysis was conducted, all the variables studied in the research were analyzed with the objective of evaluating the univariate and bivariate distributions through graphical methods (eg, branch and leaf, box-plot) and numerical methods (eg, kurtosis measurements) with the objective of evaluating normality, homogeneity of variance and the presence of extreme data (outliers, 3 standard deviations above or below the mean). For the purposes of the analysis, the software IBM SPSS Statistics version 24.0 (IBM Corp, 2016) and IBM SPSS Amos 22 (IBM Corp, 2013) were used.

Results

Positive Affects and Negative Affects Scale (PANAS)

The Exploratory Factor Analysis (EFA) of the Positive Affects and Negative Affects Scales (PANAS), (KMO = 0.92; Bartlett's Sphericity Test, $\chi 2$ (190) = 11249.77, p <.001) (Positive Scale = KMO : 0.89, Cronbach's alpha = 0.84, one factor responsible for 46% of the variance - Negative Scale = KMO = 0.88, Cronbach's Alpha (α) = 0.90, one factor responsible for 47.05% of the variance) presented a better solution with two factors, which together represented 42.95% of the variance explained by the constructs. This decision also took into account the sedimentation chart. All 20 items loaded on their respective factors with satisfactory factorial loads and did not carry another factor expressively (i.e.,> 0.30). Table 1 presents the results of the EFA, with the reliability coefficients observed.

A Confirmatory Factor Analysis (CFA) was performed with the second half of the sample (n2 = 1324) for cross-validation of the exploratory model. A borderline adjustment was achieved: RMR = 0.03; CFI = 0.91; TLI = 0.90. Factor loads ranged from 0.46 (item 3) to

0.64 (item 2) for the first factor 0.41 (item 7) to 0.79 (item 4) for the second factor.

The model only obtained satisfactory psychometric properties after receiving adjustments. Confirmatory factorial analyzes are notoriously stricter than exploratory factorial analyzes. The need for adjustments indicates that although the psychometric properties of PANAS are generally suitable for use in Brazil, some modifications in scale could improve the instrument. For example: at least three adjustments were related to item 9 ("Alert"). This word (Alert) can have a positive meaning, like being alert, but it can also have a negative meaning, like being alarmed. We believe that further studies should be done to evaluate this item.

Table 1

Exploratory factor analysis of the Brazilian version of the Positive Affects and Negative Affects Schedule (PANAS)

tems	Factor Negative Affects	Factor Positive Affects
PA01		,62
PA02		,52
PA03		,70
PA04		,66
PA05		,62
PA06		,68
PA07		,50
PA08		,71
PA09		,63
PA10		,58
NA01	,55	
NA02	,62	
NA03	,50	
NA04	,68	
NA05	,68	
NA06	,59	
NA07	,71	
NA08	,51	
NA09	,64	
NA10	,67	
Own Value	6,61	1,98
Explained Variance	33,03	9,92
Mean (SD)	2,09 (0,66)	3,32 (0,70)
Cronbach's Alpha	0,87	0,88

Extraction Method: Principal Axis Factoring, Rotation Method: Oblimin, with Kaizer normalization

Table 2
Parameters of the Confirmatory Factor Analysis of the Positive Affects and Negative Affects Schedule (PANAS)

Indicators	Pre Adjustments	Post Adjustments	Ideal Value
χ^2	1300,541	797,822	-
χ^2/gl	7,69	4,89	<5
RMR	0,04	0,03	<0,05
GFI	0,85	0,92	>0,80
AGFI	0,85	0,90	>0,80
CFI	0,84	0,91	Near 1
RMSEA	0,08 (0,07 – 0,08)	0,06 (0,05 - 0,06)	<0,10

Table 3
Correlations (r) of zero order between investigated measures

Scales[2]	1	2	3	4
1 Positive Affects Scale	-			
2 Negative Affects Scale	-0,49**	-		
3 Visual Analog Welfare Scale	0,54**	0,54**	-	
4 Subjective Well-Being Scale	0,54**	0,51**	0,64*	-
5 Mental Health Index Scale - 5	0,63**	0,72**	0,66*	0,64**

** All correlations were significant for p < 0,001. 1. To compute the score for Subjective Well-Being the Negative Affects Scale scores were inverted 2. "N"s ranged between 2648 e 2628.
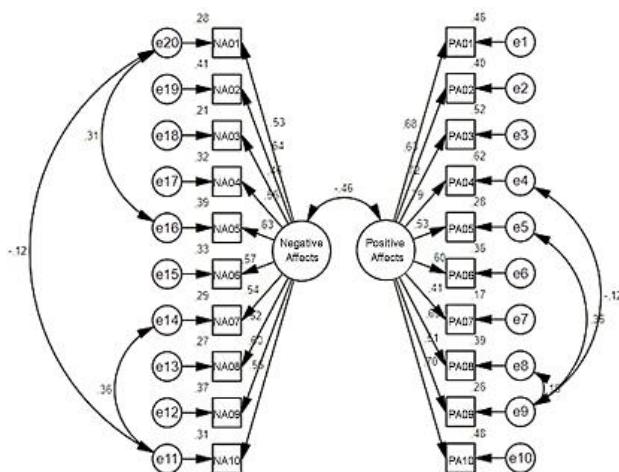

Figure 1
Confirmatory Factor Analysis of the Brazilian version of the Positive Affects and Negative Affects Schedule (PANAS)

Convergent Validity Assessment

In order to evaluate the concurrent validity of the Positive Affects Scale and Negative Affecs Schedule (PANAS), zero-order correlations were evaluated between these measures and the Visual Analog Welfare Scale, the Subjective Happiness Scale, and the Mental Health Index Scale – 5. For these analyzes the total sample (n = 2648) was used.

In the associations between the psychometric properties of the Positive Affects and Negative Affects Schedule (PANAS) and socio-demographic variables, male participants presented significantly (p <0.05) more Positive Affects (m = 3.48) and fewer Negative Affects = 1.96) than the female participants. (Positive m = 3.19 - Negative m = 2.18). It can be stated that the magnitudes of effect among these differences were average for some of the measures (Positive Affects, Negative Affects, Subjective Well-Being). For family income and age, the correlation coefficients obtained (p <0.01) were low for both positive and negative affects. (Age: 0.12 and -0.09 / Family Income: 0.07 and -0.06, respectively). In the relation between the type of course and affective state, engineering students presented significantly (p <0.05) more Positive Affects (m = 3.40) and fewer Negative Affects (m = 2.01) than psychology students. (Positive m = 3.22 - Negative m = 2.16).

Discussion

As can be seen in Table 3, very expressive correlation coefficients were identified. These coefficients indicate great convergence between all the measures considered. These results corroborate previous national and international studies, for example, Damasio,

Pacico, Poletto and Koller (2013) and Pires, Figueiras, Ribas and Santana (2013).

It is noteworthy, for example, the positive and significant correlation between the Positive Affect Scale and the Subjective Well-Being Scale (0.84), as well as the negative and significant correlation between the Negative Affect Scale and the Subjective Well-Being Scale (-0.76). In this way, the perception of affections, positive and negative, is presented as a predictor of subjective well-being, as the model proposed by Diener (1984) points out.

Another strong correlation was found between the Negative Affects Scale and the Mental Health Index Scale - 5 (-0.72), showing a negative and significant correlation, so that the lower negative affect experience is related to a better perception of mental health.

The Mental Health Index Scale - 5 also presented a significant, but positive, correlation with the Positive Affects Scale (0.63), these findings indicate that the absence of negative affects has a greater impact on the evaluation of mental health perception than the greater experience of positive affects.

On the other hand, the Positive Affects Scale presented a higher correlation with the Life Satisfaction Scale (0.52) than the Negative Affects Scale (-0.44). In this way, we can emphasize that the experience of Positive Affects has greater impact on the perception of satisfaction with life experienced by the individual.

Researches involving happiness, subjective well-being and sociodemographic variables have produced complex and often contradictory results. However, it is believed that it is safe to say that the results obtained corroborate previous robust and recognized studies with gender comparisons (Haring, Stock and Okun, 1984, Tesch-Romer, Motel-Klingebiel and Tomasik, 2008) and socioeconomic status (Kahneman & Deaton, 2010) whereas no elements have been found in the literature that discuss differences in undergraduate courses.

Conclusion

The data obtained in the present study corroborates with previous studies and indicates that PANAS presents satisfactory psychometric properties that support its use in Brazil.

The correlation analyzes of the PANAS scale with other instruments, such as the Mental Health Index and Well-being Scales, showed and confirmed the expected results, that a smaller dimension of negative affects and a larger dimension of positive affects leads to a better perception of mental health and a higher rate of subjective well-being. This indicates the convergent validity of the scales, giving greater reliability to the instrument.

However, due to the amount of adjustments required to obtain satisfactory psychometric properties, the analyzes also point to the possibility of improving the instrument, especially in relation to the terms used in its composition, due to the difference of meanings and their coverage in different languages.

Therefore, although the scale is satisfactory in the measurement of its object and reliable in its national use, new studies are recommended regarding specific items of the scale and possibly a revision of the terms that comprise this version of the instrument.

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