Psychometric properties of the RED-Technostress questionnaire in Peruvian workers

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Abstract

Background

Technostress is defined as the restlessness, fear, tension and anxiety that arises when learning and using technologies related to the use of the computer, directly or indirectly, and that, in the last place, ends with a psychological and emotional rejection that prevents continue to learn or use such technologies. This research aimed to adapt to the Peruvian context and evaluate the psychometric properties of the RED- technostress questionnaire, to demonstrate the validity and reliability of this instrument within the implementation in Peruvian organizations.

Methods and measures

258 workers participated online, mainly from the Lima-Peru region, who were working at the time of answering the questionnaire, removing those cases that showed univariate atypical influences.

Results

Content-based validity evidence was obtained; based on internal structure, through confirmatory factor analysis, obtaining acceptable goodness-of-fit indices with a second proposed model, removing three elements; and based on relation to other constructs. Likewise, acceptable reliability values were found for the second model.

Conclusion

The RED- technostress questionnaire is valid and reliable to apply in the Peruvian context and it is recommended to use the model proposed in this research.

Background

At present, the use of new information and communication technologies (ICT) demands the management of computer tools and the Internet, introduced in most productive sectors and in all functional areas of organizations, becoming an indispensable part of these [1, 2] Despite the benefits of technology on the technical and social level, technological changes can cause human and social problems[3].

In Peru, in relation to the implementation of ICTs, the National Institute of Statistics and Informatics and the Sectoral Offices of the National Statistical System, during the year 2019, registered 100 thousand 627 companies, of which 94.1% of the companies used mobile telephony, 93.8% used computers, 92.2% used the internet, 84.6% used fixed telephony, 17.4% used intranet, 15.1% Personal Digital Assistant (PDA) / Tablet and 7.4% extranet. However, only 23.3% of the business units trained their workers in the use of Information and Communication Technologies, while 76.7% did not. Therefore, it is necessary to add that the use of ICT creates demanding conditions in the workplace, and these demands have the potential to create stress in workers. Due to this, phenomena such as techno-stress originate [4, 5, 6, 7].

According to [6], techno-stress is defined as the restlessness, fear, tension and anxiety that arises when learning and using computer-related technologies, directly or indirectly, and which ultimately ends with rejection. psychological and emotional that prevents further learning or using such technologies. A difference between common stress and technostress is the effect it generates on one: in common stress, positive stress (Eustress) and negative stress (Distress) appear, unlike technostress, which manifests itself in a clearly negative way, affecting the activities of the workers. Similarly, another notable difference between common stress and technostress is in the types they have. While common stress presents the aforementioned types (positive and negative stress), the term technostress mainly encompasses three: technofatigue, referring to the situation in which a person experiences feelings of tiredness and exhaustion (mental and cognitive) as a consequence of use of technology, also complemented by skeptical attitudes and beliefs of ineffectiveness with the use of ICT; techno-addiction, which consists of a phenomenon characterized by the uncontrollable compulsion and need to make continuous, obsessive and compulsive use of ICTs and new technologies at all times and in all places [8], and techno-anxiety, in which the subject experiences high levels of unpleasant physiological arousal, and feels tension and discomfort due to the present or future use of some type of ICT. In addition techno-anxiety stems from technophobia, understood as the feeling of fear and/or unjustified and irrational rejection of technology. Additionally, techno-stress has been seen as a potential cause of Burnout syndrome, work fatigue, psychosocial discomfort and a decrease in arousal levels [3].

The need to design psychometric tools on technostress arose in the sixties and, over the years, measuring instruments on technostress have been developing. Its final objective was to gauge the degree to which attitudes towards technologies affect the psychosocial health of users and, consequently, find solutions. Mainly in the United States, technostress was managed with instruments such as the Computer Anxiety Rating Scale (CARS-C), Computer Thoughts Survey (CTS-C), General Attitudes Toward Computers Scale (GATCS-C), Computer Technology Hassless Scale (CTHS) and Technostress Questionnaire (TQ) [3, 1]. Likewise, numerous investigations resort to manufacturing their own techno-stress instruments [9, 10, 11, 12, 13, 14, 15]. However, these fail to encompass the concept of techno-stress in its entirety, being partial to anxiety or being pigeonholed in the impact of a type of technology, computers, instead of incorporating ICT in general. Given these limitations, the WONT-Psychosocial Prevention research team from Spain presented the RED-Tecnoestrés, which contemplates the experience of technostress from the dimensions of skepticism, fatigue, anxiety, ineffectiveness and, additionally, incorporating addiction to technology [3]. This last instrument has been used, especially, in the Latin American region [16, 17, 18, 19, 20, 21, 22, 23, 24], so its possible adaptation, validation and application in our country is promising.

In Peru, an attempt was made to adapt the RED-Tic to 321 employees of public and private companies in metropolitan Lima, among women and men aged 18 to 56. This questionnaire passed certain criteria which demonstrate validity and reliability [25].

However, the aforementioned research failed to pass the criteria of ten judges and the scarcity of Peruvian research on techno-stress makes a further psychometric review of this questionnaire necessary, both facts highlighted in its recommendations. Likewise, in said investigation the dimension of techno-addiction was not taken into account, for which reason its psychometric analysis is necessary. The implementation of the test is extremely important for organizational psychologists since techno-stress is a real problem in the world of work and that will have to be managed and prevented to guarantee the well-being of people, taking into account that these consequences depend both on the characteristics of ICT, as well as other factors of age, gender, education and confidence, which can affect the levels of techno-stress in the worker. Ergo, in the application of this test, the workers and, on a large scale, the organization will benefit directly.

For all the aforementioned, the present investigation had the objective of adapting to the Peruvian context and evaluating the psychometric properties of the RED-Tecnoestrés questionnaire, to demonstrate the validity and reliability of this instrument within the implementation in Peruvian organizations.

Materials and methods

Participants

In this research, 258 workers participated, mainly from the Lima region, who were working at the time of answering the questionnaire. Originally, the sample consisted of 279 participants. However, those cases that showed univariate outlier scores were withdrawn. All participants collaborated voluntarily, giving their informed consent. Likewise, in terms of demographic characteristics, the sample showed an age range between 18 and 89 years, with an average of 32.23 (SD = 14.55). On the other hand, 41.1% of the participants were male, and 58.9% female. 56.2% of those surveyed belonged to the university educational level, 41.9% came from the Southern Cone of Lima and 99.2% were of Peruvian nationality (for more detail, see Table 1).

Table 1 *Sociodemographic data*

	n	%
Distribution of participants by nationality		
Peruvian	256	99.2
Foreign	2	0.8
Total	258	100
Distribution of participants by gender		
Male	106	41.1
Women	152	58.9
Total	258	100
Distribution of participants by educational level		
Primary	0	0
Secondary	35	13.6
Advanced technician	78	30.2
Academic	145	56.2
Total	258	100
Distribución de los participantes por procedencia		
North Lima	17	6.6
South Lima	108	41.9
East Lima	27	10.5
Lima Center	74	28.7
callao	4	1.6
Province	28	10.9
Total	258	100
Distribution of participants by occupation		
Health professional	17	6.6
teacher	15	5.8
Administrative staff	29	11.2
Marketing and publicity	9	3.5
Human resources management	4	1.6
Customer service	49	19.0
Independent worker	34	13.2
National Police of Peru	3	1.2
Security agent	2	0.8

Others	96	37.2
Total	258	100

Note. N=258

Procedure

To start this research, a linguistic adaptation of the elements was carried out, from the Spanish to the Peruvian context, requesting the participation of 3 expert judges who had a minimum master's degree in psychology. Subsequently, and due to the difficulty in carrying out the test physically, the elements of the instruments were transferred to a virtual form in the Google forms application, which was disseminated mainly through social networks such as Facebook and WhatsApp.The form contained as a mandatory field to accept the informed consent, which allows the participant to be informed about the anonymity of their participation and also specifies the details of the scientific and academic objectives of the research, for which the participants were volunteers and did not receive any compensation. for your colaboration. Responses were obtained from 258 workers. Finally, the statistical analysis was carried out.

Measures

The RED-Tecnoestrés technostress questionnaire was produced, which has 22 items in 5 dimensions. Being D1 that of skepticism, which covers aspects such as disinterest, cynicism, doubt and implication that the person has in front of the technologies (1, 2, 3, 4). D2 is fatigue, this is related to the notion of relaxation, exhaustion, tiredness and concentration that the individual can feel after working with technologies (5, 6, 7, 8). D3 is anxiety, and includes the sensation of tension, fear, fear and discomfort that the subject may experience when using technology (9, 10, 11, 12). D4 is that of ineffectiveness, this is related to the difficulty, use, inefficiency and insecurity that the individual can perceive when working with technologies (13, 14, 15, 16). And finally, D5 is addiction, and contains the ideas of excess, continuity, accessibility, overthinking, impulsiveness and dedication that the person has in relation to their use of technology (17, 18, 19, 20, 21, 22). Likewise, the answers are graduated on a Likert scale of 6 categories: 0 = Never, 1 = Almost never, 2 = Sometimes, 3 = Regularly, 4 = Quite often, 5 = Almost always and 6 = Always [3]

Work Fatigue Scale The work fatigue scale (EFL) was used, which has 8 items in 2 dimensions, D1 being the physical load, which refers to muscle fatigue, which distinguishes two types of muscle effort: static and dynamic (1, 2, 3, 4); and D2 of mental load, which is related to the perceptual and cognitive elements involved in the development of an activity (5, 6, 7, 8). Likewise, the response format is a Likert scale of 4 categories: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree [26]

Statistical analysis

The items of the questionnaire were transferred to the Microsoft Office Excel 2019 program, to carry out the V of Aiken with the expert judges. On the other hand, the collected data was entered into this same program to later transfer it to the statistical package for social sciences SPSS version 27, in which the frequencies of the sociodemographic data, preliminary analyzes and evidence of validity based on relation to the data were obtained. other variables. The Amos version 24 program was also used to calculate univariate and multivariate normality. Likewise, the R-Studio program was used to apply the Confirmatory Factor Analysis (CFA) and obtain evidence of

validity based on the internal structure. This same program also produced the coefficients corresponding to reliability.

The preliminary analysis began, filtering 21 univariate atypical cases, taking into account the standard Z score, which should be outside the range − 3 and + 3. [27]. After this, the descriptive analysis of the items or reagents was carried out, obtaining scores of asymmetry and kurtosis, within the acceptable range of -1.5 and + 1.5 to identify that there is an approximation to univariate normality [28]. Regarding multivariate normality, the Mardia distance was used [29] and the critical ratio, being acceptable when it is less than or close to 5.00. [30]

Subsequently, we sought to obtain evidence of validity based on internal structure through the CFA, applying the robust weighted least squares estimator (WLSMV), since ordinal items are used [31]. Goodness of fit indices were taken into account, prioritizing a comparative fit index (CFI) and Tucker-Lewis index (TLI) greater than 0.90 to be considered acceptable [32, 33]; the root mean square error of approximation (RMSEA) and the root mean square standardized residual (SRMR), had to present values less than or equal to .05 to indicate a good fit [34]. Likewise, evaluations of the model were also obtained through the Chi-square, as well as the division between the Chi-square with the degrees of freedom [χ2/gl], forming acceptable values from 2 to 3 with a maximum of 5 [35]. Additionally, when non-optimal indices were observed, it was decided to propose a second model, removing items, and a comparison was made with the goodness-of-fit indices between this proposed model and the original one. On the other hand, for evidence of validity in relation to other constructs, a Pearson correlation coefficient was used, taking into account the effect sizes proposed by [36]. Finally, the reliability was evaluated, through the ordinal alpha coefficient, the Omega coefficient and the Extracted Analysis of Variance (AVE), which had to be located in a range of .70 to .90 to be considered acceptable [37], while the AVE had to exceed .50.

Result

Content-Based Evidence of Validity

Linguistic adaptation has been evaluated using expert criteria, with 3 psychology professionals with a master's degree being consulted. After this, the judges declared certain corrections in several items, which were adapted and items 1, 4, 5, 8, 9, 12, 13, 14, 15, 17, 18, 21 and 22 remained intact (for more detail, see Table 2).

Table 2

Linguistic adaptation of the RED-Technostress questionnaire

N° ítem	Spanish version	Adapted version
2	I feel less and less involved in the use of technologies	* I feel less and less immersed in the use of technologies
3	I feel more cynical about the contribution of technology to my work	* I feel more cynical (example: I have little or no confidence) about the contribution of technology to my work
6	When I finish working with technologies, I feel exhausted	* When I finish working with technologies, I feel exhausted
7	I am so tired when I finish working with technologies that I can't do anything else	* I feel so tired when I finish working with technologies that I can't do anything else
10	It scares me to think that I can destroy a large amount of information due to the inappropriate use of technology	* It scares me to think that I can lose or spoil a large amount of information due to the inappropriate use of technology
11	I hesitate to use technologies for fear of making mistakes	* I hesitate to use technologies for fear of making mistakes
16	I am insecure that I will finish my tasks well when I use technologies	I feel insecure about finishing my tasks well when I use technologies
19	I find myself thinking about technologies all the time (for example, checking email, searching for information on the Internet, even outside of work hours).	I think about the use of technologies continuously, such as checking email or searching for information on the Internet, even outside of working hours
20	I feel bad if I don't have access to technologies (Internet, email, mobile)	I feel bad if I don't have access to technologies

Likewise, according to the same criteria of expert judges, the majority of the linguistic adaptation items managed to obtain adequate values in Aiken's V, taking into account the domains of clarity, pertinence and relevance. The values obtained turned out to be greater than .80, which is considered acceptable within the range of 0 to 1 [38], with the exception of items 3 (Clarity = .67, Relevance = .67, Relevance = .78), and 16 (Clarity = .78).

Preliminary analysis of extreme scores

The preliminary analysis of the instrument items is evidenced, through the evaluation of asymmetry and kurtosis, which presented values that fall within the range of -1.5 and + 1.5, thus indicating that there is an acceptable approximation to univariate normality.. Likewise, with respect to multivariate normality, it was evaluated by the G2 distance of Mardia, considering the critical ratio less than the value 5.00 [30]. However, values above the said limit were obtained, being 35,142, which suggests that there is no multivariate distribution (for more detail, see Table 3).

Table 3

Normality of univariate and multivariate distribution

Variable	M	SD	g	r.c.	g2	r.c.
s1	2.87	1.694	0.842	5.523	-0.043	-0.14
s2	2.48	1.248	1.003	6.58	1.387	4.547
s3	2.35	1.151	0.886	5.808	0.62	2.034
s4	2.06	0.975	0.844	5.533	0.435	1.426
l5	2.64	1.456	1.028	6.743	0.875	2.869
l6	3.06	1.322	0.798	5.23	0.638	2.09
l7	2.52	1.181	0.903	5.923	0.846	2.774
l8	2.35	1.198	1.078	7.066	1.305	4.28
a9	2.40	1.147	0.828	5.427	0.727	2.384
a10	2.89	1.325	0.713	4.676	0.434	1.422
a11	2.27	1.046	0.587	3.849	0.018	0.059
a12	2.03	0.974	0.875	5.738	0.391	1.281
i13	1.90	0.987	1.021	6.694	0.454	1.488
i14	2.19	0.945	0.279	1.826	-0.657	-2.155
i15	1.71	0.858	1.113	7.299	0.711	2.332
i16	1.96	0.963	0.948	6.219	0.471	1.545
d17	3.09	1.534	0.588	3.858	-0.293	-0.961
d18	4.39	1.668	-0.098	-0.643	-0.914	-2.996
d19	4.32	1.793	-0.075	-0.493	-1.068	-3.503
d20	3.09	1.558	0.779	5.109	-0.032	-0.104
d21	3.28	1.592	0.558	3.66	-0.322	-1.055
d22	2.76	1.394	1.005	6.588	0.88	2.887
Multivariate (G2)					142.192	35.142
Note. M: Mean, SD: Standard deviation, g: Skewness, g2: Kurtosis, r.c: Critical ratio.						

Evidence of validity based on internal structure

The goodness-of-fit indices of the original model (Model 1), which has five dimensions, and has the 22 items of the questionnaire, were analyzed, evidencing the Chi-square values, degrees of freedom, and its division with values that exceed the threshold ($\chi 2/df = 5.644$). Likewise, the CFI and TLI were not adequate either, as they did not exceed the minimum limit of .90 (CFI = 0.881, TLI = 0.862). The SRMR presents the value of .110 and the RMSEA the value 0.134, which would not be considered optimal either.

Table 4
Goodness of fit indices

Model	χ^2	gl	χ^2/gl	p	CFI	TLI	SRMR	RMSEA	RMSEA 90% CI		WRMR
									Li	Ls	
Model 1	1123.221	199	5.644	0.000	0.881	0.862	0.110	0.134	0.127	0.142	1.879
Model 2	584.628	142	4.117	0.000	0.939	0.926	0.071	0.110	0.101	0.119	1.301

Note. χ^2: Chi square, df: degrees of freedom, χ^2/df: overall fit, p: significance of fit, CFI: goodness-of-fit index, TLI: Tucker-Lewis index, SRMR: root mean square standardized residual, RMSEA: error root mean square approximation, WRMR: weighted root mean square residual

After these results, it was decided to withdraw items 1, 18 and 19, due to their low factor loads. Therefore, a second model (Model 2) was proposed with these items eliminated. This showed improvements in its goodness of fit indices (χ2/gl = 4.117, CFI = 0.939, TLI = .926, SRMR = 0.071, RMSEA = 0.110), as well as a decrease in the WRMR, which indicates an improvement in the model (For further details, see Table 4 and Fig. 1).

Evidence of validity based on relation to other variables

Convergent validity evidence is presented between the RED-Technostress questionnaire and the Work Fatigue Scale. It was found that there is a direct and significant correlation between these two constructs (for more detail, see Table 5). This implies that the greater the amount of technostress, the greater the amount of work fatigue will be unleashed. However, due to the sample size, the effect size is extremely small (r2 = .07) (for more detail, see Table 5).

Table 5
Correlation between Technostress and Work Fatigue

V1		V2	r	p	r^2
Tecnoestrés	↔	Fatiga laboral	,507**	0.000	0.07

Note. * p < .05, ** p < .01, *** p < .001, r: Pearson coefficient, p: two-sided significance, r2: effect size

Reliability

Due to the ordinal nature of the data, the ordinal alpha and omega coefficients were calculated to estimate the reliability and internal consistency of the instrument. With the second proposed model, optimal values were shown in all its dimensions, being the ordinal Alpha coefficients (skepticism = 0.7941732, fatigue = 0.8963028, anxiety = 0.8424549, ineffectiveness = 0.8951679, addiction = 0.7995769) and omega (skepticism = 0.7574390, fatigue = 0.8603253, Anxiety = 0.7991213, Inefficacy = 0.8594114, Addiction = 0.7922576) those that indicate that the items are reliable and accurate because they are located in the range of .70 to .90. Finally, the AVE also showed adequate values in all the dimensions of the instrument (Scepticism = 0.5929253, Fatigue = 0.6848537, Anxiety = 0.5827035, Inefficacy = 0.6848722, Addiction = 0.5242852).

Discussion

The purpose of the research was to evaluate the psychometric properties of the RED-Technostress questionnaire in a sample of Peruvian workers who were working in the year 2022. The importance of knowing and evaluating technostress is sustained in a context in which ICTs increase their use considerably and can negatively affect the mental health of the worker who employs them. Therefore, the research was carried out to obtain evidence of validity and reliability of said instrument for the Peruvian context.

At first, the linguistic adaptation of the items from the Spanish to the Peruvian context was carried out, evaluating them with the criteria of expert judges in psychology. Taking their suggestions, certain items were modified (2, 3, 6, 7, 10, 11, 16, 19, 20). Likewise, it was possible to obtain evidence of content-based validity, with adequate values of Aiken's V, mostly, compared to [23], who adapted the questionnaire to Argentine university students, and did manage to demonstrate content-based validity in all the items in an optimal way.

Subsequently, evidence of validity based on the internal structure was obtained, obtaining inadequate results in the original model of the instrument. After this, a second model was proposed, removing some items (1, 18, 19), but maintaining the five original dimensions, which showed an improvement in the values of the goodness-of-fit indices, by obtaining adequate results. In agreement with the result, [39] obtained optimal goodness-of-fit indices, achieving an optimal RMSEA, unlike the present study. Likewise, [23] report that, in an exploratory factor analysis, there is also a 5-dimensional model, corresponding to the original model. However, in contrast to these results, [24] extracted the addiction scale from the original questionnaire to assess its psychometric properties in Mexican workers, obtaining results in an exploratory factor analysis that support a two-factor model in this dimension. However, since it is an evaluation of an extract from the total instrument, it does not compare the relationship of this dimension with the others.

Likewise, evidence of validity was obtained in relation to other variables, relating the RED-Technostress questionnaire with the Work Fatigue Scale. The results showed that, indeed, there is a significant relationship between both constructs. The approach of [3] on fatigue as an effect caused by techno-stress is corroborated with the empirical data of the sample.

Regarding reliability, this was evaluated through the internal consistency method through the ordinal alpha, omega and AVE coefficients. Favorable results were obtained for the second proposed model, Which maintain that the questionnaire has precision and accuracy when measuring the phenomenon. These results are comparable with the study by [39] where he also obtained adequate coefficients for the instrument, although in its first version it does not include the addiction dimension.

However, [23]managed to obtain highly optimal results in the 5 dimensions in their ordinal alpha and omega coefficients.

Having a sophisticated instrument to verify the existence of techno-stress in workers in any field is essential to know the performance that this can have within the organization, as well as to prevent more severe clinical pictures such as Burnout syndrome. Consequently, the present study manages to contribute with a brief instrument that meets the respective psychometric properties in the Peruvian context. In pragmatic aspects, tools such as the one presented are fruitful for the organizational psychologist, by using adequate and precise instruments that measure novel and emerging variables within the ICT world of work, such as techno-stress.

Limitations and future study

This study has limitations at the sample level, suggesting that psychometric tests of this nature be carried out with a larger number of participants, since the results cannot be extrapolated to larger populations. Likewise, the virtual format granted limited access for those who do not know how to fill out forms of this nature, or do not explore social networks. On the other hand, the number of evaluators as expert judges was reduced, with only 3 of them. In turn, due to time constraints, it was not possible to carry out a pilot test, to corroborate evidence of validity under the response process, nor a continuous survey of the participants, to corroborate evidence of validity based on consequences.

Finally, it is recommended that future research on technostress in Peru contemplate a larger sample, expanding its scope to regions outside of Lima. On the other hand, it is suggested that sociodemographic differences between groups, such as age and sex, be verified to create scales in the Peruvian context. Additionally, evaluating the content validity, as well as the linguistic adaptation of the original items by a greater number of expert judges, can help contribute to their validation more precisely.

Declarations

Ethics approval and consent to participate

The study was approved by the Ethics committee of Norbert Wiener Private University. Written informed consent was obtained from all participants and all the methods were performed in accordance with the Declaration of Helsinki.

Consent for publication

All participants provided informed consent for the publication of their data

Availability of data and materials

The data that support the findings during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no competing interests.

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Author contributions

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Figures

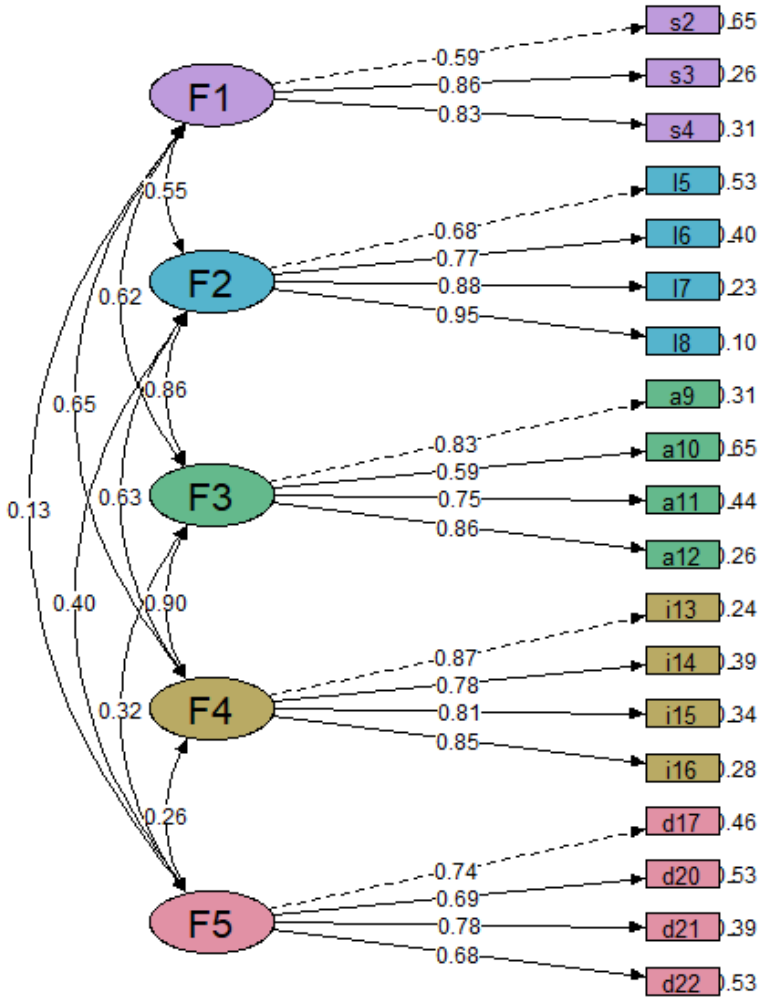

Figure 1

Model 2, eliminating item 1, 18 and 19.