Validation of the attitude scale for information and communications technologies

Validação da escala de atitude em tecnologias digitais da informação e comunicação

Validación de la escala de actitud en las tecnologías digitales de la información y la comunicación

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Abstract
Objective: To validate a scale that identifies the attitude of academics, from Health Sciences courses, as to the use of Information and Communications Technologies.
Methods: Methodological study, carried out with 292 undergraduates from Biological Sciences, Nursing, Nutrition and Medical School, and applied to the Information and Communications Technology Attitude Scales for Health with 14 items. Validation was conducted by a committee of experts involved in the translation from the Portuguese version, with internal validation, cultural adaptation. It passed through a pre-test, and a post-test, by means of exploratory factorial analysis, consistency and representability of the scale components.
Results: A total of 14 items was validated, all of which with construct adequacy, according to the measure of suitability of 0.80 and p<0.000. Factorial analyses produced a two-factor solution, positive and negative constructs, which allows better identification of academic attitudes.
Conclusion: The scale presented values of suitability above the average for this type of instrument. Thus, it is effective to assess the proposed object and it provides an innovative means of research within this field.

Resumo
Objetivo: Validar uma escala que identifica a atitude de acadêmicos, dos cursos de ciências da saúde, quanto ao uso de tecnologias digitais da informação e comunicação.
Métodos: Estudo metodológico, realizado com 292 acadêmicos dos cursos de ciências biológicas, enfermagem, nutrição e medicina, e aplicado a Escala de Atitude em Tecnologias Digitais da Informação e Comunicação para a Saúde com 14 itens. A validação ocorreu por intermédio de um comitê de especialistas envoltos na criação da tradução da versão em língua portuguesa, validação interna, adaptação cultural. Seguida ainda para pré-teste, e, pós-teste, por meio de analise fatorial exploratória, consistência e representabilidade dos componentes da escala.
Resultados: Foram validados 14 itens, todos apresentando adequabilidade de constructo, conforme medida de adequabilidade de 0,80 e p<0,000. Ainda, as analises fatoriais produziram uma solução de dois fatores, constructos positivos e negativos, o que permite melhor identificar as atitudes dos acadêmicos.
Conclusão: A escala apresentou valores de adequabilidade acima da media para este tipo de instrumento, mostrando ser efetiva para a mensuração do objeto proposto, fornecendo assim, um inovador meio de pesquisas neste campo de atuação.

Resumen
Objetivo: Validar una escala que identifica la actitud de académicos de los cursos de ciencias de la salud, en cuanto al uso de tecnologías digitales de la información y comunicación.
Métodos: Estudio metodológico, realizado con 292 académicos de los cursos de ciencias biológicas, enfermería, nutrición y medicina, y aplicado a la Escala de Actitud en Tecnologías Digitales de la Información y Comunicación para la Salud con 14 ítems. La validación se llevó a cabo a través de un comité de expertos involucrados en la creación de la traducción de la versión en portugués, la validación interna y la adaptación cultural. A continuación, para pre-test y post-test, por medio de análisis factorial exploratorio, consistencia y representación de los componentes de la escala.
Resultados: Fueron validados 14 ítems, todos presentando adecuabilidad de constructo, conforme medida de adecuación de 0,80 y p <0,000. Además, los análisis factoriales produjeron una solución de dos factores, constructos positivos y negativos, lo que permite identificar mejor las actitudes de los académicos.
Conclusión: La escala presentó valores de adecuación por encima de la media para este tipo de instrumento, mostrando ser efectiva para la medición del objeto propuesto, proporcionando así un innovador medio de investigaciones en este campo de actuación.

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Introduction

Information and Communications Technologies (ICT) are relevant products available in all areas of knowledge, especially in Health. In this field, attitudes towards their use are still poorly understood and assessed.

Despite their apparent easiness and the idea that they can train highly skilled professionals, ICTs may also be sources of distress and frustration, particularly for many academics.[1] The attitude of academics towards these technologies may interfere not only in their course continuity but also in the quality of care and use in their professional future.

It is a fact that some instruments were already created to measure factors that influence attitudes towards technologies, but with questionable validity. Nonetheless, few studies have been conducted to test the students' attitudes towards ICTs.[2]

The instruments to evaluate the attitude of the most common professionals[3] and, those developed for academics, are not yet available in a validated version in Portuguese. To this end, there must be a reliable version, in Portuguese, that presents acceptable internal and external validity indexes, as in the case of the Information Technology Attitude Scales for Health (ITASH) scale. Today it is available only in English and Korean.[2,4]

ITASH assists in identifying the attitude of health sciences professionals and students to the use of technologies. Considering that technology is evolving rapidly in recent years, ITASH has also made great strides since its publication in 2006.

The original version of ITASH had 48 items, grouped into 3 major factors. The second version had 19 items, distributed throughout 4 factors. It is now known that by applying and understanding ITASH, professors, students and professionals can better reflect on their attitudes toward technologies and seek adequate development along these lines. Technological appropriation is a demand to be met in all sectors of society, especially in Health.[2,4]

This study is presented as a solution for this gap, given that presenting a reliable instrument will be useful not only for researching, but also for teaching. When students' attitudes are identified, it is possible to decide the best way to use ICTs.

Therefore, the objective of this study was to describe the entire process of translation, transcultural adaptation, and internal and external validation of the Information Technology Attitude Scales together with Health students.

Methods

Methodological study, conducted in 2017 and 2018, in a Federal Institution of Higher Education, in the Northeast of Brazil.

In the first stage, the scale was translated from English (original language) into Portuguese by a translator, who masters both languages and is also a health professional. This was needed for achieving a quality translation. Transcription was then performed followed by back translation. Thus, after transcription in Portuguese, the scale was back translated into English, by the same translator, to verify if the original meaning remained. Finding no discrepancies, the next stage started.

In the second stage, the internal validation of the scale began. Six specialists, five of them from the Health Sciences and one from Pedagogy were chosen by curricular analysis. They evaluated the scale as for clarity, comprehension, relevance of the question and degree of relevance of the question.

The degree of relevance was based on a Likert scale, in which, 1=Irrelevant; 2=Little relevant; 3=Relevant; and 4=Very relevant. Furthermore, the Concordance Index (CI), 1 (0.25), 2 (0.50), 3 (0.75) and 4 (100) were used, calculated by the agreement provided by experts.

Items with a score of 1 or 2 were reviewed and eliminated when this average remained after the changes requested. To verify the validity of items, the minimum agreement should be 0.80.[5]

In the third stage, after the analysis by experts, the scale had another evaluator. As a Doctor of Education and practical, clinical and research expert in technologies for Health, and with mastery of English and Portuguese, he carried out the final

analysis, comparing once again the original and the produced version, to assist in the internal validation of the scale under analysis.

In the fourth stage, to verify the comprehension of the questions of the scale in its Portuguese version, it was applied, as a pre-test, for semantic analysis with students from Health Sciences. Students from courses of the institution under study, such as Nursing, Nutrition, Medical School and Biological Sciences were included. The latter was included because, within the attributions of biologists, developing studies that relate to preservation, sanitation and improvement of the environment are their duty, thus interfering in the health of the population.[6] The time to answer the questions was also evaluated, as well as the comprehension of the question and suggestions to facilitate future applications.

In the fifth and last stage, the external population had 1,198 students from the Health Sciences, belonging to the Nursing, Nutrition, Medical School and Biological Sciences, at the Federal University of Piauí (*Universidade Federal do Piauí)*/ Senador Helvídio Nunes de Barros Campus (UFPI/ CSHNB) with active enrollment and attending classes during the data collection of this study. To calculate the sample, the finite population model was used.[7] It resulted in 292 students, and this quantity was reached.

For data analysis, the Statistical Package for Social Science 20.0 for Windows (SPSS) was used. Research was approved by the Research Ethics Committee, located at UFPI/CSHNB, under Opinion 2.075.957.

Results

In the initial stage of transcultural translation and adaptation of the original version of the scale from English into Portuguese, there was no need for adjustments to the local culture. The original scale presented 19 items, all of which were maintained. The Portuguese version was named, at first, as *Escala de Atitude em Tecnologia da Informação e Comunicação aplicada a Saúde* (e-ATICS). It then passed through expert evaluation. The academic profile or experts was divided into those with master's degree (50%) and doctor's degree (50%), with experience in the area ranging from 1 to 10 years. Based on the criterion of clarity and comprehension, most items were approved, except for the items "The use of ICT devices is helping to improve patient/client care" (item 1), and "I think we are in danger for letting ICT devices take control" (item 5), which could lead to a misinterpretation. In table 1 it is possible to observe the experts' assessment of "clarity and comprehension" and "relevance". Overall, the scale was considered clear and comprehensive.

In addition, only two items (2 and 7) were scored 1 (irrelevant) and three items (12, 17 and 19) were scored 2 (little relevant). The items with CI>0.80 were considered consensual and proceeded to the next stage.

Considering the relevance of information on the existence of excessive ICT devices (item 7), it was not eliminated; this was agreed with experts in the next round. As for items 2, 12, 17 and 19, they were removed because they had contents similar to those already presented in the scale, when presented in Portuguese. The other items were adjusted according to the experts' suggestions.

Based on the results of this stage, all the suggestions were analyzed and considered by the authors of the study. A total of 15 e-ATICS was presented at the end of this stage. Moreover, the option of "uncertainty" was added in the answers so that the participants' responses be more reliable, avoiding the existence of only agreement and disagreement, as it was in the original version.

After the evaluation by the six experts, the scale went through the next evaluation, by a more experienced expert, who collaborated in the cultural/experiential and conceptual equivalence between the original version and the Portuguese version, already validated by previous specialists. Through this, the instructions for completing the scale were changed, with a change from ICT to DICT terminology when referring to technologies used in communication such as the Internet. Furthermore, items 4, 5, 7, and 9 were considered inaccurate.

Table 1. Experts' assessment of clarity, comprehension and relevance of initial items of e-ATICS

Scale item	Keep item	Clarity and comprehension n(%)	Relevance n(%)	CI
1st	NO	1(16.7)	0(0)	0.92
	YES	5(83.3)	6(100.0)	
2nd	NO	0(0)	1(16.7)	0.92
	YES	6(100.0)	5(83.3)	
3rd	NO	0(0)	0(0)	0.96
	YES	6(100.0)	6(100.0)	
4th	NO	0(0)	0(0)	0.96
	YES	6(100.0)	6(100.0)	
5th	NO	1(16.7)	0(0)	0.75
	YES	5(83.3)	6(100.0)	
6th	NO	0(0)	0(0)	0.83
	YES	6(100.0)	6(100.0)	
7th	NO	0(0)	1(16.7)	0.83
	YES	6(100.0)	5(83.3)	
8th	NO	0(0)	0(0)	0.83
	YES	6(100.0)	6(100.0)	
9th	NO	0(0)	0(0)	0.88
	YES	6(100.0)	6(100.0)	
10th	NO	0(0)	0(0)	0.92
	YES	6(100.0)	6(100.0)	
11th	NO	0(0)	0(0)	0.87
	YES	6(100.0)	6(100.0)	
12th	NO	0(0)	1(16.7)	0.88
	YES	6(100.0)	5(83.3)	
13th	NO	0(0)	0(0)	0.88
	YES	6(100.0)	6(100.0)	
14th	NO	0(0)	0(0)	0.92
	YES	6(100.0)	6(100.0)	
15th	NO	0(0)	0(0)	0.83
	YES	6(100.0)	6(100.0)	
16th	NO	0(0)	0(0)	0.92
	YES	6(100.0)	6(100.0)	
17th	NO	0(0)	1(16.7)	0.87
	YES	6(100.0)	5(83.3)	
18th	NO	0(0)	0(0)	0.87
	YES	6(100.0)	6(100.0)	
19th	NO	0(0)	1(16.7)	0.87
	YES	6(100.0)	5(83.3)	

Given these evaluations, during the synthesis process, item 4 changed from "I consider it dangerous to allow ICT devices to take control of work situations" to "I consider it dangerous to use DICT in the control of work situations". Item 5, "The time spent with ICT devices is disproportionate in relation to their benefits" changed to "Too much time is spent with DICT devices and few benefits are obtained from it", to facilitate understanding. In item 7, "ICT devices make the team less productive" interviewees were asked to explain better if it is the use in the care or if it is in the communication during work, advancing to "DICT devices make the production of clinical care of the team less effective". Item 9, "I would like to know more about ICT devices in general" changed to "I would like to know more about DICT devices in general", because digital technologies and better comprehension needed to be included.

The following changes were also made at this moment: the presentation of the single-page scale, the ordering of questions to follow a logical sequence, and the questions about learning, knowledge and competences in DICT, from 6 to 11 concerning process with DICT, from 12 to 14 hours with expressive contents of consequences of their use. The final version of the scale was named e- ().

With the purpose to perform a semantic analysis of e-ATDICS, it was applied to four students from the Health Sciences courses from a federal institution of higher education, who presented an average time of response of 4 minutes. They reported that the instrument was clear and comprehensive and did not suggest any changes. The final external validation process was then carried out.

The external validation occurred after the final version of e-ATDICS, which had 14 items, and was applied to a sample of 292 students from the Health Sciences. The validity of the factorial analysis was assessed by the Kaiser-Meyer-Olkin of Sample Adequacy (KMO), whose value was 0.80, considering the scale in Portuguese as very good.[8]

Bartlett's test presented a value of $\chi^2(91)=915.644$ and statistical significance ($p<0.000$), which demonstrates that the variables are significantly correlated (Table 2).

The results showed that e-ATDICS had adequate internal consistency. Exploratory factorial analyzes produced a two-factor solution. The first factor was related to the positive attitude towards the scale and incorporated all the reversed items. The other factor was associated with the nega-

Table 2. Average scores of e-ATDICS (A) and standard deviation (SD) for individual items, corrected item-total correlation and internal consistency (Cronbach's alpha) if the item is excluded

Item	A	SD	Corrected item correlation	Cronbach's alpha if the item is excluded
1.I would like to know more about ICT devices in general.	1.65	0.58	0.17	0.54
2.I can easily learn new skills in ICT.	2.20	0.87	0.18	0.54
3.I must work with ICT devices to be successful in my career.	1.86	0.76	0.20	0.54
4.Using ICT devices helps to increase the professional knowledge basis.	1.60	0.63	0.22	0.53
5.Skills in ICT become increasingly necessary for health professionals.	1.65	0.68	0.27	0.52
6.I usually feel confident working with ICT devices.	2.38	0.78	0.28	0.52
7.Using ICT devices is helping to improve patient/client care.	1.86	0.72	0.30	0.52
8.I believe that using ICT devices can help us provide personalized care.	1.84	0.71	0.32	0.54
9.ICT devices make the production of the clinical team care less effective.	3.26	1.01	0.22	0.55
10.I consider the use of ICT in the control of work situations to be dangerous.	3.48	0.83	0.42	0.54
11.The use of ICT devices makes my communication with other professionals faster.	1.75	0.72	0.29	0.51
12.A lot of time is spent on ICT devices and the benefits of using them are few.	3.51	0.92	0.41	0.55
13.I feel that there is an excess of ICT devices around us.	2.79	1.04	0.26	0.52
14.Using ICT devices causes more problems than benefits.	3.70	0.78	39	0.55

Table 3. Factor analysis of the main axis and commonalities (h2) of the 14 items of the e-ATDICS scale after the varimax rotation

Item	Load Factorial 1	2	h^2
4. Using ICT devices helps to increase the professional knowledge basis.	0.69	0.18	0.51
14. Using ICT devices causes more problems than benefits.	-0.59	0.44	0.54
8. I believe that using ICT devices can help us provide personalized care.	0.59	0.18	0.38
10. I consider the use of ICT in the control of work situations to be dangerous.	-0.58	0.51	0.60
7. Using ICT devices is helping to improve patient/client care.	0.58	0.33	0.44
12. A lot of time is spent on ICT devices and the benefits of using them are few.	-0.57	0.52	0.60
11. The use of ICT devices makes my communication with other professionals faster.	0.53	0.42	0.46
1. I would like to know more about ICT devices in general.	0.47	0.15	0.25
2. I must work with ICT devices to be successful in my career.	0.42	0.24	0.23
3. I can easily learn new skills in ICT.	0.31	0.26	0.16
13. I feel that there is an excess of ICT devices around us.	-0.27	0.60	0.44
9. ICT devices make the production of the clinical team care less effective.	-0.37	0.44	0.33
6. I usually feel confident working with ICT devices.	0.25	0.44	0.25
5. Skills in ICT become increasingly necessary for health professionals.	0.72	0.24	0.57

tive attitude and incorporated all contrary items. Confirmatory factor analysis led to a three-factor solution. One factor included all items of the scale, whereas the other two factors items included only inverted and not inverted words. The correlation coefficients of these two inverted and non-reversed factors with total scoring scores and characteristic shape suggest that e-ATDICS has only one significant construct (Table 3).

Thus, the scale can identify items with disparate factors, as well as items 9,10, 12,13 and 14 semantically and statistically present opposition to the other items. These items are identified as negative attitude factors. The remaining items of the scale have positive factors.

In future research, this pattern of disparity can be used as an exclusion criterion, because responses that do not follow these patterns of e-ATDICS items indicate an inconsistency with the attitude assessed. Thus, this logistic pattern assists in the exclusion of responses by chance, confirming another adequacy of the e-ATDICS scale.

In the subgroup analysis there was no significant variation influencing responses by sex, but it was observed that male individuals presented a slight tendency to greater confidence with the use and learning of ICTs.

Regarding the undergraduate course, there was a considerable variation in the answers, since students from Medical School presented a more positive attitude regarding the use of the ICTs, on average 50% higher than the students from other undergraduate courses. On the sequence, there were undergraduates from Nutrition and Nursing, with roughly identical patterns, tending to acknowledge ICTs as facilitators of the caring process. On the other hand, academics from Biological Sciences were the most skeptical about the benefits of ICTs, although they showed a greater interest in learning about them when compared to students from other courses.

Thus, based on these findings, e-ATDICS was effective for the analysis of the attitude of students from Health faced with Digital Technologies of Information and Communications for Health. Its use is recommended other researchers.

Discussion

This study made it possible to develop and validate the content of the Portuguese version of ITASH, which was named the Attitudes Scale in Digital Information and Communications Technologies for Health (e-ATDICS), to measure the attitude of students from Health Sciences given the content validation on the use of technologies. This scale is appropriate and reliable to verify students' attitudes about this subject by assisting in the comprehension of this circumstance.[2]

The transcultural adaptation procedure adopted a rigorous process. After translating the scale into Brazilian Portuguese, it passed through clinical experts and a judge to evaluate the content validation process, as the minor described in the results. In validation studies with similar methodologies, the translation stage was thorough and had no difficulties with experts; colloquialism was avoided. Few adaptations were made so that the scale items remained clear and comprehensive.[9,10]

Following the transcultural adaptation process in the validity stage, the translated instrument went through an analysis by clinical experts to verify the comprehension, clarity and relevance of each item, in which they also suggested adding factors and organizing its structure. Similar suggestions were found in the cross-cultural adaptation of the study by Leite *et al.* (2014), where they mention that the elements of the questionnaire were evaluated, created instructions for completeness, and added changes in the layout to achieve a better visual communication.[11] In the study by Assumpção *et al.* (2016), experts made verbal changes to adapt them to the grammatical rules of the translated language. They also altered words with the intention of improving the conceptual equivalence of the text.[12]

In order to evaluate the degree of content relevance of the scale items, descriptive statistics were applied in this study using valid percentages of expert opinions, whose items that obtained frequency equal to or greater than 80% were considered as consensual. Similar parameters could be found, whose authors calculated the IVC of the instrument, with 22 of the 24 proposed items were validated in the new version, however as of the adoption of a maintenance parameter with a minimum rate of 78%.[13] In another study, IVC for each item set of the analyzed indicators obtained values of 86% of agreement, granting content validity.[14] In this study, values above 80% were also adopted, and were essential for the initial analysis stage. Further statistical patterns were also used in another study of validity and reliability.[15]

For participants, the instrument was quick to apply and easy to understand. In this perspective, it is emphasized that in certain contexts, where time and availability are scarce, the time needed to fill out the instrument should be considered an important factor for validating it.[16]

Thus, by analyzing information that can be collected by the instrument and its potential benefits, the ideal filling out time is in average of 4 minutes. And, at the end of the application of the fourteen items that make up the instrument, the evaluator can have an overview of how the ICTs are seen by individuals.

In the analysis of the items that remained in the instrument, it is clear that they encompass, in a very simple and objective way, the rationale for assessing the use of ICTs by individuals, regardless of their area. The relevance of this instrument is due to the fact that, currently, there are technologies that use the most diverse means to integrate and facilitate learning, care with the patient and the communication of the professional with the team members and with the institution.[17]

Using ICTs can be considered a paradigm of innovation and evolution of societies. Nonetheless, more important than any technology is how people use it in their individual or collective development, i.e., how people make technologies be useful in their lives given that their learning styles must occur in a way comfortable to users, avoiding resistance to their use. In addition, there is a need for technical support, providing training, offering an overview of ICTs and demonstrating its main functionalities.[18,19]

The standardization of the language and the adaptations made in the e-ATDICS were fundamental for constructing the instrument. These processes allowed content categorization through a nomenclature of its own, which can be internationally recognized. They translate a common meaning to the health services in both national and international setting, in which people understand Portuguese. However, because it is a recently validated instrument, the lack of national studies developed with an emphasis on this theme made it impossible to compare the items obtained through research.

Conclusion

The validation stages also contributed to making available an evaluation instrument compatible with the national reality and the Brazilian educational institutions. This fact draws attention to the need of understanding the importance of using ICTs in their various forms, in Health, be it for educational or care purposes. It is still possible that the community is not aware of the potential of using technologies in practice. The importance of access to information and the possibility of managing it offered by the scale are highlighted, aimed at allowing decision making. The application of this scale will allow a more effective management in the use of these tools, and it is up to managers, professors and health teams to adapt to ICTs that offer more advantages or to seek solutions to the disadvantages found. There is much to be studied in the area of ICTs in Health, to learn how to deal with the technological devices that arise and their implications for the health care practice.

Collaborations

Oliveira MR, Correia VG, Dantas EO, Moreira TM and Torres RAM declare that they contributed to the study design, analysis and interpretation of data, writing of the article and approval of the final version to be published.

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