Original Article

Elaboration and validation of an assistive technology assessment questionnaire*

Elaboração e validação de instrumento de avaliação de tecnologia assistiva

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ABSTRACT

Assistive Technologies consists of resources, methods, and strategies favoring autonomy and inclusion of elderly and people with disabilities, being scarce in the literature instruments assessing them. A methodology study conducted with a panel of specialists and people with visual impairment, aimed to elaborate and validate a questionnaire to assess educational assistive technology. To consider an item as valid, we used 80% as agreement percentage, and validity and reliability of the questionnaire were calculated. Assistive Technology was characterized in six attributes: objectives, access, clarity, structure and presentation, relevance and efficacy, interactivity, and 19 items were elaborated to compose the questionnaire. From those, 11 obtained percentages higher than 80%, seven were modified and one was excluded. The instrument Cronbach's alpha was 0,822, guaranteeing validity and reliability of the tool to assess health education Assistive Technology, and therefore, its use is indicated.

Descriptors: Education, Special; Validity of Tests; Validation Studies; Reproducibility of Results; Self-Help Devices.

RESUMO

Tecnologias Assistivas consistem em recursos, métodos, estratégias que favorecem autonomia e inclusão de idosos e pessoas com deficiência, sendo escassos na literatura instrumentos que as avaliam. Estudo metodológico realizado com painel de especialistas e pessoas com deficiência visual, cujo objetivo foi elaborar e validar instrumento para avaliação de tecnologia assistiva educativa. Para se considerar um item do instrumento válido utilizou-se percentual de 80% de concordância, e foram calculadas a validade e a confiabilidade do instrumento. A Tecnologia Assistiva foi caracterizada em seis atributos: objetivos, acesso, clareza, estrutura e apresentação, relevância e eficácia, interatividade, para os quais foram elaborados 19 itens para a composição do instrumento. Destes, 11 obtiveram percentuais acima de 80%, sete foram modificados e um excluído. O alpha de Cronbach do instrumento foi de 0,822, o que garante a validade e confiabilidade do instrumento para avaliar Tecnologia Assistiva de educação em saúde, e indica-se, portanto, o seu uso.

Descritores: Educação Especial; Validade dos Testes; Estudos de Validação; Reprodutibilidade dos Testes; Equipamentos de Autoajuda.

INTRODUCTION

Many materials, methods, and strategies can be used as Assistive Technology (AT), to assist elderly and people with disabilities in their daily activities. Assistive Technology can be conceptualized as "field of knowledge, with interdisciplinary characteristic, englobing products, resources, methodologies, strategies, practices and services aiming to promote the functionality and participation of people with disabilities, their autonomy, independence, quality of life and social inclusion"[1]. The main AT goals are promotion of accessibility, quality of life and inclusion[2].

The AT use allows involvement of many professionals, as occupational therapists, speech therapists, physical therapists, psychologists, nurses, social workers, ophthalmologists, hearing specialists and prosthetics[3]. Assistive technologies are considered materials and products to assist in tasks as eating and dressing, resources to allow communication, control of electronic equipment, safety systems, accessibility projects, orthoses and prosthetics, postural adequacy, wheelchairs, base furniture, walking aids, magnifying glasses and lenses, Braille for equipment with voice synthesis, large print screens, telephone with keyboard – teletype (TTY), systems with touch-visual alert and accessibility resources to computers (voice synthesis, modified keyboards, special softwares)[2].

The study identified as main Assistive Technology attributes: interdisciplinary field of knowledge, resources, services, methods, strategies, practices, products, technology, equipment[4]. Those attributes are important because they help to characterize an Assistive Technology, therefore it is fundamental do assess them.

The use of valid and reliable instruments is necessary to affirm the adequacy of those Technologies to attend the finality of which they are proposed to, however after revising databases, it was noted that those instruments were scarce in the literature. Thus, a gap in the production of knowledge in this area is noted, because an adequate AT is important to promote autonomy and quality of life for elderly and people with disabilities and, a validated instrument contributes with an effective quality assessment of it.

Therefore, an instrument assessing the satisfaction of Assistive Technology users was identified in the literature, denominated Quebec User Evaluation of Satisfaction with Assistive Technology (QUEST 2.0)[5]. This instrument can be applied as a clinical or research tool and it has 12 items evaluated using a Likert type scale with five points. The items evaluate weight, height, fixation, safety and technology service, allowing the assessment of diverse Assistive Technologies. Thus, it was observed that this instrument is more adequate to assess hard type Assistive Technologies, as chairs, fixed bases, among others.

For this reason, it is considered needed to elaborate an instrument to assess educational AT, as texts, videos, audios, manuals, which are useful to provide information regarding healthcare to its users.

When observing the AT type, researchers may need to develop a measure for a particular construct that optimizes the construct operability in accordance with what the researcher design it for[6].

Educational Assistive Technologies are relevant information therapy strategies. In those, accessibility and intrinsic characteristics from technological supports and provided information should be considered when using it as educational therapeutic strategy by the nursing professional[7]. When considering these aspects, we need to guarantee that the right information gets to the right person at the right time.

To verify the identified needs to qualify better the care of people depending on Assistive Technologies, this study aimed to elaborate and validate an assessment questionnaire of educational assistive technology.

METHODS

A methodological study, with focus in the construction and validation of instruments[8]. In accordance with the adopted reference, the creation of instruments occurs in three steps, called clusters, as

follows: theoretical cluster, experimental cluster and analytical cluster. The theoretical cluster focuses theory questions involving the construct which is wanted to develop the measurement instrument, as well as the construct operability in items. The empirical cluster defines steps and techniques to apply the pilot tool to assess the instrument psychometric quality. Finally, the analytical cluster establishes the statistical analysis procedures to conduct with data aimed to conduct to a valid, precise, and standardized instrument[8].

The theoretical cluster is constituted by many steps, and it starts with delimitation of the psychological system or construct that is intended to measure. Psychological systems or constructs cannot be measured; however, its properties and attributes can be measured. Thus, the definition of attributes from the psychological or construct system is the step that follows, for which the measurement questionnaire is intended to be built. To delimitate attributes, it is suggested to follow the researcher experience, literature help and field specialists[8].

After, constitutive and operative definitions for the attributes are created. Constitutive definitions are those that commonly appear in dictionaries and encyclopedias. One definition is operative when the construct is defined not in conceptual terms, but in physical behavior terms, reflecting its expression. At last, theoretical analysis is performed by specialists, giving opinions about the relevance of the instrument items and, the semantical analysis performed with targeted population groups, confirming the comprehension of items[8].

On the experimental cluster, the steps for planning the instrument application occur, in which the sample, the instructions for its application, and information data collection are defined. On the other hand, there is data analysis in the analytical cluster[8].

In this study, the theoretical cluster step was conducted at first. Thus, educational Assistive Technology was the chosen construct. After, a literature review was conducted about Educational Technologies and educational Assistive Technologies that pointed as its attributes: objectives, accessibility, clarity, structure and presentation, relevance and efficacy, and interactivity[4,9-10]. Following, supported by the literature, constitutive and operational definitions for each attribute were created, described as follows:

AT **Objectives** are defined as purposes, goals or reasons to be reached with its use[9-10]. **Access** consists of the facility level to access the AT, if it is intelligible and comprehensible; as well as the right to access the information network, the elimination of architecture barriers, the communication availability, the physical access, equipment and adequate programs; content and information presentation in alternative formats[11].

On the other hand, content c**larity** indicates if the information presented by the AT is easy to understand. If the information statement is clear in the sense of content transmission[12]. **Structure and presentation** of the AT content refers to how information is presented and, includes its general organization, structure, presentation strategy, coherence and formatting[10]. **Relevance and efficacy** refers to characteristics assessing the level of significance from the presented educational material, to its capacity to cause impact, motivation and/or interest, as well as its significance level[9-10].

Interactivity consists on the subject's involvement in the educational process in an active way, and it can transform something that was pre-established in didactic situations in varied and interesting ones, to the point that it can provoke involvement. It is also related to the potentiality of a user to create ways and access information in accordance with their interest and work rhythm[13]. Interactivity stimulates processes and choices of subjects involved with the educational activity, which strengthens teaching and learning processes[14].

After the creation of constitutive and operative definitions of attributes, the construction of items for the Assessment questionnaire was developed, which were analyzed by specialists.

Six specialists participated in this step, they had practical experience and scientific production related to assistive technology, creation of tools or people with disabilities themes. Specialists were identified from a search on *Plataforma Lattes*, contacted by e-mail, and they also responded to this research by e-mail.

The items of the questionnaire should give values to the criteria: language clarity, practical pertinence, theoretical relevance and theoretical dimension. The **language clarity** criteria considers the language used on the items, considering the characteristics of the respondent population. **Practical pertinence** considers it each item was created to assess the concept of interest in a determined population, analyzes if in fact each item has importance to the questionnaire. The **theoretical relevance** criteria, aims to analyze if the item is related to the construct and **theoretical dimension**, investigates the adequacy of items to the theory studied[8]. Each criterion was assessed by a Likert type scale with three points: 0 inadequate, 1 partially adequate and 2 adequate.

The agreement percentage used was 80% among specialists as the decision criteria for pertinence of items on the questionnaire. After analyzing the answers, corrections were performed and the questionnaire was obtained, which was submitted to assessment by people with disabilities. This last assessment aimed to verify if the members of the targeted population comprehended the items.

The experimental cluster was conducted with the application of the questionnaire with visually impaired people in associations or institutes for blind people in the cities Recife, Natal, João Pessoa, Fortaleza and Teresina. We made an initial contact with directors from those institutions to present the study. From there, directors indicated members from the institutions, which helped the researcher to contact its users. When contacting a user, the research objectives were presented initially, and after a reading of the Informed Consent Term was done, asking participants to sign it. After such care, the researcher applied the questionnaire.

After the experimental cluster, the analytical cluster was conducted, consisting in analysis of the collected data. Data was entered in an Excel spreadsheet and analyzed using the *Statistical Package for the Social Sciences* (SPSS), version 19. The adopted level of confidence was 95%.

At last, validity and reliability of the instrument were calculated. Validity was verified by factorial analysis. The analysis in main components was followed by varimax rotation, a method used when a simple structure is wanted, once this is a technique that maximizes the most elevated and reduce the lowest saturations.

Regarding instrument reliability, internal consistency calculus was used, specifically, the Cronbach's Alpha coefficient.

The study was approved by the Ethics in Research Committee of the Universidade Federal de Pernambuco (CAAE 08796212.2.0000.5208).

RESULTS

The panel of specialists was constituted by six professionals of different fields of knowledge, as Nursing, Pedagogy, Physical Therapy, Occupational Therapy and Computer Sciences. Regarding their work experience, it varied from six to 38 years, in average 20,33 years. All selected specialists presented scientific production in the field of assistive technology development, people with disabilities or inclusive education. One of them develops research related to elaboration of instruments. Regarding titles, two of them have Master's degree and all others, Doctoral degrees.

From the definition of Assistive Technology attributes described previously, 19 items were created, and they were assessed by the panel of specialists. On Table 1, the items are described and the percentage of agreement obtained in each assessed criteria.

Table 1: Distribution of items in accordance with the percentage of agreement among specialists. Fortaleza, CE, Brazil, 2014.

Attributes	Items	Language clarity (%)	Practical pertinence (%)	Theoretical relevance (%)	Theoretical dimension (%)
Objectives	Relates the content addressed in Assistive Technology in your daily routine	83	100	83	100
	Solves doubts about the content addressed	100	83	83	83
	Stimulates learning about the content addressed	83	100	100	100
Access	Allows search for information with no difficulties	100	100	100	100
	Offers the adequate and needed resources for its handling	100	100	100	100
Clarity	Presents concise information	50	83	83	83
	Information content is adequate to the user's reality	66	100	100	100
	Describes presented concepts	66	100	100	100
Structure and presentation	Presents structured content	66	100	100	100
	Presents organized content	66	100	100	100
	Presents relevant aspects of the addressed content	66	100	100	100
Relevance and efficacy	Allows reflection about the content presented by the AT	83	100	100	100
	Arouses interest to use Assistive Technology	83	100	100	100
	Stimulates behavior change	83	100	83	83
	Reproduces the addressed content in different contexts	100	100	100	100
Interactivity	Offers interaction with Assistive Technology	50	100	100	100
	Allows navigation without difficulties through links presented by the AT	83	100	100	100
	Efficiency on operation of topics made available for AT access	66	100	100	100
	Provides autonomy to the user in relation to AT operation	83	100	100	100

From the evaluated items, eight presented agreement percentage lower than 80% in the language clarity criteria. From those, seven items were reformulated and one was excluded, as suggested by the specialists. Discordant items of language clarity criteria assessed: access, clarity of content addressed in AT, and structure and presentation.

Regarding practical pertinence criteria, theoretical relevance and dimension, items reached an agreement percentage between specialists equal or higher than 80%. Thus, all items were considered representative to assess Assistive Technologies, educational as educational texts, videos, manuals, among others.

Items were distributed in accordance with attributes identified for educational Assistive Technology. Four items judged the technology's objectives, two assessed access to AT, three assessed clarity, two evaluated structure and presentation of AT content, four assessed

relevance and efficacy and three evaluated interactivity. When the assessment by the panel of specialists was concluded, the items were inserted in the questionnaire, constituted by 18 items, as presented in Chart 1.

Chart 1: Distribution of items in the questionnaire. Fortaleza, CE, Brazil, 2014.

Atributes		Item	0	1	2
Objectives	1	Relates the addressed content in your daily life			
	2	Solve doubts about the addressed content			
	3	Stimulates learning about the addressed content			
	4	Stimulates learning of new concepts or facts			
Access	5	Allows to search for information without difficulties			
	6	Offers adequate and needed resources for its use			
Clarity	7	Presents necessary information for better comprehension of content			
	8	Information content is adequate to its needs			
	9	Presents information in a simple manner			
Structure and presentation	10	Presents content in an organized manner			
	11	It has an attractive presentation strategy			
Relevance and efficacy	12	Allows reflection on the presented content			
	13	Arouses interest to use it			
	14	Stimulates your behavior change			
	15	Reproduces content addressed in different contexts			
Interactivity	16	Offers interaction, active involvement on the educational process			
	17	Allows navigation without difficulties through the presented links			
	18	Provides autonomy to user in relation to its operation			

The instructions accompanying the questionnaire inform that participants should attribute grade 0 when judging the item as inadequate, 1 when partially adequate or 2 when considering the item adequate. To consider the questionnaire valid, it is important that all items are answered.

When specialists concluded the analysis, the questionnaire was submitted to semantical analysis by the targeted population and all items were considered clear and comprehensible and it was not needed to modify them.

In respect to the experimental cluster, 140 people with visual impairment participated, from those 65,7% were male, with mean age of 37,1 years and mean education level of 10,1 years. Regarding the type of visual impairment, 84,3% were blind and 15,7% had low vision.

In respect to validity, initially, the analysis of correlations matrix between items and the scale total was verified, allowing identification of indexes highly significant ($p<0,05$), with exception of items 1,2,7 and 10. All other items presented significant correlations between themselves and with the questionnaire's total. Factorial analysis attended to the decision criteria of Guttman-Kaiser, and revealed the existence of four attributes, as observed in Table 2.

After this analysis, four items were removed from the questionnaire and at last, the Cronbach's alpha was calculated, being 0,822.

When the analysis of psychometric measures was finalized, four attributes with 14 items remained and the questionnaire could be considered valid and reliable. The final version of the Assistive Technology Assessment Questionnaire can be found as follows, with previous guidance for fulfillment.

Assistive Technology Assessment Questionnaire

This tool aims to register your evaluation in relation to Assistive Technology (AT).

For each attribute, you should give the score of 0 to 2, as you wish, in accordance with the instructions below:

- Inadequate: the assistive technology does not attend to the item's definition.
- Partially adequate: the technology partially attends to the item's definition.
- Adequate: the technology attends to the item's definition.

If you are interested, you can comment, criticize or suggest the aspects that you considered positive or negative related to the AT.

Table 2: Distribution of questionnaire items in accordance with attributes. Fortaleza, CE, Brazil, 2014.

Items	Attributes				h^2
	1	2	3	4	
8	0,704				0,586
16	0,495				0,352
17	0,769				0,649
18	0,593				0,461
3		0,802			0,675
4		0,756			0,663
5		0,599			0,552
11		0,510			0,483
6			0,547		0,642
13			0,634		0,643
14			0,800		0,684
15			0,479		0,508
9				0,499	0,442
12				0,769	0,690
% Variance	32,457	9,558	7,907	7,444	
% Accumulated Variance	32,457	42,014	49,921	57,365	

Tests: Varimax Rotation. Factorial analysis.

Chart 2: Part of the Assistive Technology Assessment Questionnaire. Fortaleza, CE, Brazil, 2014.

Attributes		Item	0	1	2
1 Interactivity	1	The content is adequate to its needs			
	2	Offers interaction and involvement in the educational process			
	3	Allows access to the topics presented			
	4	Provides autonomy to the user in relation to its operation			
2 Objectives	5	Stimulates learning about the addressed content			
	6	Stimulates learning of new concepts			
	7	Allows to search for information with no difficulties			
	8	It has an attractive presentation strategy			
3 Relevance and Efficacy	9	Provides adequate resources for its use			
	10	Arouses interest to use it			
	11	Stimulates behavior change			
	12	Reproduces the addressed content in different contexts			
4 Clarity	13	Presents information in a simple manner			
	14	Allows reflection about the presented content			

DISCUSSION

During their practices, professionals focus on the promotion of more autonomy for people with disabilities. With the availability of the educational Assistive Technology assessment tool, we expect that professionals and users can evaluate their adequacy to proposed objectives, specially, when used as a questionnaire of therapeutic information.

Therapeutic information is based on evidence for a determined patient, caregiver, or consumer at the right moment to help them to make a health decision or an efficacy auto-management action of a therapeutic regimen[15]. The prescription of the right information, at the right moment and at the adequate dose is part of the caregiving process, it opens doors to a new way of thinking Nursing, creating a new opportunity to provide healthcare.

A study conducted with patients of chronic obstructive pulmonary disease identified that educational resources can adopt different technological supports, as long as they are adequate to the patients' informational needs[7]. This result is similar to the present study, as through an adequate instrument, it is possible to assess the informational capacity of an educational Assistive Technology that aims to inform and promote the user's autonomy. The information with therapeutic qualities for people with disabilities must be focused on decision, evidence-based, revised by specialists, updated and comprehensible to the people whose it was prescribed.

In a similar manner, the findings of this study corroborates with a study conducted with visually impaired people about sexually transmitted diseases, that pointed to the need of accessible initiatives for health promotion, as health information, dialogue, tactile materials, to this population exposed to diverse risk factors[16].

Results presented in this study are similar to another study in which the satisfaction scale for Assistive Technology was developed. The content validation with a panel of specialists was conducted, and they assessed the preliminary version of the questionnaire. At this level, the results revealed that it includes all important aspects of Assistive Technology satisfaction, and also it was verified the need of wording alterations of items and procedures to guarantee optimal content validity[5]. Content validation by specialists constitutes one of the steps to elaborate instruments[17]. This step refers to the phase when items adequately represent the construct that is intended to assess[18].

In this step, the panel of specialists provides a constructive feedback about the quality of measurement recently built and objective criteria to assess each item. Besides that, offers concrete suggestions to improve the measure[6]. It allows to improve and legitimate a new measurement instrument that is being proposed, relevant to create valid and reliable tools in the present health context[19]. Thus, there is evidence of the relevance of content validation studies, although it presents subjectivity of analysis from specialists as the main limitation, as well as divergence about what is the ideal number of specialists.

CONCLUSION

The validation process of the educational assistive technology assessment questionnaire was supported by literature review that identified objective attributes, access, clarity, structure and presentation, relevance and efficacy and interactivity with 19 items. After assessment by specialists, the instrument kept the attributes, and seven items were reformulated and one excluded. The resulting instrument from this step was submitted to the targeted public, people with visual impairment.

Statistical analysis with Cronbach's alpha of 0,822 consolidated the Assistive Technology Assessment Tool with four attributes: interactivity, objectives, relevance and efficacy and, clarity, distributed in 14 items.

The intention while conducting the study was to contribute with the elaboration of educational Assistive Technologies that could be assessed by reliable instruments. In general, this validation study provided

better direction to the revision of the investigated measure.

The proposed questionnaire was considered practical to assess educational Assistive Technologies designated to people with disabilities or elderly people who use them.

The presented results contribute to increments of knowledge in the theme, however, the proposed questionnaire reaches only educational Assistive Technologies, not being recommended its application to other types of AT.

The valid questionnaire is adequate to be used by people with disabilities to assess educational accessible objects, which becomes an innovation in the context of care for this clientele.

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