Adaptation of the Information Competency Assessment Instrument and Its Application to Undergraduate Students of the Universities of Magallanes and Playa Ancha

Cristian Valenzuela Urra
Universidad de Playa Ancha

Boris Valdenegro Egozcue
Universidad de Playa Ancha

Sergio Oliveros Castro
Universidad San Sebastián

Marlene Alvarado
Universidad de Magallanes

This article analyses the adaptation, application, behavior and analysis of psychometric qualities of the Information Competency Assessment Instrument (ICAI), developed by Rodney Marshall of Eastern Illinois University (2006), through the application on a stratified sample of students (n = 381) of the upper levels of the University of Playa Ancha and the University of Magallanes. Due to the low internal consistency of the original instrument, an exploratory factor analysis was developed to determine the emergent structure from the application, performing an analysis of the confirmatory coefficient to weight the adjustment level of the new emergent structure. The results propose an instrument to measure informational competencies in Chilean university students composed of 27 items and a distribution of five elements emerging, showing adequate levels of reliability (except for one of the subscales) and absolute, incremental and parsimony adjustment. Although the factorial structure differs from that proposed by the author, it is considered to be a recommendable instrument for the evaluation of informational competencies in Chilean university students.

Keywords: informational competencies assessment, competency assessment instruments, informational competencies

INTRODUCTION

The advance of digital technologies and the development of mass media and information resources, multiplatform and free access, are changing the ways in which relationships between people are carried out, establishing new ways of understanding human interaction mediated by technological tools, redefining the conception of networked learning (Sloep and Berlanga, 2011) and the criteria that allow evaluating the

concepts, channels and ideas that help to define the perception of the person's environment (Samerón, Rodríguez and Gutiérrez, 2010). This transformation is framed within what is normally known as the information and knowledge society, producing a series of innovations such as the breaking down of distance barriers and the increase and massive access to knowledge through the Internet and ICT networks (Arab and Díaz, 2015).

These advances have significantly influenced the educational level, reformulating and incorporating a series of new strategies and knowledge that aim to face the changes that the technologization of society brings, establishing forms of learning of an entrepreneurial type to the formative level, such as education by competencies (Palmer, Montaño and Palou, 2009), which are formed by a combination and interweaving of knowledge, skills and attitudes focused on the resolution of a problem, which is framed in a specific context; these competencies are characterized by being readaptable to the needs of their user (Sol, Mora and Moya, 2018).

In this perspective, among the essential competences in and for the information society are the information competences, which address issues such as searching, evaluating, processing and communicating information; these are part of a broader framework of knowledge, skills, abilities, dispositions and behaviors related to the capabilities of individuals to solve social, cultural, digital and academic problems by using information in a logical, structured, updated and ethical manner in different situations (Gamboa, Martínez and Maass, 2018).

Thus, information competencies are structured in the first place by information technology skills, which correspond to the manipulative, intuitive and functional use of computers, databases and computer systems that allow access to information resources to achieve academic goals (Osorio and Chiavola, 2008; Cuevas, 2006; Calderón 2010; Arévalo and Vázquez, 2016). Subsequently, it will be essential to develop information skills, which are framed in the basic cognitive structures of people and should be understood as the ability to do an activity or series of activities correctly and specifically with relative ease, these being developable through training or by the individual's own natural aptitudes when interacting with information (Nolasco and Ojeda, 2016).

It could be stated that information skills are the set of cognitive processes related to the use and management of information and are linked to technical and technological training to establish a mastery of the methodological principles of a subject for its correct use in the different informational media (Marzal, 2008a; Hernández & Iglesias, 2017).

These are expressed in the way in which the person is able to identify, interpret, argue and solve complex and authentic problems of the context with accuracy, speed, suitability and ethics using the information and data at his/her disposal (Attewell, 2009; Calderón, 2010; Area and Guarro, 2012; Borges and Marzal, 2017), also understanding the process of generation, production and transfer of information in technological environments and the principles of organization, representation and retrieval of the different contents on the web (Marzal, 2008b; Guix, 2016; Moyano, 2017).

This concept of information competencies is part of information literacy that emerged in the 1970s, based on Zurkowski's approaches (1974) regarding the importance of information in business systems and the way to manage it with the new technological means of the time. Since this first view, until today, this set of ideas and approaches on the subject has had an evolution and growth, both in the way of understanding and evaluating it (Rodríguez-Conde, Martínez-Abad and Olmos-Migueláñez, 2013). It is from the 90's that ALFIN, assumes a more emphatic role, emerging a series of institutions, researchers and lines of studies that are shaping it, which establish and position a series of standards (AASL, 2017; ACRL, 2016; Boden, Woolley, Armstrong, Webber, Town, & Abell, 2004; Bundy, 2003; Pasadas, 2002, 2001a, 2001b) and statements (Cortés, González, Lau, Moya, Quijano, Rovalo, & Souto, 2002; Cortés & Lau, 2004; Pasadas, 2003; IFLA, 2005, 2006, 2012, 2014; ALIA, 2006; IFAP & UNESCO, 2009; Obama, 2009; Ministry of Culture of Spain, Government of Catalonia, Departament de Cultura i Mitjans de Comunicació, and Col·legi Oficial de Bibliotecaris - Documentalistes de Catalunya, 2009; Regional Library of Murcia, 2010; ANABISAI & UNET, 2010; UNB, IBICT & FEBAB, 2011; UNESCO, 2011, 2014a; 2014b, 2015; BIALL, 2013), which deliver indicators to appreciate the performance and progress of people who have been

instructed in these info-competency knowledge (Cabra-Torres, Marciales, Castañeda-Peña, Barbosa-Chacón & Melo, 2017).

Competency Assessment

Among the different institutions carrying out initiatives regarding ALFIN, the first was the *American Library Association* (ALA), which presented its final report entitled: *"American Library Association Presidential Committee on Information Literacy: Final Report"* in 1989, which established a series of standards and regulations for the teaching and use of information literacy competencies through university libraries.

This document describes four basic competencies related to information management: (1) the skill to recognize when information is needed; (2) the skill to locate information; (3) the skill to evaluate information; and (4) the skill to effectively use the required information. This document establishes the basis for what will be the concept proposal of the *Association of College and Research Libraries* (ACRL) (2001), who generate the standards entitled: "Objectives for information literacy instruction: *A model statement for academic librarians"*, from which the following competencies will be derived: determining the nature and level of information needed, accessing the information needed effectively and efficiently, evaluating the information and its sources critically and incorporating the newly selected information into the knowledge base and value system, effectively using the information obtained individually or as a member of a group to achieve specific purposes, and understanding many of the economic, legal and social issues and problems surrounding the use of information, and accessing and using it ethically and legally. These were the basis in the 2000s for library institutions at the international level to generate their own information standards, with their respective variations, but retaining the basic idea and forming the conceptual theoretical body accepted worldwide until today (Torres-Gómez, 2016).

In terms of the evaluation of informational competencies, there are a number of studies that perform these measurements in students and teachers from different institutions (Rodríguez-Conde, Martínez-Abad & Olmos-Migueláñez, 2013); which are the result of the adaptation of other studies or designed by the researchers based on the specific case in question. This lack of instruments to evaluate information competencies in a standardized way has led to a gap between the results obtained among the different researches that have been conducted on the subject, and their theoretical-practical correlations (Uribe-Tirado and Alhuay-Quispe, 2017). The main problem with these instruments is measurement, since it depends on the type of study and scale preferences. On this point, those related to self-perception of competence (Pinto, Sales and Martínez-Osorio, 2009), attitudes towards competence (Cano, 2008), those that measure the level of technological use of users (Rangel, 2015), and those of self-efficacy (Pool-Cibrián and Martínez-Guerrero, 2013) stand out, the latter being the most widespread and well-known, as they have a broader scientific validity, although they require review, contrast and interpretation, depending on each case, and the respective care must be taken with them to avoid altered or erroneous results in the measurement (Franco and Rodríguez-Morales, 2010). Regarding the application of these instruments, an essential item to take into consideration is the educational level at which they are applied, being mostly at university level (Bielba, Martínez, & Rodríguez, 2017), and concentrating their focus on the measurement of competencies related to the search for information and usability of library resources (Ortoll, 2004).

It is in view of this background that the process of adapting the information competency assessment instrument ICAI (*Information Competency Assessment Instrument*) designed by Rodney Marshall, PhD in Information Science and Communication Studies at *Eastern Illinois University*, was developed. This instrument was initially introduced at the *National Communication Association Conference, New Orleans, Louisiana* (2002), based on the *Association of College & Research Libraries* (2001) standards for information literacy in higher education students.

Thus, one of the main objectives of this instrument's translation was its pilot application and to analyze its behavior as a mechanism for assessing information competencies based directly on the ACRL standards (2001), in Spanish, taking into account that the experiences in measuring info-competencies are instruments not designed and directly linked to the institution responsible for the standard (Hernández, Martínez, Olmos, & Rodríguez, 2016). Furthermore, as another relevant item, in the case of Chile, there is no standardized

instrument to measure ALFIN competencies, being the existing experiences tools designed by the libraries that carry out training programs in the subject (Marzal and Saurina, 2015).

METHODOLOGY

Sample

The development process of this study began in 2018, with data being taken from October of that year until April 2019, with the analysis of the data and results to proceed in the months that followed.

The sample was made up of 381 participants from the Playa Ancha University (UPLA, Valparaíso) and Magallanes University (UMAG, Punta Arenas), belonging to the higher levels (4th and 5th years) of their careers, drawn from a universe of 2899 students belonging to both institutions. The distribution by university was 176 (46.2%) for UPLA and 205 (56.8%) for UMAG. Ages ranged from 19 to 42 years, with a mean of 23.5 years and standard deviation of 3.1 years. The gender distribution was 43% for men and 57% for women.

Instrument

The "Information Competency Assessment Instrument" - ICAI (Marshall, 2006) was applied. It is a self-administered questionnaire composed of 40 items divided into ten (10) subdimensions, each one consisting of:

TABLE 1
SUBDIMENSIONS AND ITEMS

Subdimensions	Items
(a) Identification of contents	1,2,3,4
(b) Determination of requirements	5,6,7,8
(c) Use of information technologies	9,10,11,12
(d) Localization and retrieval of information	13,14,15,16
(e) Information from media	17,18,19,20
(f) Assessment of information	21,22,23,24
(g) Organization and synthesis	25,26,27,28
(h) Presentation of information	29,30,31,32
(i) Legality and ethics of information	33,34,35,36
(j) Assessment and learning arising from experience	37,38,39,40

Source: Marshall, 2006.

The response mode for each item is the expression of the degree of agreement on a scale from 1 to 7, with "1" being "strongly disagree" and "7" being "strongly agree". For its analysis, the author suggested recoding items 2, 4, 5, 7, 11, 14, 15, 17, 19, 21, 22, 25, 28, 29, 31, 33, 34, 38, 40 (worded in the opposite sense of being enabled in the consulted competency).

The global reliability report (Cronbach's alpha) of the instrument is 0.88, which is considered acceptable.

Processing

The ICAI instrument was translated from its original English version through different stages, in accordance with the proposal of several authors for the cultural adaptation of instruments (Hambleton and Patsula, 1999; Balluerka, Gorostiaga, Alonso-Arbiol and Haranburu, 2007) summarized below:

(a) A formal request was made to the author of the instrument, who gave his consent to carry out the process of adapting the instrument to Spanish. His formal consent was obtained prior to the start of the procedure.

(b) An original version of the instrument was then given to two translators, who independently translated it into Spanish. This version is agreed upon in a single version, in the company of a thematic specialist.
(c) The agreed version was translated into English independently by two translators (different from the previous ones), and a common version was agreed upon.
(d) The original and retranslated versions (in English) were discussed by the four translators together with a thematic specialist, analyzing the possible non-equivalences between the items. The corresponding adjustments were made to this retranslated version.
(e) The retranslated English version was sent to the instrument's author, and was observed and approved by him, and the final adjustments were made.
(f) The final translation of the retranslated version into Spanish was performed by an independent translator and finally reviewed by a thematic specialist.

Subsequently, a pilot application was carried out in order to obtain empirical data on the instrument from its application. These factors were taken into account in the final application, both in the preparation of the application protocol and in the final adjustment of some items in which comprehension difficulties were recorded.

The modified version of the ICAI was applied on the premises of the Magallanes University and the Playa Ancha University, in collective administrations carried out by members of the research team, during the students' academic period. The application time was 20 to 30 minutes.

Written and informed consent was requested, in which the rights and (minimal) risks involved in the application of the instrument were detailed, and a copy was given to each person.

Statistical Analysis

Before performing the confirmatory analysis, an exploratory factor analysis was carried out, both because of the results of the internal consistency analysis of the items and because there were no previous applications of the instrument in the Chilean university population. The Maximum Likelihood Method with Promax oblique rotation (SPSS version 23) was developed, as it was congruent with the existing relationship between the different dimensions of the construct. Subsequently, a confirmatory coefficient analysis of the modified model was performed using the AMOS Structural Equations Program (version 23).

RESULTS

Results of the a) descriptive analysis; b) internal consistency analysis (reliability and homogeneity); c) exploratory factor analysis; and d) confirmatory coefficient analysis are hereby presented.

Descriptive Analysis

The descriptive statistical data of the application are shown.

TABLE 2
DESCRIPTIVE STATISTICAL DATA

	Nº	Mean	Median	Mode	Stand. Deviation	Min.	Max.	Asym.	Kurtosis
1 Identifying the topic	381	5,47	6	6	1.276	1	7	.873	.694
2 Identifying the topic	381	4,23	5	5	1.649	1	7	.373	.835
3 Identifying the topic	381	5,24	5	6	1.323	1	7	.549	.203
4 Identifying the topic	381	3,6	4	2	1.819	1	7	.197	.1059
5 Determining the requirements	381	4,14	4	4	1.717	1	7	.242	.827
6 Determining the requirements	381	4,95	6	7	2.036	1	7	.754	.674
7 Determining the requirements	381	2,79	2	1	1.811	1	7	.649	.722
8 Determining the requirements	381	5,65	6	6	1.238	1	7	.995	.742

9 Use of information technologies	381	3,23	3	1	2.200	1	7	.457	1.270
10 Use of information technologies	381	4,99	5	5	1.349	1	7	.459	.016
11 Use of information technologies	381	3	3	1	1.838	1	7	.516	.852
12 Use of information technologies	381	5,46	6	7	1.577	1	7	.973	.274
13 Locating and retrieving information	381	4,72	5	7	1.894	1	7	.480	.834
14 Locating and retrieving information	381	4,07	4	4	1.725	1	7	.095	.775
15 Locating and retrieving information	381	3,78	4	4	1.588	1	7	.055	.597
16 Locating and retrieving information	381	6,07	7	7	1.325	1	7	1.758	3.115
17 Information from media	381	3,48	4	4	1.737	1	7	.083	1.010
18 Information from media	381	5,9	6	7	1.398	1	7	1.403	1.537
19 Information from media	381	4,52	4	4	1.405	1	7	.275	0.34
20 Information from media	381	5,04	5	5	1.518	1	7	.625	.010
	Nº	**Mean**	**Median**	**Mode**	**Stand. Deviation**	**Min.**	**Max.**	**Asym.**	**Kurtosis**
21 Assessing information	381	3,1	3	2	1.604	1	7	.328	.889
22 Assessing information	381	3,53	4	4	1.587	1	7	.0.18	.872
23 Assessing information	381	5,27	5	6	1.213	1	7	.584	.144
24 Assessing information	381	5,55	6	6	1.175	1	7	.684	.099
25 Organizing and synthesizing	381	3,89	4	4	1.644	1	7	.055	.885
26 Organizing and synthesizing	381	5,4	6	6	1.315	1	7	.773	.344
27 Organizing and synthesizing	381	5,07	5	6	1.462	1	7	.779	.284
28 Organizing and synthesizing	381	3,73	4	4	1.935	1	7	.116	1.112
29 Presentation of information	381	3,73	3	1	1.822	1	7	.313	.972
30 Presentation of information	381	5,25	5	5	1.298	1	7	.717	.683
31 Presentation of information	381	3,26	3	4	1.642	1	7	.249	.899
32 Presentation of information	381	5,38	6	6	1.277	1	7	.838	.838
33 Ethics and legality of information	381	3,7	4	1	1.966	1	7	.050	1.281
34 Ethics and legality of information	381	3,91	4	4	1.648	1	7	.169	.662
35 Ethics and legality of information	381	4,56	5	4	1.611	1	7	.360	.375
36 Ethics and legality of information	381	5,32	6	7	1.842	1	7	.872	.300
37 Assessing and learning from experiences	381	4,55	5	4	1.522	1	7	.316	.349
38 Assessing and learning from experiences	381	2,37	2	1	1.572	1	7	.926	.165
39 Assessing and learning from experiences	381	5,5	6	6	1.295	1	7	.812	.405
40 Assessing and learning from experiences	381	3,85	4	4	1.706	1	7	.134	1.014

Developed by the author, 2020.

It can be seen that the maximum and minimum values considered in the questionnaire ("1" and "7") have been chosen for all the items.

Except for items 16 and 18, the coefficients of skewness are within ranges from -1 to +1, consistent with a linear model typical of AFE (Ferrando & Anguiano-Carrasco, 2010; Lloret-Segura, Ferreres-Traver, Hernández-Baeza, & Tomás-Marco, 2014).

Internal Consistency Analysis

The internal consistency analysis of the application was carried out through Cronbach's alpha and the item-total correlation.

TABLE 3
RELIABILITY AND HOMOGENEITY ANALYSIS

General	Alpha: 0,876	

Scale 1: Identification of contents. Alpha: 0,566		
	Item - Scale Total	Item - Questionnaire Total
Item 1	0,258	0,360
Item 2	0,292	0,228
Item 3	0,131	0,375
Item 4	0,370	0,517

Scale 2: Determination of Requirements. Alpha: 0,383		
	Item - Scale Total	Item - Questionnaire Total
Item 5	0,321	0,455
Item 6	0,080	0,205
Item 7	0,246	0,379
Item 8	0,246	0,436

Scale 3: Use of Information Technologies. Alpha: 0,423		
	Item - Scale Total	Item - Questionnaire Total
Item 9	0,205	0,177
Item 10	0,364	0,367
Item 11	0,216	0,225
Item 12	0,211	0,375

Scale 4: Localization and retrieval of information Alpha: 0,334		
	Item - Scale Total	Item - Questionnaire Total
Item 13	0,179	0,417
Item 14	0,278	0,367
Item 15	0,162	0,159
Item 16	0,083	0,189

Scale 5: Information from Media. Alpha: 0,422		
	Item - Scale Total	Item - Questionnaire Total
Item 17	0,179	0,417
Item 18	0,278	0,367
Item 19	0,162	0,159
Item 20	0,083	0,189

Scale 6: Assessment of Information. Alpha: 0,706		
	Item - Scale Total	Item - Questionnaire Total
Item 21	0,598	0,624
Item 22	0,492	0,446
Item 23	0,512	0,515
Item 24	0,410	0,449

Scale 7: Organization and Synthesis Alpha: 0,316		
	Item - Scale Total	Item - Questionnaire Total
Item 25	0,220	0,352
Item 26	0,268	0,516
Item 27	0,010	-0,097
Item 28	0,171	0,488

Scale 8: Presentation of information. Alpha: 0,634		
	Item - Scale Total	Item - Questionnaire Total
Item 29	0,426	0,566
Item 30	0,392	0,382
Item 31	0,434	0,480
Item 32	0,440	0,453

Scale 9: Legality and ethics of information Alpha: 0,396		
	Item - Scale Total	Item - Questionnaire Total
Item 33	0,263	0,414
Item 34	0,245	0,411
Item 35	0,294	0,432
Item 36	0,083	0,247

Scale 10: Assessment and Learning Arising from Experience. Alpha: 0,455		
	Item - Scale Total	Item - Questionnaire Total
Item 37	0,179	0,417
Item 38	0,278	0,367
Item 39	0,162	0,159
Item 40	0,083	0,189

	Item - Scale Total	Item - Questionnaire Total			Item - Scale Total	Item - Questionnaire Total
Item 17	0,362	0,583		Item 37	0,339	0,237
Item 18	0,250	0,331		Item 38	0,169	0,424
Item 19	0,130	0,169		Item 39	0,280	0,326
Item 20	0,205	0,442		Item 40	0,262	0,359

Developed by the author, 2020.

As shown in Table 3, according to the assessment proposed by several authors (Nunnally, 1978; George and Mallery, 1995; Polit, Hungler, Palacios and Féher de la Torre, 1999), the general reliability coefficient remains at high levels (0.876), in accordance with the results reported by the author. When reviewing the subscales, only "Evaluation of information" (0.706) is within acceptable values, while "Presentation of information" (0.634) is at a weak level and "Identification of content" (0.566) is at a poor level; the rest of the scales are at an unacceptable level.

Together, the homogeneity of the items for each scale corresponds to the values of the alpha coefficients of each scale, ranging between 0.392 and 0.598 in the scales with acceptable levels of reliability ("Evaluation of the information" and "Presentation of the information"), while the remaining scales have weak correlations (between 0.010 and 0.370), with only four of them above 0.30. Item 27 is significantly low in the correlation coefficient, both for the scale (0.010) and for the general questionnaire (-0.097).

It is interesting to emphasize that the "Item-total questionnaire" correlations are in almost all cases (with the exception of items 2, 9, 22 and 37) higher than the "Item-total scale" correlations. This shows that the items respond to a general component rather than to the factorial structure proposed by the author.

According to this analysis, the levels of internal consistency observed do not support the multifactorial structure proposed by the author. It is proposed to develop an exploratory factor analysis in order to determine the coefficient structure that emerges from the empirical dimension of the sample studied.

Exploratory Factor Analysis (EFA)

An EFA was performed with the "Maximum Likelihood" extraction method, with Promax rotation. This type of rotation allows the existence of correlated items, adjusting to the assumption of a relationship between the dimensions of the information competency scale.

Regarding the requirements for the application of the EFA, it is important to note that the construct "Informational Competencies" is measured from a Likert scale with seven levels of response, managing to resemble the pattern of a continuous type variable (Lloret- Segura, Ferreres- Traver, Hernández- Baeza, & Tomás- Marco, 2014). Regarding sample size, there are authors who propose a size between 5 and 10 cases for each variable (Guadagnoli and Velicer, 1988; Velicer and Fava, 1998), although there are those who reject these item/individual ratios, recommending minimum standards of 400 subjects (Conway and Huffcutt, 2003; Gorsuch, 2003). According to either approach, our sample size (n= 381) is within acceptable margins.

In order to determine master adequacy, the Kayser- Meyer- Ohlin (KMO) and Bartlett's Test of Sphericity measures of sample adequacy were calculated, as shown in Table 4:

TABLE 4
KMO STATISTICS AND BARTLETT'S TEST OF SPHERICITY

Kaiser-Meyer-Olkin Measure of Sampling Adequacy	,873	
Bartlett's test of sphericity	Chi-square	3899,83
	gl	780
	Next	,000

Developed by the author, 2020.

According to Table 4, the KMO index = 0.873 is in an adequate range, indicating that the coefficients of the partial correlations between the variables are sufficient for the performance of an EFA. Regarding Bartlett's test of sphericity, the sphericity requirement is met, with $X2$=3899.83; p<0.01.

Determination of Factors and Proposals for Type of Analysis

The factorial loads matrix of the rotated solution includes all items (values above 0.30). Both the scree plot and eigenvalue methods propose the structuring of eleven components, as presented in the following structure matrix:

TABLE 5
STRUCTURE MATRIX

	Factor:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
it24 Assessing Information	0,62										
it 18 Informat. from Media	0,61										
it23 Assessing Information	0,564										
it26 Organizing and Synthesizing	0,561										
it8 Determining the Requirements	0,552										
it3 Identifying the Topic	0,529										
it1 Identifying the Topic	0,521										
it20 Informat. from Media	0,521										
it32 Presentation of information	0,497										
it10 Use of Information Technologies	0,461										
it16 Locating and retrieving information	0,461										
reit4 Identifying the Topic		0,714									
reit5 Determining the Requirements		0,541									
reit2 Identifying the Topic		0,507									
reit7 Determining the Requirements		0,397									
reit14 Locating and retrieving information		0,357									
reit11 Use of Information Technologies			0,565								
reit15 Locating and retrieving information			0,366								
reit34 Ethics and Legality of Information				0,56							
reit31 Presentation of Information				0,529							
	Factor:										
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
reit33 Ethics and Legality of Information				0,521							
reit29 Presentation of Information				0,456							
reit17 Informat. from Media				0,452							
reit25 Organizing and Synthesizing				0,435							
it37 Assess. and Learning Arising from Experience.					0,718						
it30 Presentation of Information					0,672						
it39 Assess. and Learning Arising from Experience.					0,546						
it6 Determining the Requirements						0,443					
it9 Use of Information Technologies						0,417					
reit40 Assess. and Learning Arising from Experience.							0,609				
reit28 Organizing and Synthesizing							0,504				

reit38 Assess. and Learning Arising from Experience.							0,388				
it35 Ethics and Legality of Information								0,579			
it36 Ethics and Legality of Information								0,452			
it27 Organizing and Synthesizing								0,322			
it12 Use of Information Technologies									0,671		
it13 Locating and retrieving information									0,555		
reit22 Assessing Information										0,788	
reit21 Assessing Information										0,592	
reit 19 Informat. from Media											0,617

Developed by the author, 2020.

The rotated factorial solution proposes the emergence of 11 items. According to Table 5, components 3, 6, 9, 10 and 11 do not present the recommended minimum quantity of 3 items (Lloret- Segura, Ferreres-Traver, Hernández- Baeza and Tomás- Marco, 2014), with items 11, 15, 6, 9, 12, 13, 22, 21 and 19 being excluded. This leaves a structure of six factors, with 31 items.

Confirmatory Coefficient Analysis

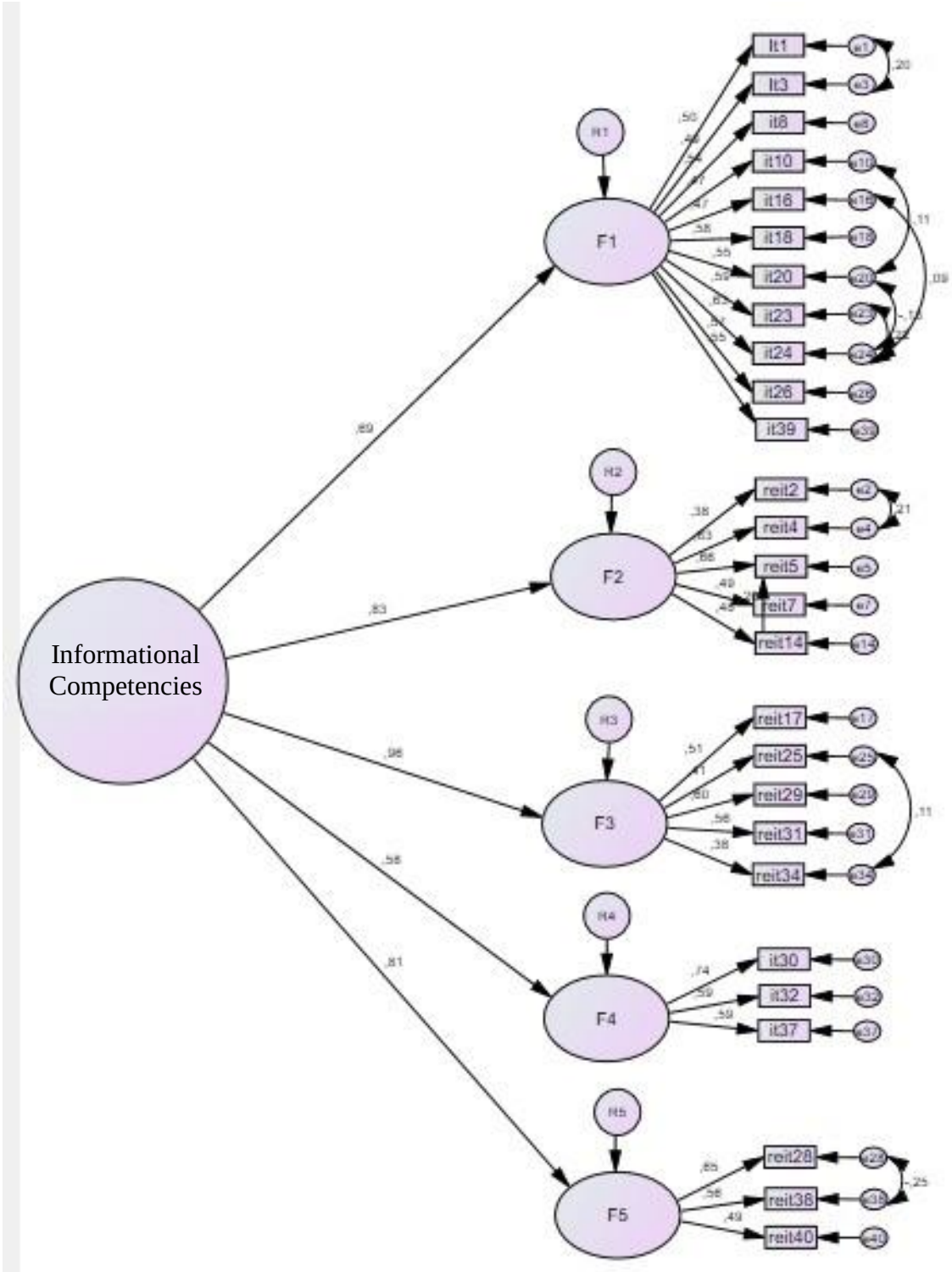
For the estimation of the factorial structure of the ICAI in its application in Chile, the structural equation modeling program, AMOS version 23, was used. The maximum likelihood estimation method was used. The modifications for model adjustment finally generate a five-item structure with a total of 27 items, obtaining the model shown in Figure 1, with adjustment indexes contained in Table 6.

TABLE 6
ADJUSTMENT INDEXES OF THE MODIFIED MODEL

	Absolute Adjustment Indexes			Incremental Adjustment Indexes			Parsimony Indexes	
	CMIN/DF (<5)	RMSEA (≤0,05)	GFI (0,90 – 1)	CFI (0,90 – 1)	TLI (0,90 – 1)	IFI (0,90 – 1)	AGFI (0,90 – 1)	PGFI (0,5 to 0,7)
Adjusted Model (27 Items)	1,662	,042	,911	,905	,892	0,907	0,892	0,747

Developed by the author, 2020.

FIGURE 1
FACTORIAL STRUCTURE WITH STANDARDIZED ESTIMATES. ICAI MODIFIED MODEL



Developed by the author, 2020

According to the CMIN/DF, GFI and RMSEA indexes, the model has an adequate absolute adjustment. The CFI, TLI and IFI indexes show the adequacy of the proposed model with respect to the comparison with a nested model. Finally, the AGFI and PGFI indexes, although below the cut-off level, are in a close range, showing that the model has an acceptable level of parsimony adjustment.

The final instrument is shown in Table 7.

TABLE 7
FINAL QUESTIONNAIRE

Factor	Alpha (Stand.)	Items
1.- Integration of Information and Simultaneous Thinking	0,824	1.- When I receive a task concerning a research project or an oral presentation, I feel confident about determining what topic I need to look for. 2.- I can address a complex topic and break it down into simpler, more useful articles. 3.- I am sure that I can use the information I find. 4.- It is easy for me to interpret the results of a search. 5.- I know the difference between a summary and an article. 6.- I can confidently use different types of media (printed materials, video, photographs, etc.) as information elements for my topic. 7.- I can confidently detect inaccuracies, errors, etc., in information from media. 8.- The information I use is comprehensive and reliable. 9.- I am sure that the information I have answers my question or addresses my topic. 10.- After collecting information, it is easy to classify it by similar contents. 11.- I can realize which processes would be useful to find information in the future.
2.- Determination of Information Constraints	0,632	12.- Sometimes I feel lost because the topic I want to research is not very clear to me. 13.- "Confused" is probably the best term to describe me when I start a project. 14.- Sometimes I am not sure how much information I need to accomplish the task. 15.- I get confused due to the existence of many different formats (printed materials, electronic, etc.) when I look for information. 16.- I consider government documents to be confusing.
3.- Presentation of Information	0,633	17.- Sometimes I am unable to find out for whom the information is intended. 18.- Most of the information I find is irrelevant and unnecessary. 19.- I am not sure what kind of media (transparencies, slides, video, etc.) is appropriate to provide this information.

		20.- Sometimes I have doubts about why I am communicating this information. 21.- I have doubts about the privacy of the information I receive.
4.- Organization and Synthesis of Information	0,672	22.- I know my target audience and I know the information I present meets their needs. 23.- I am sure that my information is presented in a clear and accurate manner. 24.- Sometimes my request changes according to the information I find.
5.- Certainty about the Correct Use of Information	0,519	25.- If my topic outline does not make sense, I get discouraged. 26.- Feedback discourages me. 27.- After the information was presented, I am not sure how it was received.
General Alpha	0,868	

Developed by the author, 2020.

DISCUSSION

The results obtained in the ICAI instrument can be explained from the logic of the sequentiality of thought, which is reflected in the ALFIN standards, located and developed between 2001 and 2006 (Pasadas, 2001a; Pasadas, 2001b; ACRL, 2001; Pasadas, 2002; Bundy, 2003; Boden, Woolley, Armstrong, Webber, Town and Abell, 2004; Cuevas, 2006); Cuevas, 2006), which respond to and contribute to the prioritization of a series of items that are organized in a chronological order marked by the continuous and inflexible positioning of their parts, which, in turn, are conditioned by the antisymmetry between them and their contents (Pérez-Álvarez and Timoneda-Gallart, 2000; Sarria, 2002).

This sequential thought processing, which is implicit in the ALFIN 2001 - 2006 standards, views the student as a being who seeks to solve his/her doubts, organize what he/she has learned, encode and decode meanings, store data, information and experiences to later retrieve and manage them according to his/her experiential needs (Pérez, Herrera and Ferrer, 2016). All these processes are established under a sequence of logical-rational imperatives that must trace predictable guidelines that allow the creation of verifiable deductions based on the information acquired.

As previously mentioned, it is necessary to highlight the rigidity of the sequential logic that is implicit in the 2001 ACRL ALFIN standards, which, although there are similarities with others in their internal components (Pasadas, 2002; Bundy, 2003), they are not fractionable or interchangeable, since they have their own indicators, tools, execution modalities and objectives.

With the emergence of mobile devices and the standardization of the massive use of digital tools in society, there were restructurings and updates in information literacy standards designed from 2011 to 2018 (SCONUL, 2011; ACRL, 2016; AASL, 2017; Sales, 2020; Coonan, Geekie, Goldstein, Jeskins, Jones, Macrea-Gibson y Secker, 2018), which were intended and designed in order to respond to the logic of simultaneous thinking processing, which is characterized by the parallel interaction of several nodes, which perform a series of processes at the same time to solve a problem more quickly (Delgado, Etchepareborda, Bakker and Rubiales, 2013).

The simultaneous thinking modality can be observed in the ALFIN standards, under the concept of *metaliteracy*, which is a framework in which critical and collaborative thinking is promoted in the digital context in which social networks and online communities are efficiently used, allowing the processes of obtaining, creating and developing knowledge together. This approach as a literacy conception influenced by simultaneous processing addresses four developmental domains in the informational behavior of each individual: behavior, cognition, affectivity and metacognition. These domains interact jointly in the understanding of the creation and distribution process of information, the recognition of gaps in personal

knowledge and also in external knowledge, the search for new knowledge to adapt to complex environments, the capacity to adapt to multiple technological changes, critical self-analysis of informational limitations, empowerment through interaction, communication and presentation of knowledge in different contexts, and reflecting on production and participation in collaborative environments (Mackey and Jacobson, 2011; Jacobson, Mackey and Head, 2015).

Metaliteracy, as part of information literacy, also develops a series of competencies that are an essential part of its integral approach: (1) Understanding in the use of different types of formats and the modality in which they are used, (2) Assessment of others' knowledge, understanding them from an investigative and active perspective, (3) Creation of contexts for the information that is generated in different environments, (4) Critical evaluation of the dynamic contents of the network, (5) Production of original content using multiple media and digital formats, (6) Understanding of the different issues related to personal privacy, information ethics and intellectual property, (7) Sharing information in participatory and complex environments and (8) The use and deep understanding of the taxonomies of multiliteracies (Marzal, 2020).

It is within this framework where information is not considered a static block of accessible and usable data, but rather a highly dynamic, reusable, interactive, retrievable, virtual, multimodal, media and ICT-interconnected grouping (Marzal and Borges, 2017), produced by a connective and connectionist speech (Downes, 2012; Fonseca, 2007; Siemens, 2004).

Under this framework, metacognition, critical thinking, reflection about the technological and communicational environment are central elements in the analysis of information, allowing to move from the instrumental to the cognitive part of the knowledge generation process; in this process also take relevance the different ways of learning of people for the creation of meanings based on personal experiences connecting with their cultural schemes and previous idiosyncrasies.

CONCLUSIONS

In terms of conclusions based on the results obtained from the translation, application and analysis of the ICAI results, it is possible to say that the ICAI had a totally unexpected behavior, since its original design logic corresponded to a sequential thought processing established and developed by the information literacy standards, between 2001 and 2006.

This can be seen in the original structure of the instrument, which has 10 measurement items connected to each other, which cannot be separated and attempt to measure each competency in relation to the previous one.

Transferring this rigidity to the analyzed instrument, which presented differences when tested with students who exhibited an informational behavior that differed from that proposed by the ACRL 2001 standards, due to two components, digital nativity and the change in the logic of interaction with information.

The aforementioned change in logic is a response to the processing of simultaneous thinking in the development of information literacy standards (2011 - 2018), which could explain to some extent the behavior of the ICAI instrument, applied in a university context different from the one in which it originated.

This form of simultaneous thinking can be observed in the items of the final questionnaire, since it groups items that are characterized by their creative capacity, validation of alternative ideas, new approaches and possibilities of action, creation of modifiable patterns, not subject to a determined order, restructuring of naturalized concept models, validation of the process over the result, acceptance of deviations in the process, linking of external ideas to the subject under review, exploration of less obvious paths, highly probabilistic processing and the use of information as a means and not an end in itself. This results in the 5 final items of the instrument: integration of the information and simultaneous thinking, determination of the conditioning factors of the information, presentation of the information, organization and synthesis of the information and certainty regarding the correct use of the information.

The above mentioned entails breaking the natural rigidity of the analysis processes, which try to divide the traditional logical order, in order to obtain different components that allow establishing a new form of

order that is different from the initial one and, consequently, to reach a result that orthodox thinking is not able to visualize (Flores, 2011).

On the other hand, the instrument's behavior could be explained fundamentally from the aforementioned conception of *metaliteracy*, as a frame of reference that connects learning about new technologies emerging in society with the different types of literacies that have emerged during the 21st century, unifying them in a single process. This is displayed in the results regarding the use of information based on previous knowledge, transforming the student, not into a recipient of information, but into an active producer of it, allowing him/her, within the simultaneity, to fade away the limits between the traditional systems of acquiring and producing academic knowledge.

Finally, it is necessary to state that although the original instrument is built under the logic of sequential thinking, the final proposal responds to a thinking of simultaneous logic and integration of knowledge, responding to different contexts, means and competencies, which does not mean that they are exclusive or that they cancel each other out; but rather that they are subject to an action according to the solution required for a problem, the information nature with which the person interacts and the individual learning modality of the person. In addition to the above, it is necessary to highlight that the results of the instrument are also conditioned by external agents such as the socioeconomic level of the students participating in the survey and the emotional and cultural elements to which they are subjected due to the degree completion process.

As a closing remark, it only remains to mention that the instrument that was originally intended for a quantitative measurement of informational competencies, is complex and limited by the very nature of the competencies it tries to measure. Arising from this complexity, there is a need to take into consideration the measurement of the qualitative factor represented in the new structuring of the instrument's items that respond to simultaneous and personal cognitive processes of the individual, and not to rigid mechanics of standardized problem solving (Ruvalcaba, 2018; Marciales, Castañeda-Peña, Barbosa-Chacón; Barreto and Melo, 2015).

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