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Artículos Científicos

Instrumento certificador de tecnologías de la información y comunicación y tecnologías del aprendizaje y el conocimiento para docentes universitarios

Instrument Certifier of Information and Communication Technologies and Learning and Knowledge Technologies for University Teachers

Instrumento de certificação de tecnologias de informação e comunicação e tecnologias de aprendizagem e conhecimento para professores universitários

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Resumen

Este artículo presenta los resultados de la investigación cuyo objetivo consistió en la elaboración de un instrumento innovador, ágil, veraz y confiable para evaluar y certificar al personal académico universitario. Un instrumento capaz de detectar cuatro niveles de conocimientos y uso en tecnologías de la información y la comunicación (TIC) y tecnologías del aprendizaje y el conocimiento (TAC).

Se trató de un estudio cuasiexperimental dividido en tres fases: *a)* elaboración de la prueba con diseño mixto transformativo secuencial; *b)* evaluación de la prueba con diseño mixto secuencial, y *c)* sistematización con App Ionic 3.

Una vez realizados los análisis cualitativos y cuantitativos, el instrumento resultó versátil y transferible en *1)* selección y contratación de personal, *2)* identificar el nivel conocimientos que tiene el personal, *3)* crear programas y/o cursos que refuerce o cree nuevas habilidades en TIC y TAC, *4)* categorizar al personal de acuerdo su nivel de conocimientos, *5)* promocionar al personal para adquirir beneficios o prestaciones laborales, *6)* evidenciar el nivel que tiene los académicos en la evaluación que realizan los organismos acreditadores y *7)* constancia curricular de posesión de nivel de conocimiento y uso en TIC y TAC en área académica.

Dicha prueba puede ser aplicable de forma individual o colectiva y obtener calificaciones a través de un método manual, por lo que se anexa una guía de usuario, o electrónico, para lo cual se requiere solicitar la página web a los autores.

Palabras claves: evaluación del docente; tecnologías educativas, tecnologías de la información y comunicación.

Abstract

The objective of this study was the development of an innovative, agile, truthful and reliable instrument to evaluate and certify university academic staff; a detector of four levels of knowledge and use in information and communication technologies (ICT) and learning and knowledge technologies (LKT).

This investigation was divided in three phases: a) Elaboration of the test with sequential transformative mixed design. b) Evaluation of the test with sequential mixed design. c) Systematized with App Ionic 3.

After the qualitative and quantitative analyses, the instrument turned out to be versatile, transferable in: 1) Selection and hiring of personnel, 2) Identify the level of knowledge that the personnel have, 3) Create programs and/or courses that reinforce or create new skills in ICT

and TAC, 4) Categorize personnel according to their level of knowledge, 5) Promote personnel to acquire benefits or labor benefits, 6) Evidence the level that the academics have in the evaluation that the accrediting bodies carry out and 7) Curricular evidence of possession of the level of knowledge and use in ICT and LKT in the academic area.

This this is applicable in individual or collective form and the qualification could be manual, reason why it is annexed instructions of user, or electronic —it is required to request the web page to the authors.

Keywords: teacher evaluation; educational technologies, information technologies.

Resumo

Este artigo apresenta os resultados da pesquisa cujo objetivo foi o desenvolvimento de um instrumento inovador, ágil, verdadeiro e confiável para avaliar e certificar o corpo docente universitário. Um instrumento capaz de detectar quatro níveis de conhecimento e uso em tecnologias de informação e comunicação (TIC) e tecnologias de aprendizagem e conhecimento (TAC).

Trata-se de um estudo quase-experimental, dividido em três fases: a) elaboração do teste com desenho misto transformacional sequencial; b) avaliação do teste com desenho misto sequencial ec) sistematização com App Ionic 3.

Uma vez que as análises qualitativas e quantitativas foram realizadas, o instrumento foi versátil e transferível em 1) recrutamento e recrutamento, 2) identificar o nível de conhecimento que a equipe possui, 3) criar programas e / ou cursos que reforçam ou criam novas habilidades em TIC e TAC, 4) categorizam o pessoal de acordo com o seu nível de conhecimento, 5) promovem o pessoal para obter benefícios ou benefícios do trabalho, 6) mostram o nível de acadêmicos na avaliação realizada pelos organismos de acreditação e 7) evidência do currículo de posse de nível de conhecimento e uso em TIC e TAC na área acadêmica.

Esse teste pode ser aplicado individual ou coletivamente e obter qualificações por meio de um método manual, portanto, um guia do usuário, ou eletrônico, é anexado, para o qual é necessário solicitar o site aos autores.

Palavras-chave: avaliação de professores; tecnologias educacionais, tecnologias de informação e comunicação.

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Introduction

This research develops, validates, systematizes and standardizes an instrument to evaluate university academic staff in terms of knowledge and use in information and communication technologies (ICT) and learning and knowledge technologies (TAC). It is a carefully crafted instrument, capable of estimating four levels of knowledge and use in applied technology in the teaching-learning process taught by academics.

Among the main criteria evaluated by the accrediting bodies are the educational programs and their implementation. The implementation highlights the knowledge and use of ICT and TAC of academic staff, as they are essential tools for the integral training of students: they promote technological skills essential to enter the labor market.

The instrument presented is an innovative, agile, truthful and reliable measurement product. It is able to detect levels of knowledge and use in ICT and TAC that the university academic staff possesses in accordance with the following parameters: a) theoretical concepts ratified in other recognized certifying research, b) expert piloting and c) criteria established by the Council for Accreditation of Higher Education (Copaes). What allows the instrument to be a certifier of knowledge and use in ICT and TAC.

Therefore, the results of the evaluation of the instrument serve as evidence, an element required by the accrediting bodies, and streamline the processes of measuring educational quality and its relevance in higher education.

However, the applicability of the instrument is acceptable because it collects data / information in a systematic way and allows obtaining individual or group results. Likewise, it presents an adequate transfer in Mexican higher level universities because it is prepared under the criteria requested by the Copaes and standardized with a university population of 20 states of Mexico.

The accrediting bodies registered in the Copaes request evidence of evaluations following the following criteria:

a) Essential indicators, sections: 4. Curriculum, subsection 4.2. Complying with technology teaching. 5. Academic Staff, subsection 5.1. Academic training and teaching experience (teaching using technology).

b) Indispensable indicators, sections: 4. Curriculum, subsection 4.3. Response to the needs of the discipline, its trends and areas of application (area of knowledge technologies). 5. Academic Staff, subsections 5.6. Teaching skills (technological) and 5.7. Teaching method (use of digital tools and platforms).

c) Necessary indicators, section 3. Administrative and financial management in section, section 3.4. Use of computer centers, classrooms and / or digital laboratories.

Who regulates and validates educational quality?

The international and national accrediting bodies are those that validate and certify educational quality based on culture, science and world economy.

Evaluations have become necessary internationally because there are organizations that continually determine educational quality. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is one of them. In the document Education by 2030, in its global indicator 4.4, the following is mentioned: “By 2030, considerably increase the number of young people and adults with necessary skills, in particular technical and professional, to access employment, decent work and entrepreneurship ”(Unesco, 2016, p. 78).

The quality of education and its relevance to employment have been measured for decades. For example, the Tuning Project (English words that mean que synchronization project ’), conceived by European universities and presented in 2003, aims to measure, compare and regulate learning in terms of generic and specific skills. Created with a universal language of knowledge and skills, used in different disciplinary areas, it has been the basis for the homologation procedure of study programs between universities in different European countries, and has enabled graduates to work in other locations in the European Union (González and Wagenaar, 2003). In Latin America, on the other hand, there is an adaptation of this initiative: Alfa Tuning Latin America, which is also based on the transfer of knowledge, homologation of university study programs and the social and economic development of the area (Beneitone *et al*., 2007).

In Mexico, national surveys are conducted to learn about the educational policy perspectives directed by the Organization for Economic Development Cooperation (OECD). These surveys evaluate the following factors: a) Students in terms of equity and educational quality, indexes for inclusion in the future beneficial and remunerated that requires knowledge in skills and technological skills; b) Educational institutions regarding the evaluation of the quality control of the teaching of technological skills as requirements for entering the labor market, and c) Educational systems to carry out the educational policy in terms of governance according to global socioeconomic growth (OECD) , 2017).

According to the indices produced by the 2016-2017 survey, the OECD (2018) advises the Mexican authorities as follows:

> Increase synergies between the Ministry of Finance, Public Credit, the Ministry of Economy, the Ministry of Finance, the Ministry of Labor and the National Council of Science and Technology to improve the quality and relevance of education for development needs to short and long term of the country (p. 17).

Another institution such as the International Labor Organization recommends lines of action to the SEP and other national educational institutions to regulate and coordinate education according to productive development and the national and international labor market.

The certification process in Mexico and its actors

The previous paragraphs show how international organizations make recommendations for Mexican educational institutions. The implementation of the recommendations regulate the standards of educational quality and their relevance to the production rates and needs of the national and international labor market.

The Ministry of Public Education [SEP] is responsible for guiding and measuring these lines of action stipulated by the different international organizations. And as is known, the SEP directs the Copaes, the only instance authorized by the Federal Government to accredit higher level educational programs in Mexico (Copaes, 2018).

Another instance that supports and supervises the certification processes is the National Association of Universities and Institutions of Higher Education (Anuies).

The Copaes, whose objective, as already mentioned, is to evaluate the educational quality, carries out its work based on the following guidelines: 1) Equity and impartiality, 2) Congruence and reliability, 3) Quality control and assurance, 4) Responsibility and seriousness and 5) Transparency and accountability (Copaes, 2018).

The Copaes has the registry of all authorized accrediting bodies, which are alien to any particular interest of person, group or institution (Copaes, 2016).

The first accrediting body in Mexico is the so-called Inter-Institutional Committees for the Evaluation of Higher Education (CIEES). This is able to measure and support the institution or higher education program because it has nine inter-institutional committees, according to the different areas of knowledge, measuring and certifying in Level I.

Level II educational quality is more specific and is evaluated by certification bodies specialized in different areas of knowledge; All evaluations are reported and recorded in Copaes (2018) through categories.

The categories contain a set of criteria, indicators and standards, which are subject to detailed evaluations to be able to issue an accreditation opinion, according to the Copaes (2016);

and are: 1) Academic staff, 2) Students, 3) Curriculum, 4) Learning evaluation, 5) Comprehensive training, 6) Learning support services, 7) Linking, Extension, 8) Research, 9) Infrastructure and equipment and 10) Administrative and financial management. In addition to this, each category has subcategories that encompass the specific evaluation form (Copaes, 2016).

The present study focused on category 1) Academic staff. It contains the subcategories:

a) Recruitment, selection and hiring: are the processes for entering the academic institution, which considers the hiring of personnel who have the skills and abilities for the management of ICT and TAC.

b) Development: a process that measures trajectory (such as the assignment of programs and / or courses that reinforce or create new skills, including the use of ICT and TAC as a transversal competence).

c) Categorization and level of studies: processes that evaluate the balance of academic staff in the activities that must be carried out within the institution and its competences, where knowledge and use of ICT and TAC can be paid

d) Internal evaluation: estimation of the performance of academics and the promotion they have received according to their performance (National Council for Teaching and Research in Psychology [CNEIP], 2018b, pp. 17-20).

This same trend is reflected in higher education institutions, as observed in the Autonomous University of the State of Mexico (UAEM).

> The primary purpose of professional studies is the training of the student, through the development of their faculties, aptitudes, attitudes and values, to exercise high quality professional activities and evolve in the labor field, as well as to perform in the investigation, creation and recreation of knowledge ”Regulation of Professional Studies (UAEM, 2017, p. 195).

It should be noted that this institution has 92% of its educational programs with some accreditation from various organizations. Due to its trajectory, the UAEM was selected and its experts in ICT and TAC were invited to participate in this research, as well as the academic experts needed to perform the qualitative analysis.

Evaluation of ICT and TAC in higher education

Higher education institutions have developed procedures and measuring instruments because they require evidence to prove their educational quality. Through them, the knowledge

criteria and the use of ICT and TAC are evaluated. Although these are related to transverse instrumental academic competencies (Prendes, 2010).

The indexes and evidence requested by the accrediting bodies regarding the evaluation items of university academic personnel are the general guidelines of a personal type (curricular). In the academic trajectory it is possible to observe specific parameters of teaching-learning processes, adjusted to the learning and development programs, the updating of specific and transversal skills in the use of ICT (Cabero and Gutiérrez, 2015). Mentions are also mentioned for academic staff.

> It involves three relevant dimensions in the consideration of competency training: a) the professional profile as a reference for curriculum design, b) the training space, integrating the training institution and the socio-labor institution and c) the training time, which is projected along of a lifetime, the initial training being insufficient and highlighting the role of continuous training (Tejada y Ruiz, 2016, p. 7).

Instruments for assessing ICT and TAC at a higher level

Under the auspices of the European Commission, ICT research has been carried out and several instruments have been designed on the Web, such as DigComp, which measures digital skills in a common population (Ferrari, 2013). This, in addition, was the foundation for the construction of the DigCompEdu instrument, which also measures digital competencies in professors of any academic level and is supported by the Joint Research Center (JRC). Both instruments are contemplated in the Europe 2020 Strategy, an agenda that evaluates the teaching today according to the employment of tomorrow (JRC, 2017).

Under the sponsorship of the Spanish Ministry of Education and the support of the Educational Technology Research Group of the University of Murcia, the questionnaire entitled "ICT Competencies for Teaching at the Spanish Public University" was built in 2010 (Prendes, 2010), the which served as a background to build the instrument to certify the ICT competence of Durán (2015) and Durán, Gutiérrez and Prendes (2016). The preliminaries of the latter consist of the following: 1) has internal validation (discussion group) supported by good teaching practices (Prendes and Gutiérrez, 2013) and 2) has external validation with a pilot test in university professors and with parameters of the European Union (Gutiérrez 2011 and 2014). These types of continuous evaluations serve as the basis for certification bodies in Spain.

In the Latin American context, Taquez, Rengifo and Mejía (2017), researchers from the School of Education Sciences of the Icesi University of Cali, Colombia, built an instrument

called SABER-TIC, which allows obtaining information on the knowledge and appropriation of ICT in teachers, with the aim of identifying the "educational needs for the design of teacher training plans for the integration of ICT in the teaching and learning processes" (Taquez et al., 2017, para. 9).

As we have seen, there are different instruments that measure ICT. Well, it is an essential area in education, so there are specialists in describing the impact that ICTs and TACs have on university education (Ramírez and Casillas, 2014), considered here as essential tools for the execution of integral education.

Bases for the construction of the instrument proposed in this investigation

The instrument proposed here measures ICT and TAC. The construct validity was obtained through the proven theoretical parts that support the two instruments mentioned above: 1) The one proposed by Durán (2015) and Durán et al. (2016), which supports and verifies the aspects of cross-sectional and domain evaluation that teaching-learning with ICT requires. The above through the measurement of three intrinsic blocks of ICT competence and three levels of mastery, which gives the certification range (Durán, 2015; Durán et al., 2016) and 2) the SABER-TIC instrument, which it bases and measures the part of use and appropriation of ICTs, including in practice these tools, since they are in the implementation of technology in learning (Taquez et al., 2017).

The instrument is useful because it allows to evaluate and certify in an agile, valid and reliable way the academic staff in a) level of knowledge in ICT and TAC within the personnel selection process, b) detect the training needs in ICT and TAC, c) detect the level of knowledge in ICT and TAC for categorization promotions and d) prepare proof of accreditation in four levels of knowledge in ICT and TAC; valid and reliable evidence for when they are evaluated by external certification bodies.

Method

This is a quasi-experimental study developed in three phases, namely: 1) Development of the instrument: a sequential transformative design (Ditras) was implemented; 2) Evaluation of the provisional instrument: a sequential mixed design was used [Dimixs] (Llobel, Pérez and Navarro, 1996), and 3) Final instrument alignment: it was systematized and standardized (see figure 1).

Figura 1. Estudio cuasiexperimental con diseños mixtos

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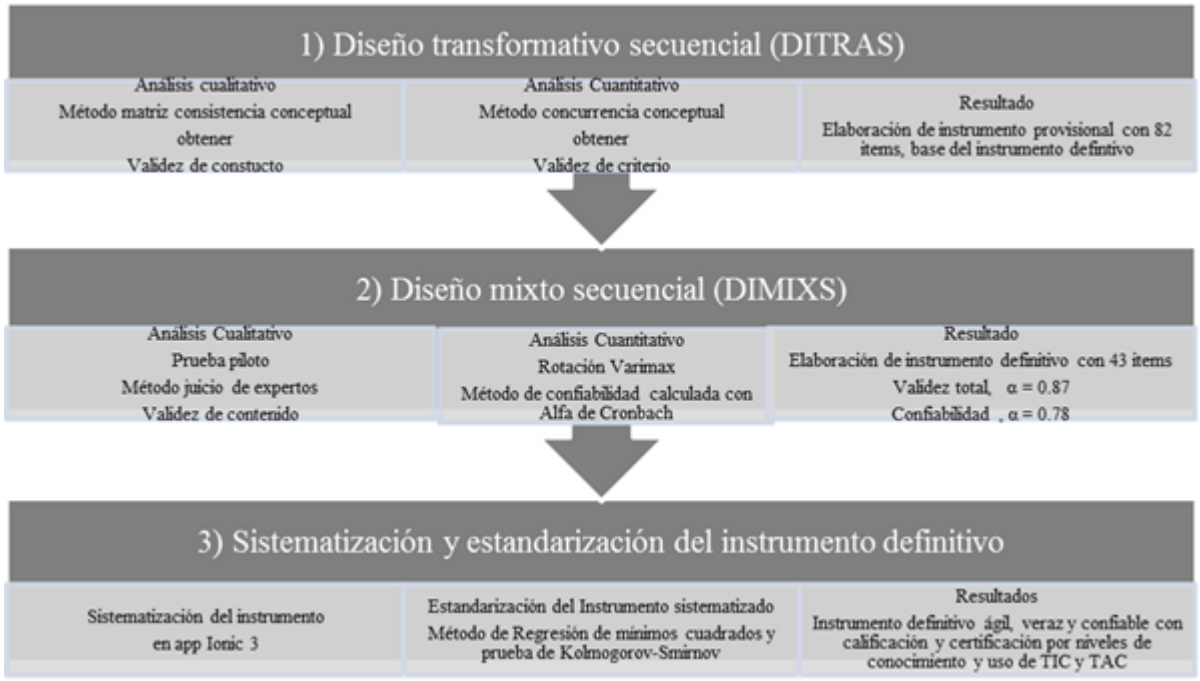

Fuente: Elaboración propia

Process

Phase 1. Preparation of the instrument.

Level 1.1 A qualitative analysis was applied through a conceptual consistency matrix to obtain construct validity. There, the items elaborated with theories recognized and tested in two instruments made by Durán (2015) and Durán et al. (2016) and Taquez et al. (2017).

Level 1.2 A quantitative analysis was applied through the conceptual concurrence method to obtain the criterion validity. At this point the frequency of the standards (result of the academic practice), issued by the Mexican Classification of Programs of Study by Academic Formation Fields, edited by the National Institute of Statistics and Geography [Inegi] (2012) and backed by the Copaes and the SEP.

For the amount of the information, the standards of three specific knowledge areas were randomly selected: a) Business and administrative area: Board of Accreditation of Accounting and Administration Education [Caceca] (2018); b) Engineering area: National Council of Accreditation in Computing and Computing [Conaic] (2017), and c) Area of social sciences: National Council for Teaching and Research in Psychology [CNEIP] (2018a).

Level 1.3 Preparation of a provisional instrument with 82 integrated and transformed items.

Phase 2. Evaluation of the provisional instrument.

Level 2.1. A qualitative analysis was used in the pilot test through the expert judgment method to obtain content validity; 36 academic experts in three knowledge areas participated;

issued their criteria on the knowledge and use of ICT and TAC; rated one (knowledge), two (personal use) and three (academic use). The items could be scored with the three points or stopped qualifying, in order to obtain the highest scoring criteria for each item analyzed.

Level 2.2 With the scores an exploratory factor quantitative analysis was carried out through the method of extraction of principal components, with varimax rotation to simplify the interpretation of the factors in the different parts. And the Kaiser-Meyer-Olkin sample adequacy index (KMO) ≥ 0.5 (Kerlinger, 2009) was applied.

After extracting the main items for having high correlations, r> 0.05, the reliability test was applied: the Cronbach's alpha test> 0.75 was used (Cronbach, 1998).

Level 2.3 Preparation of the final instrument.

The definitive instrument contains 43 items. It was divided into three parts: 1) General considerations (five items), 2) academic activities (15 items) and 3) Use of educational tools (23 items).

Phase 3. Systematization and standardization of the definitive instrument.

Level 3.1. The instrument was systematized through Ionic 3 computer application. Ionic ones were created and developed in line with Ionic commands (CLI) and use Córdova as a native application.

In this level the color palette, logos, welcome and farewell messages were also customized. The question design interface is for intuitive mode and with three main sections: the text (top), type of question (center) and options (bottom).

In addition, this tool stores database in HTML format. And it is capable of transporting data to XLS, XLSX, CSV, JSON and PDF formats.

It should be clarified that Ionic 3 does not require a dedicated infrastructure, as well as the installation and configuration of dedicated servers or software. It can be used in mobile phones, which offers greater versatility of use.

Level 3.2. Standardization of the Ionic 3 app. It was successfully tested with 338 university academics, which helped verify the capture and storage process. The academics were from 20 states of Mexico, which, in turn, helped to obtain external validation; similar results were selected through the least squares regression test to observe the variability between the groups considering r2> 0.75 at p <0.05. Finally, the population distribution was evaluated through the Kolmogorov-Smirnov test, where similarity to the normal distribution was observed, which guarantees standardization in the Mexican teaching population.

Level 3.3. Exhibition of an agile, truthful and reliable definitive instrument with qualification and certification by levels of knowledge and use of ICT and TAC

Its form, validity and reliability were preserved, and what was described by Kerlinger in 2009 was corroborated, who mentions that the evaluation instruments must maintain the characteristics for which they were designed, regardless of the implementation processes.

Results

The instrument was carefully elaborated. First, the validity of the construct was reviewed through theoretical references and previous tests (Gutiérrez and Prendes 2016; Taquez, et al., 2017). The validity of the content was also reviewed based on the Copaes and the SEP (Inegi, 2012).

Regarding the internal validity, performed with the 36 academic staff, k = 0.72 was obtained; For the variance of the results, the Kaiser-Meyer-Olkin test (coefficient = 0.789) and the Bartlett sphericity test ($\chi 2 = 964.06$, $p = .001$) were used. Because it is considered a one-dimensional instrument, the method of extracting principal components with varimax rotation was applied. Items that did not meet the value greater than 0.50 of Eigen load were eliminated, and reduced to 43 reagents out of a total of 82, which were distributed in three areas (General considerations, Academic activity and Use of technological tools for education) that explained 78% of the total variance. It is important to note that not all tables are placed due to space issues.

The General Considerations subscale was made up of a total 5 of 14 items: equivalent to 41.6%. While the subscale of Academic Activities was made up of a total of 15 of 38 items: equivalent to 39.4%. Finally, the subscale of Use of tools for education was made up of 23 of a total of 30 items: equivalent to 76.6%. In the latter, the number of items did not decrease significantly because the diversity of use depended on the academic area of university academic staff (see table 1).

Tabla 1. Análisis factorial, promedio por subescalas

Promedio subescala	**Factores**			
	0	1	2	3
		N = 36		
Consideraciones generales: 5 ítems	0.723	0.841	0.59	0.51
Actividades académicas: 15 ítems	0.595	0.679	0.653	0.575
Uso de herramientas: 10 ítems	0.528	0.678	0.666	0.636

Fuente: Elaboración propia

Reliability was calculated through Cronbach's alpha for each subscale and the total reagents were $\alpha = 0.78$, which evidences an adequate internal consistency (Cronbach, 1998). In

the subscales, acceptable Cronbach alpha values were found; the lowest was found in the subscale of Use of tools for education by the diversification of knowledge areas (see table 2).

Tabla 2. Confiabilidad del instrumento en subescalas y total

Subescalas	A
N = 36	
Consideraciones generales: 5 ítems	0.77
Actividades académicas: 15 ítems	0.82
Uso de herramientas para la educación: 10 ítems	0.75
Total del instrumento	0.78

Fuente: Elaboración propia

In addition to the above, the Kolmogorov-Smirnov test was used to determine the goodness of fit of the sample in relation to the normal curve, and adequate asymmetry coefficients were obtained, which is confirmed with the test of p = 0.79 (see table 3).

Tabla 3. Estadísticos descriptivos de los factores

Subescalas	**Media (DE)**	**P25**	**P50**	**P75**	**Coeficiente de asimetría**
		N = 336			
Consideraciones generales: 5 ítems	1.49 (0.57)	1.26	1.83	1.33	0.63
Actividades académicas: 15 ítems	2.00 (0.65)	1.2	2	1.6	0.774
Uso de herramientas: 10 ítems	2.21 (0.51)	2	2.5	2.25	0.817

DE: Desviación estándar, P = Percentil.

Fuente: Elaboración propia

All the above analysis ends with the total validity of the instrument, Cronbach's alpha α = 0.87, and calculated reliability, Cronbach's alpha α = 0.78 (Cronbach, 1998).

Discussion

The development, validation and standardization of the Web instrument for the certification of university academics in ICT and TAC knowledge and use serves to expedite the processes of evaluation of the heading for academic staff.

As stated in this research, the continuous evaluation of certification bodies is a necessity in higher education institutions. These organizations evaluate indicators and standards to issue an opinion on accreditation of educational quality.

The instrument for evaluation is agile, truthful and reliable. It is useful to define the level of knowledge and use of ICT and TAC academics, in accordance with the rules stipulated by the Copaes and several experts in the field. The results can be edited quickly by being on a web page.

The extension of the instrument is moderate, it has only 43 items, and it is divided into three subscales (General Considerations, Academic Activities and Use of Education Tools) that measure the three main indispensable factors and representatives of the three theoretical axes (Prendes et al., 2010; Durán, 2015; Durán et al., 2016).

It has a total validity of $\alpha = 0.87$ and calculated reliability of $\alpha = 0.78$, tested in a population with a normal distribution with $p = 0.79$, which shows acceptable transfer for being standardized, and allows the instrument to be used in various populations of university academic staff, as required by the procedure manual edited by the Copaes (2018).

The specific URL of the study showed the following: 1) Very low level, with score $\leq$ 27: they are academics who have little knowledge and have made little practice of ICT and TAC, so they need to be trained with basic courses so that Use these technological tools within your subject. 2) Basic level, with a score of 28 to 43: academics who have knowledge, but only eventually use ICT and TAC in practice because they have not discovered the benefits of using these technological tools. What they require are motivational courses that show the benefits of the applicability of technology in education. 3) Medium level, with a score of 44 to 60: they are academics who have knowledge of the subject in question and put it into practice frequently, which allows them to see the advantages of using technological tools. This impacts their students to continue using technology in their day to day. 4) High level, with a score of ≥ 61: teachers who frequently know and use technology in their courses, which encourages better learning by students and infects them in the daily use of these tools, both in their personal lives as his working life, as evidenced in his cross-sectional educational studies Durán et al. (2016).

The very low level and basic level require training in ICT and TAC, while the medium and high level can access categorization promotions, because they are teaching their students more effectively and are impacting on these regarding the good use of the technology (Cano,

2008). The above is already evaluated by researchers Moreno and Trigo in 2017, who prove that training in ICT and TAC generates positive attitudes among academics in practices and raises students' abilities for learning, life and preparation for life labor.

Certifications guarantee educational quality. Desirably trained and qualified academics with digital educational knowledge, as required today (Moya, 2013), favor the education of the future and increase digital knowledge in their students, which enables the training of professionals according to the demands of world organizations.

Conclusions

The systematized instrument presented in this investigation is agile, truthful and reliable. The above is demonstrated since its construction because it goes through several validity filters, both internal and external.

The transfer is acceptable because it is standardized in the population of university teachers. What allows to evaluate the teaching staff that need to be certified in levels of knowledge and use of ICT and TAC.

The applicability of the certification is diverse: 1) Selection and hiring of staff, 2) Identify the level of knowledge that the staff has, 3) Create programs and / or courses that reinforce or create new skills in ICT and TAC, 4) Categorize the staff according to their level of knowledge, 5) Promote staff to acquire benefits or work benefits, 6) Evidence of the level that academics have in the evaluation carried out by accrediting bodies and 7) Curricular proof of possession of level of knowledge and use in ICT and TAC in academic area.

Another of the benefits of the instrument is that it can be applied individually or in groups and is available in both paper and digital versions (request the website from the authors).

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Anexo 1

Manual para usuario de la versión en papel

El instrumento cuenta con 43 ítems. Se dividió en tres subescalas*: 1)* Consideraciones generales (cinco reactivos), donde se mide la importancia del uso de la tecnología en la educación; *2)* Actividades académicas (15 reactivos), donde se mide el uso de la tecnología en

el aula para resolver problemas académicos, y *3)* Uso de herramientas para la educación (23 reactivos).

Cada ítem presenta una escala del 0 a 3, donde *0* significa 'nunca', *1* significa 'pocas veces', *2* significa 'muchas veces' y *3* significaba 'siempre', para diferenciar la frecuencia de conocimiento y uso de las TIC y TAC.

La evaluación implica los siguientes pasos: *1)* Se realiza la sumatoria cada uno de los puntos de cada columna. *2)* A la sumatoria se multiplica por 0, 1, 2 y 3, número ya estipulado en cada columna. *3)* Se suman todas las columnas multiplicadas para formar el gran total. 4) Se busca el rango al que pertenece el gran total para convertirlo al nivel de certificación (ver tabla de conversión del gran total).

Es importante señalar que las partes uno y dos se consideran *todos los ítems*, pero en la parte tres se considera solo *10 ítems* como mínima puntuación, porque va a depender del área de conocimiento del académico. La evaluación se realiza por rangos categorizando a los tres niveles de certificación de la siguiente tabla

Tabla de conversión del gran total

Rangos del gran total	**Nivel de certificación**
Menor o igual a (≤) 27	Nivel muy bajo
28 a 43	Nivel básico
44 a 60	Nivel medio
Mayor o igual a (≥) 61	Nivel alto

Instrumento certificador (versión en papel)

Instrumento para la certificación de docentes universitarios en conocimiento y uso en tecnologías de la información y la comunicación (TIC) y tecnologías del aprendizaje y el conocimiento (TAC)

Nombre del docente: _____

Área o departamento académico donde imparte clase: _____

Edad: _____ Antigüedad como docente: _____

A continuación, se encuentra una serie de afirmaciones respecto al uso de herramientas tecnológicas para educación. Instrucciones: Marca con una cruz la casilla que corresponda a tu respuesta. Recuerda ser lo más honesto posible.

Parte 1: Consideraciones generales					
Afirmaciones		**Nunca**	**Pocas veces**	**Muchas veces**	**Siempre**
1	La educación superior es favorecida por la implementación y uso de las tecnologías de la información y comunicación (TIC) y tecnologías del aprendizaje y el conocimiento (TAC).				
2	La política educativa de la institución donde laboro debería de favorecer la capacitación y el uso de las TIC y TAC.				
3	El uso de las TIC es necesario para el futuro profesional de los estudiantes.				
4	El uso de las TAC brinda soluciones a las necesidades de enseñanza.				
5	Las TAC facilitan el aprendizaje de mis estudiantes.				
Parte 2: Actividad académicas					
Afirmaciones		**Nunca**	**Pocas veces**	**Muchas veces**	**Siempre**
1	Utilizo los recursos o herramientas de las TIC.				
2	Utilizo las TAC en diversas de metodologías didácticas.				
3	Utilizo las TIC y/o TAC para evaluaciones y autoevaluaciones educativas.				
4	Estimulo la participación en TIC y TAC a mis estudiantes.				
5	Difundo en las TAC la información didáctica autogenerada.				

6	Aprendo a usar herramientas y/o aplicaciones TIC y TAC de forma autónoma.				
7	Soluciono problemas académicos utilizando las TAC.				
8	Reporto la escasez de equipamiento o fallas técnicas presentadas en mi clase.				
9	Trabajo en equipo con actividades de TAC académicas.				
10	Intercambio con otros docentes mis reflexiones, experiencias y recursos sobre el uso de las TIC y/o TAC.				
11	Promuevo el uso de las TIC y/o TAC fuera del aula.				
12	Planeo mis clases en función de las TAC a usar.				
13	Pruebo la utilidad de las TIC y TAC antes de usarlas en clase.				
14	Brindo asesorías sobre TIC y/o TAC fuera de la clase.				
15	Promuevo autoaprendizaje en TAC para los estudiantes.				

Paste 3: Uso de herramientas tecnológicas para la educación

Frecuencias de uso de herramientas para educación		**Nunca**	**Pocas veces**	**Muchas veces**	**Siempre**
1	Correo electrónico (Gmail, Yahoo, etc.).				
2	Foros de discusión (dentro de alguna plataforma o algún sitio de Internet).				
3	Servicio de mensajería (Whatsapp, Telegram, Facebook, etc.).				
4	Videoconferencia (Skype, Hangouts, Zoom, etc.).				

5	Redes sociales o redes sociales visuales (Facebook, Twitter, Instagram, Instagram, Pinterest, etc.).				
6	Redes profesionales (Linkedin,, Xing, Universia).				
7	Herramientas de búsqueda de información (Google, Yahoo, Bing, Bases de Datos Académicas).				
8	Herramientas ofimáticas (Word, Excel, PowerPoint, Google Docs, Open Office).				
9	Editores de imágenes (Photoshop, Gimp).				
10	Editores de audio (Audacity, Wavepad).				
11	Editores de video (Windows Movie Maker, Imovie, Adobe Premiere).				
12	Herramientas de creación de contenidos (Prezi, Office Mix, Powtoon).				
13	Plataformas de gestión de aprendizaje (Moodle, Edmodo, Blackboard, Sakai, Google Classroom).				
14	Espacios de administración de archivos digitales (Dropbox, Google Drive, OneDrive).				
15	Repositorios institucionales (Merlot, Biblioteca digital de su institución, etc.).				
16	Sistemas de gestión de contenido (Google Sites, Wix, Wordpress, Blogger, Joomla).				
17	Herramientas de gestión de fuentes y revisión de citaciones (Mendeley, Endnote, Zotero).				

18	Herramientas de detección de coincidencias (Turnitin, SafeAssign, Plagiarism).				
19	Plataformas de contenido audiovisual (YouTube, TED, Vimeo, Soundcloud).				
20	Herramientas de creación de cuestionarios (Google Forms, Surveymonkey, SurveyPlanet, PollDaddy).				
21	Plataformas de preguntas y respuestas (StackOverflow, Talkyard).				
22	Cursos o tutoriales en línea				
23	Otras herramientas: Indicar cuáles y coloca la cruz en la frecuencia correspondiente.				
Suma las cruces de cada una de las columnas					
Multiplica las sumatorias por		0 = ____	1 =_____	2 =_____	3 =_____
Suma de todas las columnas y estipula el gran total = _____					