Revista Española de Pedagogía

Revista Española de Pedagogía (REP)
ISSN: 0034-9461
e-ISSN: 2174-0909

Reliability and validity of the upper secondary education teaching competencies scale

Fiabilidad y validez de la escala de competencias docentes de educación media superior

Dr Emerson LÓPEZ-LÓPEZ. Associate professor. Undergraduate and postgraduate programmes in Education, Universidad Linda Vista, Mexico *(emerson.lopez@ulv.edu.mx)*.

Dr. Luis Gibran JUÁREZ-HERNÁNDEZ. Associate professor. Faculty of Medicine and Biomedical Sciences, Universidad Autónoma de Chihuahua and Centro Universitario CIFE, Mexico *(gibbjuarez@gmail.com)*.

Abstract:

The psychometric properties of content validity, construct validity, and reliability of an instrument to assess teaching competencies in upper secondary education were analysed. To analyse content validity, the instrument was evaluated by 21 experts and Aiken's content validity coefficient V was then calculated. Its reliability was evaluated with McDonald's Omega. For the analysis of construct validity, the instrument was administered to 3726 upper secondary education students. In the construct validity analysis, a cross-validation process was used that involved exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The instrument included the eight competencies established by the Government of Mexico in a simplified manner and in total consisted of 20 items. The items were validated for content (Aiken's V > 0.75, LV > 0.50). Its reliability was optimal (McDonald's Omega: 0.959, 95 % CI: 0.957 ± 0.961). The EFA also verified the instrument's correspondence with the theoretical model, as it only indicated one factor that explained 60 % of variance and in which 18 of the 20 items were represented. The evaluation of this model by confirmatory factor analysis revealed an optimal fit (χ^2/df ratio: 1.89; GFI: 0.995; RMSAE: 0.050; RMR: 0.028; CFI: 0.992; TLI: 0.994). The ECDEMS instrument has adequate psychometric properties.

Keywords: factor analysis, teaching, competence-based education, student, assessment, measurement instrument

Resumen:

Se analizaron las propiedades psicométricas de validez de contenido, constructo y confiabilidad de un instrumento para evaluar las competencias docentes en la educación media superior. Para la validez de dicho contenido, el instrumento se sometió al juicio de 21 jueces y se calculó el coeficiente de validez de contenido V de Aiken. La confiabilidad fue evaluada con

Date of receipt of the original: 2025-05-01.
Date of approval: 2025-06-01.
Please, cite this article as follows: López-López, E. & Juárez-Hernández, L. G. (2025). Reliability and validity of the upper secondary education teaching competencies scale [Fiabilidad y validez de la escala de competencias docentes de educación media superior].*Revista Española de Pedagogía, 83*(292), 687-708 https://doi.org/10.9781/rep.2025.384

el Omega de McDonald. Para el análisis de la validez de constructo, el instrumento se aplicó a 3726 estudiantes de la educación media superior. En el análisis de validez del constructo, se empleó un proceso de validación cruzada que involucró el análisis factorial exploratorio (AFE) y el análisis factorial confirmatorio (AFC). El instrumento integró de manera simplificada las ocho competencias establecidas por el Gobierno de México y en total se conformó de 20 ítems. Los ítems fueron validados en contenido (V de Aiken > 0.75, VI > 0.50). La confiabilidad fue óptima (Omega de McDonald: 0.959 IC al 95 %: 0.957 ± 0.961). Por su parte, en el AFE se verificó la correspondencia del instrumento con el modelo teórico, ya que únicamente denotó un factor que explicó 60 % de varianza, en el cual se encontraron representados 18 de los 20 ítems. La evaluación de este modelo mediante el análisis factorial confirmatorio reveló un ajuste óptimo (razón χ^2/gl: 1.89; GFI: 0.995; RMSAE: 0.050; RMR: 0.028; CFI: 0.992; TLI: 0.994). El instrumento «ECDEMS» posee adecuadas propiedades psicométricas.

Palabras clave: análisis factorial, docencia, educación basada en las competencias, estudiante, evaluación, instrumento de medida.

1. Introduction

The term competences, first used by McClelland (1973), is defined as a capacity that includes intelligence, aptitudes, motivation, personality traits, and behaviours that make for effective job performance by people and success in life. Boyatzis (1983) subsequently developed a systemic–empirical focus to evaluate and develop managerial talent in organisations, and later (2006) categorised competences into cognitive, emotional and behavioural ones when comparing high-performing employees' attributes with those of employees with average performance. While there have been terminological advances, the concept remains multifaceted, complex, open to debate, and lacking a consensus.

There are two main tendencies in the term depending on the context in which it is used. The first focusses on evaluation of work tasks and the second, on people's behaviours, attitudes, and performance (Wong, 2020). But in a broad sense, competences are regarded as capacities, attributes, knowledge, skills, self-concepts, values, personal traits, motivations, attitudes, or trainable, observable and measurable factors that make it possible to develop a complex and specific job and to do so outstandingly (Arribas et al., 2024; Zumstein-Shaha & Grace, 2023; WHO, 2022).

Something similar happens with the concept of teaching competences, as these have a wide range of definitions, which can be summarised as knowledge, skills, capacities, values, attitudes, and didactic–pedagogical experiences that enable teachers to create effective, efficient, excellent, and productive learning environments, under specific contexts and complex demands, seeking to develop the potential and formation of students, in accordance with the educational objectives established by the institution (Burbano et al., 2024; Otto, 2024; Singh, 2024; Uysal et al., 2021; Zhou et al., 2023).

Given the many meanings of teaching competences as a term, this article uses the definition established by the Mexican government for upper secondary education (USE): "those that formulate the individual qualities, of an ethical, academic, professional, and social character that the teacher must possess" (DOF, 2008c, p. 2). These are classified in eight personalised competences and are contextualised within Mexico's National Baccalaureate System: continuous professional training; command of knowledge to achieve meaningful learning; planning with a competence-based and contextualised focus; practising an effective, creative, and innovative teaching–learning process; providing formative assessment; building autonomous and collaborative learning; promoting healthy and integral development; and participating in the constant improvement of the school and in institutional management

(pp. 2–3). These are aligned with the generic competences (DOF, 2008b, pp. 2–4), disciplinary competences (DOF, 2008b, pp. 4–7), professional competences (DOF, 2008b, pp. 7–8), and extended competences (DOF, 2008b, pp. 6–7) of the students (DOF, 2008b; DOF, 2009), as well as competences required for the leaders of schools (DOF, 2008d, pp. 2–4).

Given their national and international relevance, teaching competences are important because they are part of the professionalisation of teachers (Agüero-Servín, 2022), who are the key stakeholders in education systems (Domínguez-González & Serna-Poot, 2021) and are responsible for the efficient implementation of the teaching–learning process (Granada et al., 2024). In the case of students, teachers' competences help them improve their educational achievement, as some studies attest (Di Lisio et al., 2025; Firda & Khairat, 2023; Putra & Yanto, 2025), they help students go on to higher education (Hollenstein & Brühwiler, 2024) and find better jobs (Gonzáles & Estrella, 2023) and they contribute to national and global development (DOF, 2008a, p. 2).

Moreover, it is essential to evaluate teaching competences given that they make it possible to diagnose the educator's capacity to transfer knowledge (Brown, 2024), identify their strengths and opportunities to improve the quality of teaching (Skedsmo & Huber, 2024), improve their professional development (Perrenoud, 2004; Wang & Sang, 2024), and inform society (Bleiberg et al., 2024), decision makers (Hunter & Kho, 2023), and educational policymakers (Castro-Castillo et al., 2024).

From the students' perspective, evaluating teachers' competences makes it possible to obtain, among others, indicators of the degree of development of the students' competences, which derive from the teachers' competences (Nessa et al., 2024), as well as of the level of learning acquired (Sánchez-Tarazaga & Ferrández-Berrueco, 2022). However, it is vital to have appropriate instruments for these aims.

Given the importance, complexity, and challenges of evaluating teaching competences in USE, there are several international instruments (Aydin et al., 2024; Baena-Extremera et al., 2015; Cabero-Almenara & Palacios-Rodríguez, 2020; Cinque Gómez-del-Pulgar & Rodríguez-Mantilla, 2020; Chee Yuet et al., 2016; Cortes et al., 2020; Fernández-Díaz et al., 2016; Gümüs & Kulkul, 2023; Kim & Kim, 2016; Salihu, 2019; Sánchez-Tarazaga & Fernández-Berrueco, 2022), as well as ones for Latin America (Hernández-Suárez et al., 2021; Pérez-Contreras et al., 2022), and for Mexico (Abarca-Cedeño et al., 2024; Luna-Serrano & Reyes-Piñuelos, 2015; Morán et al., 2015; Ramón-Santiago et al., 2017). Instruments self-administered by the teacher are most common, with few that are answered by the students, such as those of Baena-Extremera et al. (2015), Luna-Serrano and Reyes-Piñuelos (2015), and Ramón-Santiago et al. (2017).

When considering the theoretical foundations of these instruments, in most of them: a) there is a lack appropriate foundations for the teaching competences construct in USE; b) they are not confined to a specific focus; c) the dimensions established are broad and the items unrepresentative; d) the theoretical model that underpins the instrument is poorly identified; and finally e) they display dimensions and measurements of behaviours of little relevance, presenting under and over-representation of some domains.

Given these limitations, it should be noted that constructing an instrument demands the existence of an adequate justification, a precise definition of the study variable, a correct working, semantic, and syntactic definition of its relevant dimensions and pertinent behaviours; and an interrelation between these elements and items (Muñiz & Fonseca-Pedrero, 2019). Likewise, specific identification of the context of the study, the target population, the circumstances, the form of application, and the use of the instrument are vital, as are the appropriate content and construct analyses (AERA et al., 2014).

Consequently, the following objectives were chosen for the present study: 1) To design a scale to evaluate teaching competences in upper secondary education; 2) To determine the content validity of the instrument that evaluates individual competences of teachers from the students' perspective; 3) To define the general reliability of the instrument with McDonald's Omega; and 4) To establish the construct validity of the tool through exploratory and confirmatory factor analysis.

2. Methodology

2.1. Type of study

An instrumental study was performed, which, as Montero and León observe (2007), involves the development of tests and tools, including their design and adaptation, as well as study of their psychometric properties.

2.2. 2.2. Instrument

From the perspective of individual competences, the following working definition of the construct of teaching competences was used: "Those that comprise the individual qualities, of an ethical, academic, professional, and social character that a USE teacher must possess" (DOF, 2008c, p. 1). These include the areas of being (ethical character), knowledge (academic), action (professional), and coexistence (social), along with their respective competences and attributes that the Official Diary of the Federation establishes, superimposes, and interrelates (2008c, pp. 2–3). These qualities are also aligned with generic, disciplinary, and extended student competences (DOF, 2008b; DOF, 2009), as well as with competences required of school leadership (DOF, 2008d).

Nonetheless, to develop the Upper Secondary Education Teaching Competences Scale (Escala de Competencias Docentes de Educación Media Superior, ECDEMS), each competence specified in the Official Diary of the Federation (DOF, 2008c) was reflected on, namely: 1) Continuous professional training; 2) Command of knowledge to achieve meaningful learning; 3) Competence-focussed and contextualised planning; 4) Practising effective, creative and innovative teaching–learning processes; 5) Providing formative assessment, 6) Constructing autonomous and collaborative learning; 7) Promoting healthy and integral development; and 8) Participating in the continuous improvement of the school and in institutional management (pp. 2–3), and their respective attributes. These attributes were included in the items that make up the instrument. These comprised 20 positively worded items to be answered using a Likert-type scale with values ranging from 1 = Never to 5 = Always (Table 1).

Table 1. Structure of the ECDEMS.

Items
1) When my teacher makes a mistake in what he/she is teaching us, he/she makes an effort to improve in the following classes.
2) I note that my teacher always displays a willingness to continue learning and improve his/her classes.
3) I note that my teacher relates the content to the different subjects that I study.
4) My teacher asks us about what we have learnt in his/her classes.
5) My teacher sets project-based assignments.
6) When teaching us, my teacher emphasises practical learning.
7) I can see that my teacher plans and organises well the classes he/she teaches.
8) My teacher is creative when teaching.
9) My teacher likes to innovate when teaching us.
10) The way we are evaluated is made clear to us.

11) My teacher makes comments to us about how to improve a task or activity before giving us the definitive mark.

12) I can see that when my teacher assesses us, he/she is interested in my learning improving.

13) I think that my teacher is only interested in assessing me to give me a grade.

14) My teacher's way of teaching encourages me to continue learning for myself.

15) He/she looks for ways for us to learn by collaborating with our classmates.

16) The teacher respects our diversity of beliefs, values and ideas in the classroom.

17) His/her example inspires us to practice a healthy lifestyle.

18) He/she makes us participants in creating rules for coexistence in the classroom.

19) I can see that my teacher is committed to the continuous improvement of the school.

20) I can see that my teacher supports the administration of this school.

Source: Prepared by the authors.

2.3. Content validity analysis

The content validity analysis involved validation of the instrument by expert judgement involving 21 subject experts (Table 2). Criteria such as experience in the field of research, academic level, and experience in the design and validation of instruments (CIFE, 2018b; Juárez-Hernández et al., 2017; Juárez-Hernández & Tobón, 2018) were taken into account when selecting the experts.

TABLE 2. Characteristics of the Experts

Details	Characteristics
Gender (%)	23 % men and 77 % women
Highest level of studies	8 % post-doctoral 38 % doctoral, and 54 % master's
Roles	23 % postgraduate coordinators and administrators, 77 % research-active professors in higher education
Areas of professional experience	100 % university teaching and research

Mean years of professional experience (mean ± standard deviation)	19.84 (± 9.68)
Mean years of university teaching and research experience (mean ± standard deviation)	13.61 (± 7.82)
Mean number of articles published in the field (mean ± standard deviation)	21.69 (± 29.45)
Mean number of books published in the field (mean ± standard deviation)	4.23 (± 7.86)
Mean number of book chapters published in the field (mean ± standard deviation)	8.69 (± 13.74)
Experience in analysis, revision, design, and/or validation of research instruments	100%
Institution where they work at the moment of the evaluation of the instrument	23 % private universities, 77 % public universities

Source: Prepared by the authors.

The expert validation had a qualitative–quantitative focus (Juárez-Hernández & Tobón, 2018) and the expert validation scale was used (CIFE, 2018b), which consists of a qualitative evaluation where the experts can suggest precise improvements to items. For the quantitative evaluation, the instrument includes a Likert-type scale to evaluate the pertinence and wording of the items (Table 3), which were evaluated using Aiken's V content validity coefficient and its 95 % confidence interval (Penfield & Giacobbi, 2004). Specifically, a minimum value for acceptance of more than 0.75 for the coefficient was considered and of 0.50 for the lower value of the interval (Bulger & Housner, 2007).

Table 3. Expert Validation Scale

Category	Classification of level of pertinence	Exclusion
Pertinence The item evaluates a central aspect of the aim, dimensions, and/or theoretical construct of the instrument.	1. Not relevant	The item does not contribute to evaluating the aim, dimensions, and/or construct of the instrument. It can be eliminated completely.
	2. Low pertinence	The item evaluates a superficial aspect of the aim, dimensions, and/or construct of the instrument.
	3. Medium pertinence	The item acceptably evaluates the aim, dimensions and/or theoretical construct of the instrument.
	4. High pertinence	The item truly evaluates the aim, dimensions and/or construct of the instrument, and is in line with recent theoretical and methodological developments in the area.
Category	Classification of the level of comprehension	Exclusion
Wording The item is comprehensible by potential users and complies with the grammatical rules of the Spanish language.	1. It is not comprehensible	The item is not comprehensible by potential users of the instrument.
	2. Low comprehension	The item must be improved in at least half of its components, in aspects of wording and grammar.
	3. Medium comprehension	The item requires some superficial improvements to make its comprehension excellent.
	4. High comprehension	The item is highly comprehensible for potential users and follows the grammatical rules of the language.

Note: Taken from CIFE (2018b).

2.4. Pilot test

Having made the necessary improvements to the scale based on the experts' recommendations, the instrument was applied to 21 students from the sixth semester of USE. The chosen number of participants was based on the recommendations of Carpenter

(2018), who states that for this phase it can range from 5 to 100 people from the target group or population. The pilot group was 61.9 % female and 38.1 % male, with a mean age of 17.095 years (± 0.3008). 100 % (n = 21) were from the morning shift at a private school with a mixed socio-economic level. The pilot study analysed the feasibility of the instrument (Carvajal et al., 2011), specifically evaluating the level of understanding of the instructions and items using the instrument satisfaction questionnaire (CIFE, 2018a), and an initial reliability analysis was done using McDonald's Omega (McDonald, 1999) and its 95% confidence intervals. Regarding ethical questions, the aim of the instrument was explained to the participants, their informed consent was acquired, and their personal data was protected as required by the Mexican government (Cámara de Diputados del H. Congreso de la Unión, 2017).

2.5. 2.5. Construct validity analysis

To perform the analysis, the instrument was applied to a convenience sample of 3726 students from various USE subsystems belonging to various bodies from the south and south east of Mexico from publicly run and private schools. The mean age was 17.80 (± 0.650); 49 % female and 51 % male. As with the pilot group, the aim of the instrument was explained to them, they were asked to give informed consent, and their personal data was protected as required by the government (Cámara de Diputados del H. Congreso de la Unión, 2017).

A first analysis was done to establish whether the items fit the normal distribution using the Mardia index (Mardia, 1970). The item–test correlation was analysed and any items that displayed a value greater than 0.90 or less than 0.20 were eliminated (Tabachnick & Fidell, 2001). McDonald's Omega (McDonald, 1999) was calculated to evaluate the reliability of the instrument.

The sample was then divided into two equal parts (n1 = 1863; n2 = 1863), using random numbers through an electronic spreadsheet. The first subsample was analysed using exploratory factor analysis (EFA), and the second with confirmatory factor analysis (CFA). These analyses were done using the R software program (R Core Team, 2020). In this order, EFA was done with the first subsample to explore the structure, and CFA was done with the second subsample to confirm this structure (Brown, 2006). This process ensures that the factor structure identified is not a specific characteristic of the initial subsample, it reduces the possibility of biases, and it permits a better evaluation of the fit, stability, and quality of the model (Carpenter, 2018; Kline, 2013; Lloret-Segura et al., 2014; Worthington & Whittaker, 2006).

In the case of the EFA, the value of the determinant, the KMO test and the Bartlett test were analysed to determine their pertinence of analysis (Howard, 2016). Having established these, the type of correlation matrix and the extraction method were chosen, with the Pearson product–moment correlation matrix and the maximum likelihood estimation method being used if the items displayed a normal distribution (Howard, 2016; Lloret-Segura et al., 2014), and the polychoric matrix of correlation and the unweighted least squares (ULS) method being used if the assumption was not fulfilled (Xia & Yang, 2019). The number of factors to retain was based on the maximum consensus technique among the 23 methods used with the support of the nFactors library (Lüdecke et al., 2020). For the analysis of the factor matrix, the significance of the factor loadings per item had to be greater than 0.55 (Hair et al., 2010). In the event of problems with factorial complexity, the matrix was rotated using the most appropriate method (Juárez-Hernández, 2018; Lloret-Segura et al., 2014).

The factor structure obtained from the EFA was analysed in the second subsample using CFA. The maximum likelihood estimation method was used if the assumption of normality was fulfilled; if it was not, the unweighted least squares (ULS) estimation method was used (Yuan, 2005). The model's goodness of fit was evaluated using various indicators and indices (χ^2/df, GFI, CFI, TLI, RMSEA, RMR), considering the threshold values indicated by Ráczová et al. (2021). This analysis was done using the R software program and the laavan (Rosseel, 2012) and psych (Revelle, 2017) packages.

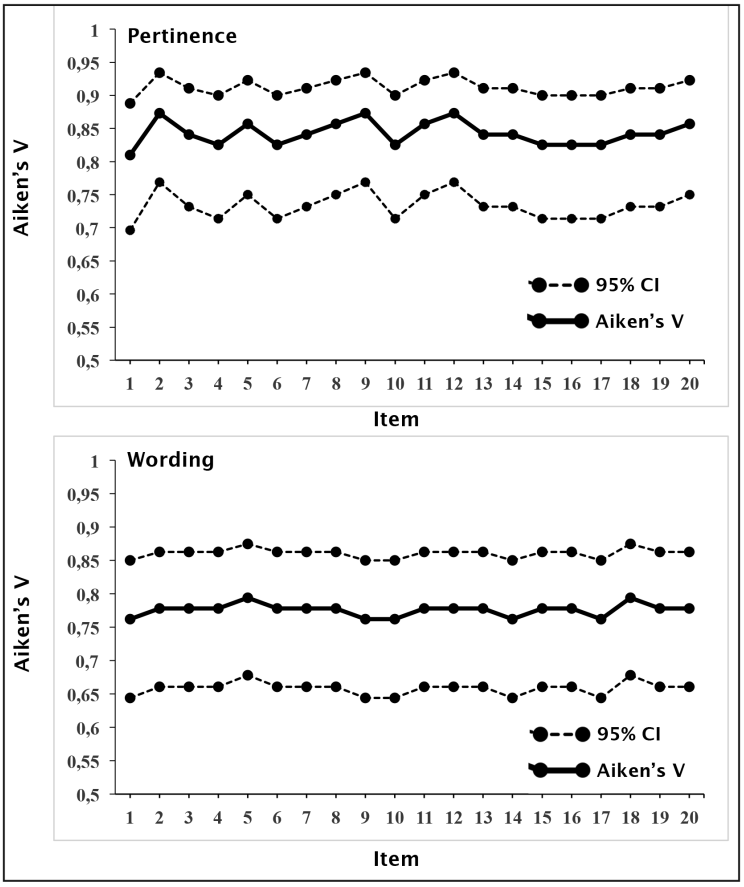
Through the standardised factor loadings, the average variance extracted (AVE) and the composite reliability were calculated, with the threshold value for the former being greater than 0.50 (Fornell & Larcker, 1981) and for the latter 0.70 (Hair et al., 2014). The convergent validity was analysed, considering that the AVE must be greater than or equal to 0.5, the standardised factor loadings greater than 0.50, and the composite reliability greater than 0.70 (Fornell & Larcker, 1981; Hair et al., 2014). Finally, the reliability was evaluated using McDonald's Omega (McDonald, 1999) and its 95% confidence intervals.

3. Results

3.1. Content validity analysis

All of the items were validated in the pertinence and wording criteria (Aiken's V > 0.75, LV > 0.50) (Figure 1).

FIGURE 1. Representation of the Results of the Quantitative Analysis of the Validation by Experts.



Source: Prepared by the authors.

The qualitative evaluation provided some observations relating to questions of wording that required attention (Table 4).

Table 4. Observations by the Experts

Items	Observations
13. I think that my teacher is only interested in assessing me to give me a grade.	Expert 1: The question should be in the same direction as the others as this complicates the scoring.
19. I can see that my teacher is committed to the continuous improvement of the school.	Expert 2: The question should be in the same direction as the others as this complicates the scoring.

Source: Prepared by the authors.

3.2. Pilot group

In general terms, the participants reported a high level of comprehension of the items (66.7 %) and a high level of comprehension of the instructions (76 %). Regarding the level of relevance and pertinence of the items, they described most of them as very important (47.6 %). The average time to respond to the instrument was 5.71 minutes. The reliability of this phase was optimal (McDonald's Omega: 0.920, 95 % CI: 0.853 ± 0.960).

3.3. Analysis of items and reliability

The absence of multivariate normality (kurtosis $p < 0.05$; skew < 0.05) was verified. Regarding the item–test correlation (ITC), it was found that item 13 had to be eliminated (Table 5). In this regard, this item makes a negative affirmation and states: I think that my teacher is only interested in assessing me to give me a grade. After this, the reliability was optimal (McDonald's Omega: 0.959, 95 % CI: 0.957 ± 0.961).

Table 5. Initial Analysis of the Items

Item	Item–test correlation
1	0.741
2	0.793
3	0.535
4	0.67
5	0.382

6	0.746
7	0.792
8	0.784
9	0.789
10	0.734
11	0.722
12	0.759
13	0.044
14	0.773
15	0.743
16	0.612
17	0.752
18	0.709
19	0.777
20	0.684

Source: Prepared by the authors.

3.4. Construct validity analysis

The analysis of the assumptions for application of EFA was satisfactory, as the variables were found to be significantly related ($p < 0.05$) and a determinant close to zero was found (0.0000001735). Similarly, the Kaiser–Meyer–Olkin test (KMO: 0.98) and Bartlett's test of sphericity ($p < 0.001$) demonstrated the pertinence of the use of EFA.

With regards to the extraction of factors, it was necessary to retain one factor, which contained 18 of the 19 items (with factor loadings greater than 0.50) and explained more than 60 % of the variance (Table 6). The resulting factor model corresponded with the theoretical model, which indicates that the items refer to the personal characteristics of teachers specified in Agreement 447, expressed as competences and attributes, because they are directly related to the teachers' being, knowledge, action, and coexistence.

Table 6. Result of the Exploratory Factor Analysis

Item	Factor loading
9	0.87
2	0.86
7	0.85
8	0.84
14	0.83
19	0.83
12	0.82
17	0.81
1	0.8
6	0.79
15	0.79
10	0.79
11	0.77
18	0.76
20	0.73
4	0.72
16	0.69
3	0.56

Source: Prepared by the authors.

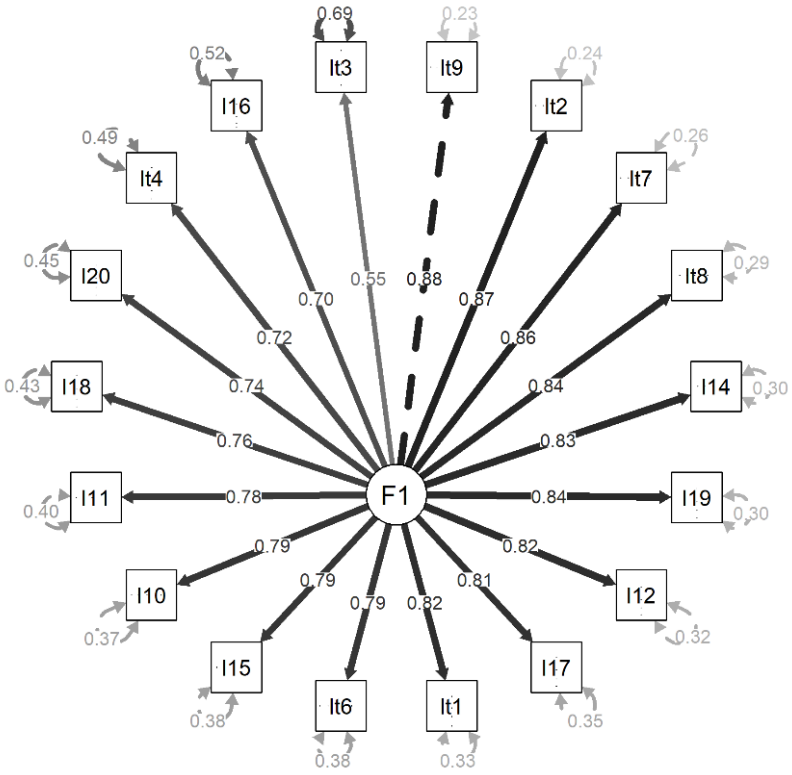
The CFA displayed a good fit for the model obtained (Table 6), as the different indices displayed optimal values (Table 7). The value of the average variance extracted (AVE: 0.7905) and of the composite reliability (CR: 0.966) were optimal. Each item displayed standardised factor loadings greater than 0.50 (Figure 2).

TABLE 7. Fit of the Factor Model

Index	Value expected (Ráczová et al., 2021)	Value obtained
Chi-squared/degrees of freedom ratio (χ^2/df)	Menor a 3	1.89
Goodness of fit index (GFI)	Mayor a 0.90	0.995
Root mean square error of approximation (RMSEA)	0.050 a 0.080	0.050 (0.048 a 0.079)
Root mean square residual (RMSR)	Menor a .050	0.028
Comparative fit index (CFI)	Mayor a 0.95	0.992
Tucker–Lewis Index (TLI)	Mayor a 0.90	0.994

Source: Prepared by the authors.

FIGURE 2. Representation of the Confirmatory Factor Model



Source: Prepared by the authors.

4. Discussion

Studying the construct of teaching competences is, among other reasons, part of the process of professionalisation of teachers to provide quality education, as they are key figures in education systems given the effectiveness and efficiency that they must demonstrate in the teaching–learning process in order to elevate students' educational achievements so that they can access a better quality of life in a globalised world.

It has also been established that evaluating teaching competences is important in USE, as this provides valuable data for public policymakers and decision makers within institutions. Specifically, it makes it possible to diagnose teachers' ability to transfer knowledge and to identify their strengths and weaknesses as points of reference to improve their educational and professional quality, as all educational processes and the stakeholders in them are ultimately closely connected to one another, in order to shape a student body that is competitive and ready to join the world of work or to go on to higher education.

Against this background, although it has been demonstrated that there are tools for evaluating teaching competence, these have been found to have limitations with regards to solid theoretical bases, and they have not been tested in a variety of contexts to confirm that they are appropriate for measuring the construct of teaching competences in USE. Consequently, there is a need to design and comprehensively validate the ECDEMS, based on the theoretical formulations of the Common Curriculum Framework of the National Upper Secondary Education System (Marco Curricular Común del Sistema Nacional de Educación Media Superior) and aligned with competences of the students and management of educational institutions at this level.

In line with these considerations, relevance is given to the individual qualities of the teachers' being, knowledge, action, and coexistence as a professional, which were transformed into items elaborated in the form of a scale as use of this type of instrument is recommended when measuring single-variable attributes (teaching competences), with graded answer options from which the respondent – in this case the student – must pick one.

After creating the instrument, it is vital to evaluate the quality of its measurement, which is done by analysis of its psychometric properties (Carvajal et al., 2011). In this regard, validation by experts found that all of the items displayed content validity. This means that the instrument reflects a specific content domain that it measures (Hernández-Sampieri et al., 2010). It is important to note that the validation by experts was based on quality guidelines, such as the selection of experts, the number of experts, qualitative–quantitative evaluation, and analysis by means of a relevance index (Juárez-Hernández & Tobón, 2018; Maldonado-Suárez & Santoyo-Telles, 2024), which gave the validation robustness and precision.

As for pilot testing, this is a fundamental phase, as its objective is to provide an initial approach to the instrument's adequacy for the target population, verify logistical aspects of application and administration of the instrument, and perform an initial analysis of reliability (Carpenter, 2017; Maldonado-Suárez & Santoyo-Telles, 2024; Muñiz & Fonseca-Pedrero, 2019). Accordingly, the adequacy of the instrument in this phase was satisfactory, as the degree of comprehension of items was acceptable and the degree of comprehension of the instructions was good. For its part, the reliability in this application was optimal.

A cross-validation process was performed for construct validity analysis, which is considered to be optimal (Lloret-Segura et al., 2014). EFA was used to test the structure that underlines the set of items, and CFA to validate this structure (Lloret-Segura et al., 2014). In this order, the preliminary analysis of the items found that item 13 – "I think that my teacher is only interested in assessing me to give me a grade" – displayed a low correlation with the instrument. Logic suggests that the correlation being like this is correct because, on the one hand, it addresses the absence of a competence, something that is not part of the study

performed, and on the other hand it could be due to lack of understanding by the respondent, or unclear wording.

According to the results of the EFA, the correspondence with the proposed theoretical model is established, in other words, one single factor explained more than 60 % of the variance, which is considered optimal (Velicer & Fava, 1998). In this sense, this factor included 95 % of the items, meaning that these represent the construct addressed (Lagunes, 2017), which emphasises the significance of the content validation process performed (Hayness et al., 2009). Regarding item 5, which was not represented in the factor model ("My teacher sets project-based assignments"), this could be because it addresses aspects relating to activities outside the classroom and non-specific assignments with a large scope, or, as noted above, it could be because of unclear wording or a failure to understand the item by the respondent.

The evaluation of the factor model through CFA verified the model's fit with the data, as all of the indicators displayed near optimal values. One aspect to note was the value of the standardised factor loadings, the average variance extracted, and the composite reliability, which indicate the existence of convergent validity (Fornell & Larcker, 1981; Hair et al., 2010), meaning that the proposed indicators adequately measure this factor (Cheung & Wang, 2017).

Observation through content validity that the instrument measures a specific domain (for example, personal competences), that the EFA identifies correspondence with the proposed theoretical model, and that the CFA corroborates the empirical sustainability of the model demonstrates that the instrument addresses the needs and distinctive characteristics of human nature through teaching competences. In other words, they emphasise analytical competences, action-oriented competences and the social competences of Baartman (2007) while seeking to develop personal well-being and the competence of the students (Braun & Hooper, 2024; Cachutt-Alvarado et al., 2024).

With regards to reliability, according to the results this was optimal; the precision and the degree of correlation between the final 18 items of the instrument is noted, indicating that the measurement is free from error (Carvajal et al., 2011; Jabrayilov et al., 2016). Therefore, we can conclude that the ECDEMS has adequate psychometric properties that reflect the quality of its measurement.

One strength of the study is that it followed the ideal model presented in the literature with content analysis performed first followed by analysis of construct validity through the process of cross validation (EFA and CFA). Also, a reasonably large sample population was used from a major geographical sector of the south and south east area of Mexico.

One significant limitation of the present study is methodological as probability sampling was used, which prevents the findings from being generalised. Another could be how each participant interpreted each item, as well as their socio-emotional conditions when they responded. A further limitation is the form or the circumstances under which the researchers collected the information.

5. Conclusion

Using evaluation scales such as the present instrument has important theoretical and practical implications because it allows measurements of teaching performance in USE to be contrasted with what theory states. For future teachers, it enables personalised identification of areas for improvement, as well as possibilities for professional feedback and the development of key and specific competences to increase students' educational achievement, as well as improving the efficacy of the local teacher training programmes.

This tool can also be used by educational policy makers and by the leaders of upper-secondary education institutes to diagnose teaching competences at the macro level and establish the corresponding medium- and long-term strategies.

Consequently, future research should replicate this study in other contexts both in Mexico and abroad, using probability sampling so that the results obtained can be generalised, and carry out comparative studies by gender to evaluate students' perception of their teachers, according to the regions they are from.

Author contributions

Dr. Emerson López-López: Conceptualisation, data curation, investigation, methodology, data collection, project administration, writing – original draft, writing – review & editing.

Dr Luis Gibran Juárez-Hernández: Data curation, methodology, formal analysis, supervision, validation, visualisation, writing – original draft, writing – review & editing.

References

Abarca-Cedeño, M. S., Juárez-Hernández, L. G., Márquez-Orozco, L., & Villanueva-Magaña, R. M. (2024). Validación de constructo y confiabilidad de una escala de autoevaluación de competencias docentes y contexto institucional para el fomento de la creatividad. Ciencia Latina Revista Científica Multidisciplinar, 8(1), 5271-5292. https://doi.org/10.37811/cl_rcm.v8i1.9860

AERA-APA-NCME. (2014). Standards for educational and psychological testing. AERA.

Agüero-Servín, M. (2022). Formación y profesionalización docente en la educación media superior en México. Revisión crítica y narrativa de la literatura científica. Revista Electrónica en Educación y Pedagogía, 6(10), 228-248. https://doi.org/10.15658/rev.electron.educ.pedagog22.04061015

Arribas-Águila, D., Castaño, G., & Martínez-Arias, R. (2024). A systematic review of evidence-based general competency models: Development of a general competencies Taxonomy. Journal of Work and Organizational Psychology, 40(2), 61-76. https://doi.org/10.5093/jwop2024a6

Aydin, M. K., Yildirim, T., & Kus, M. (2024) Teachers' digital competences: a scale construction and validation study. Frontiers in Psychology, (15), 1-13. https://doi.org/10.3389/fpsyg.2024.1356573

Baena-Extremera, A., Granero-Gallegos, A., & Martínez-Molina, M. (2015). Validación española de la escala de evaluación de la competencia docente en educación física de secundaria. Cuadernos de Psicología del Deporte, 15(3), 113-122. https://dx.doi.org/10.4321/S1578-84232015000300011

Baartman, L. K. J., Bastiaens, T. J., Kirschner, P. A., & Van der Vleuten, C. P. M. (2007). Evaluating assessment quality in competence-based education a qualitative comparison of two framework. Educ. Res. Rev., (2), 114-129. https://doi.org/10.1016/j.edurev.2007.06.001

Bleiberg, J., Brunner, E., Harbatkin, E., Kraft, M. A., & Springer, M. G. (2024). Taking teacher evaluation to scale: The effect of State reforms on achievement and attainment. Education Policy Analysis Archives, 32(1), 1-24. https://doi.org/10.26300/b1ak-r251

Boyatzis, R. E. (1983). The competent manager. A model for effective performance. Wiley.

Boyatzis, R. E. (2006). Core competencies in coaching others to overcome dysfunctional behavior. En V. U. Druskat, F. Sala, & G. Mount (eds.), Linking emotional intelligence and performance at work: Current research evidence with individuals and groups, 81-95. Lawrence Erlbaum Associates Publishers.

Braun, S. S., & Hooper, A. L. (2024). Social and emotional competencies predict pre-service teachers' occupational health and personal well-being. Teaching and Teacher Education, (147), 1-11. https://doi.org/10.1016/j.tate.2024.104654

Brown, G. T. L. (2024). Editorial: Insights in assessment, testing, and applied measurement: 2022.. Frontiers in Education, (9), 1-3. https://doi.org/10.3389/feduc.2024.1488012

Brown, T. A. (2006). Confirmatory Factor Analysis for Applied Research, The Guilford Press.

Bulger, S. M., & Housner, L. D. (2007). Modified Delphi investigation of exercise science in physical education teacher education. Journal of Teaching in Physical Education, 26(1), 57-80. https://doi.org/10.1123/jtpe.26.1.57

Burbano, A., Ledesma, A. J., & Ordoñez, D. A. (2024). Competencias docentes de ingeniería. Revisión bibliográfica de literatura. Revista Mexicana de Investigación Educativa, 29(101), 181-203. https://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1405-66662024000200181

Cabero-Almenara, J., & Palacios-Rodríguez, A (2020). Marco europeo de competencia digital docente «DigCompEdu». Traducción y adaptación del cuestionario «DigCompEdu». EDMETIC Revista de Educación Mediática y TIC 9(1), 213-234. https://doi.org/10.21071/edmetic.v9i1.12462

Cachutt-Alvarado, C., Méndez-Gómez-Humaran, I., & Velasco-Álvarez, J. (2024). Personal competencies for work–family integration and its relationship with productivity and comprehensive health in salaried professionals, Safety, 10(1), 1-25. https://doi.org/10.3390/safety10010028

Cámara de Diputados del H. Congreso de la Unión. (2017). Ley general de protección de datos personales en posesión de sujetos obligados. https://www.diputados.gob.mx/LeyesBiblio/pdf/LGPDPPSO.pdf

Carpenter, S. (2018). Ten steps in scale development and reporting: A guide for researchers. Communication Methods and Measures, 12(1), 25-44. https://doi.org/10.1080/19312458.2017.1396583

Carvajal, A., Centeno, C., Watson, R., Martínez, M., & Sanz Rubiales, A. (2011).¿Cómo validar un instrumento de medida de la salud. Anales del sistema sanitario de Navarra, 34(1), 63-72. https://dadun.unav.edu/server/api/core/bitstreams/e7e33006-2f83-4f55-a180-ef5c297b54b6/content

Castro-Castillo G, Cárdenas-Cobo, J., Soldevilla, M. T., & Vidal-Silva, C. (2024). Analyzing the teaching profile and competency-based training in online education: a case study of Ecuadorian professors. Frontiers in Education, 9. https://doi.org/10.3389/feduc.2024.1397086

Chee Yuet, F. K., Yusof, H., & Syed Mohaman, S. I. (2016). Development and validation of the teacher leadership competency scale. Malaysian Journal of Learning and Instruction, 13(2), 43-69. https://e-journal.uum.edu.my/index.php/mjli/article/view/mjli2016.13.2.2

Cheung, G. W., & Wang, C. (2017). Current approaches for assessing convergent and discriminant validity with SEM: Issues and solutions. Academy of Management Proceedings, (1). https://doi.org/10.5465/AMBPP.2017.12706abstract

CIFE. (2018a). Instrumento «Cuestionario de satisfacción con el instrumento». https://www.google.com/url?q=https://docs.google.com/forms/d/e/1FAIpQLSc8-jOiWYwG64QbnhRyGAg1ElTggq2aP1XiSg45pyN9XLbXNQ/iewform&sa=D&source=hangouts&ust=1590684761042000&usg=AFQjCNGAhEP1wC0U3VYcgk29198gFzHJSQ

CIFE. (2018b). Instrumento «Escala Jueces Expertos». https://www.google.com/url?q=https://docs.google.com/forms/d/e/1FAIpQLScWn-tYKAVPIr2EFBq723JYZWMNabLmukc-ReaOWp0tUc0IzA/viewform&sa=D&source=hangouts&ust=1590684754446000&usg=AFQjCNFv70JsedumZjNtxrRZH8qy1ratQQ

Cinque Gómez-del-Pulgar, S. & Rodríguez-Mantilla, J. M. (2020). Las competencias instrumentales en los futuros Maestros de Educación Primaria: Autopercepción y satisfacción con la formación recibida en estudiantes de la UCM. Profesorado. Revista de Currículum y Formación de Profesorado, 24(3), 309-333. 10.30827/profesorado.v24i3.8158]

Cortes, S., Pineda, H., & Geverola, I. J. (2020) Development and validation of a scale on teacher's competence in action research. International Journal of Research Studies in Education, 9(6), 77-85. https://doi.org/10.5861/ijrse.2020.5041

Di Lisio G., Mila Roa, A., Halty, A., Berástegui, A., Couso Losada, A., & Pitillas, C. (2025) Nurturing bonds that empower learning: a systematic review of the significance of teacher-student relationship in education. Front. Educ., 10. https://doi.org/10.3389/feduc.2025.1522997

DOF. (02 diciembre 2008d). Acuerdo número 449 por el que se establecen las competencias que definen el perfil del director en los planteles que imparten educación del tipo medio superior. https://www.sep.gob.mx/work/models/sep1/Resource/7aa2c3ff-aab8-479f-ad93-db49d0a1108a/a449.pdf

DOF. (17 enero 2008a). Programa sectorial de educación 2007-2012. https://www.dof.gob.mx/nota_detalle.php?codigo=5028684&fecha=17/01/2008&print=true

DOF. (21 octubre 2008b). Acuerdo número 444 por el que se establecen las competencias que constituyen el marco curricular común del Sistema Nacional de Bachillerato. https://educacionmediasuperior.sep.gob.mx/work/models/sems/Resource/10905/1/images/Acuerdo_444_marco_curricular_comun_SNB.pdf

DOF. (29 octubre 2008c). Acuerdo número 447 por el que se establecen las competencias docentes para quienes impartan educación media superior en la modalidad escolarizada. https://dof.gob.mx/nota_detalle.php?codigo=5066425&fecha=29/10/2008#gsc.tab=0

DOF. (30 abril 2009). Acuerdo número 486 por el que se establecen las competencias disciplinares extendidas del Bachillerato General. https://educacionmediasuperior.sep.gob.mx/work/models/sems/Resource/10905/1/images/Acuerdo_486_competencias_extendidas.pdf

Domínguez-González, N., & Serna-Poot, D. (2021). Competencias docentes para la educación en línea. RIDE Revista Iberoamericana para la Investigación y el Desarrollo Educativo, 11(22), 1-27. https://doi.org/10.23913/ride.v11i22.968

Fernández-Díaz, M. J., Rodríguez-Mantilla, J. M., & Fernández-Cruz, F. J. (2016). Evaluación de competencias docentes del profesorado para la detección de necesidades formativas. Bordón, 68(2), 85-101. https://doi.org/10.13042/Bordon.2016.68206

Firda, S., & Khairat, A. (2023). The impact of teacher skills'on students' interest and learning outcomes. International Journal of Education, Management, and Technology, 1(1), 1-10. https://doi.org/10.58578/ijemt.vlil.1881

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18(1), 39-50. https://doi.org/10.2307/3151312

Gonzáles, J., & Estrella, J. (2023). Educación del Siglo XXI, competencias, metodologías y estrategias. Esprint Investigación, 2(1). 5-15. https://doi.org/10.61347/ei.v2i1.50

Granada, G. D., & Oco, R. M. (2024). Classroom management and teaching competencies of elementary teachers. International Journal of Multidisciplinary Research and Analysis, 7(3), 1276-1283. https://doi.org/10.47191/ijmra%2Fv7-i03-50

Gümüs, M. M., & Volkan, K. (2023) Developing a digital competence scale for teachers: validity and reliability study. Education and Information Technologies, 28(1), 2747-2765. https://doi.org/10.1007/s10639-022-11213-2

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data análisis. (7ma. ed.). Pearson.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). Multivariate data análisis. (7ma. ed.). Pearson.

Haynes, S. N., Richard, D., & Kubany, E. S. (1995). Content validity in psychological assessment: A functional approach to concepts and methods. Psychological Assessment, 7(3), 238-247. 10.1037/1040-3590.7.3.238

Hernández-Sampieri, R., Fernández, Collado, C., & Baptista Lucio, P. (2010). Metodología de la Investigación. (5ta. ed.). McGraw-Hill Interamericana.

Hernández-Suárez, C. A., Gamboa-Suárez, A., & Avendaño-Castro, W. R. (2021). Validación de una escala para evaluar competencias investigativas en docentes de Básica y Media. Revista Boletín Redipe, 10(6), 393-406. https://doi.org/10.36260/rbr.v10i6.1335

Hollenstein, L., & Brühwiler, C. (2024). The importance of teachers' pedagogical-psychological teaching knowledge for successful teaching and learning. Journal of Curriculum Studies, 56(4), 480-495. https://doi.org/10.1080/00220272.2024.2328042

Howard, C. M. (2016). A review of exploratory factor analysis decisions and overview of current practices: What we are doing and how can we improve?. International Journal of Human–Computer Interaction, 32(1), 51-62. https://doi.org/10.1080/10447318.2015.1087664

Hunter, S. B., & Kho, A. (2023). The effects of teacher evaluation policy on student achievement and teacher turnover: Leveraging teacher accountability and teacher development. Journal of Education Human Resources, (aop), e20230040. https://doi.org/10.3138/jehr-2023-0040

Jabrayilov R., Emons, W. H. M., & Sijtsma, K. (2016). Comparison of classical test theory and item response theory in individual change assessment. Applied Psychological Measurement, 40(8), 559-572. https://doi.org/10.1177/0146621616664046

Juárez-Hernández, L. G., & Tobón, S. (2018). Análisis de los elementos implícitos en la validación de contenido de un instrumento de investigación. Espacios, 39(53), 23-30. http://www.revistaespacios.com/cited2017/cited2017-23.pdf

Juárez-Hernández, L. G. (2018). Manual práctico de estadística básica para la investigación. KResearch Corp. http://dx.doi.org/10.24944/isbn.978-1-945721-24-3

Kim, B. H., & Kim, J. (2016) Development and validation of evaluation indicators for teaching competency in STEAM education in Korea. Eurasia Journal of Mathematics, Science and Technology Education, 12(7), 1909-1924. https://doi.org/10.12973/eurasia.2016.1537a

Kline, R. B. (2013). Beyond significance testing: Statistics reform in the behavioral sciences (2nd ed.). American Psychological Association. https://doi.org/10.1037/14136-000

Lagunes-Córdoba, R. (2017). Recomendaciones sobre los procedimientos de construcción y validación de instrumentos y escalas de medición en la psicología de la salud. Revista Psicología y Salud, 27(1), 5-18. https://psicologiaysalud.uv.mx/index.php/psicysalud/article/view/2431/4279

Lloret-Segura, S., Ferreres-Traver, A., Hernández-Baeza, A., & Tomas-Marco, I. (2014). El análisis factorial exploratorio de los ítems: una guía práctica, revisada y actualizada. Anales de Psicología, 30(3), 1151-1169. https://scielo.isciii.es/pdf/ap/v30n3/metodologia1.pdf

Lüdecke, D., Ben-Shachar, M. S., Patil, I., & Makowski, D. (2020). Extracting, computing and exploring the parameters of statistical models using R. Journal of Open Source Software, 5(53), 1-5. https://doi.org/10.21105/joss.02445

Luna-Serrano, E., & Reyes-Piñuelas, E. P. (2015). Validación de constructo de un cuestionario de evaluación de la competencia docente. Revista Electrónica de Investigación Educativa, 17(3), 13-27. https://redie.uabc.mx/redie/article/view/1090

Maldonado-Suárez, N., & Santoyo-Telles, F. (2024). Validez de contenido por juicio de expertos: Integración cuantitativa y cualitativa en la construcción de instrumentos de medición. REIRE Revista d'Innovació i Recerca en Educació, 17(2), 1-19. https://doi.org/10.1344/reire.46238

Mardia, K. (1970). Measures of multivariate skewness and kurtosis with applications. Biometrika, 57(3), 519-530. https://doi.org/10.1093/biomet/57.3.519

McClelland, D. C. (1973). Testing for competence rather than for intelligence. The American Psychologist, (28), 1-14. https://doi.org/10.1037/h0034092

McDonald, R. P. (1999). Test theory: A unified treatment. Lawrence Erlbaum Associates Publishers.

Montero, I., & León, O. G. (2007). Una guía para nombrar los estudios de investigación en Psicología. International Journal of Clinical and Health Psychology, 7(3), 847-862. https://web.archive.org/web/20180508202326id_/http://aepc.es/ijchp/GNEIP07_es.pdf

Morán. R., Cardoso, E. O., Cerecedo, M. T., & Ortiz, J. C. (2015). Evaluación de las competencias docentes de profesores formados en instituciones de educación superior: El caso de la asignatura de tecnología en la enseñanza secundaria. Formación Universitaria, 8(3), 57-64. http://dx.doi.org/10.4067/s0718-50062015000300007

Muñiz, J., & Fonseca-Pedrero, E. (2019). Diez pasos para la construcción de un test. Psicothema, 31(1), 7-16. https://www.psicothema.com/pdf/4508.pdf

Nessa, K., Akter, S., Faruk, G., & Raihan, F. (2024). Teaching competence and academic achievement on Higher Secondary students in Satkhira District. International Journal of Research and Innovation in Social Science, 8(3), 446-456. https://doi.org/10.47772/ijriss.2024.803030s

Otto, A. (2024). CLIL in pre-primary education. A qualitative analysis of teachers' view in a Spanish context. En J. Rodas Segarra, S. Mengual-Andres y A. Cortijo Ocaña. (eds.), Educational innovation to address complex societal challenges, 121-136. IGI Global. 10.4018/979-8-3693-3073-9.CH009

Penfield, R. D., & Giacobbi, P. R. (2004). Applying a score confidence interval to Aiken's item content-relevance index. Measurement in Physical Education and Exercise Science, 8(4), 213-225. https://doi.org/10.1207/s15327841mpee0804_3

Pérez-Contreras, J., Bahamonde-Pérez, C., Pardo-Tamayo, C., Merino-Muñoz, P., & Aedo-Muñoz, E. (2022). Validación y fiabilidad del instrumento "Escala de percepción de competencias docente en educación física en la atención de las personas en situación de discapacidad". Retos, (43), 931-937. https://doi.org/10.47197/retos.v43i0.86477

Perrenoud, P. (2004). Diez nuevas competencias para enseñar. Editorial Grao.

Putra, E., & Yanto, M. (2025). Classroom management: boosting student success –a meta-analisis review. Cogent Education, 12(21). https://doi.org/10.1080/2331186X.2025.2458630

R Core Team. (2020). R: A language and environment for statistical computing. R Foundation for Statistical Computing. R-project.org/.

Ráczová, B., Kačmár, P., & Hricová, M. (2021). A psychometric evaluation and initial validation of the Slovak version of the Goal Adjustment Scale (GAS). Studia Psychologica, 63(1), 94-109. https://journals.savba.sk/index.php/studiapsychologica/article/view/82/53

Ramón-Santiago, P., Aquino-Zúñiga, S. P., & Alejandro-Jiménez, M. (2017). Evaluación de las competencias docentes de profesores de Educación Media Superior del Estado de Tabasco, México. Sinéctica Revista Electrónica de Educación, (47), 1-17. https://www.scielo.org.mx/pdf/sine/n48/2007-7033-sine-48-00013.pdf

Revelle, W. (2017). Psych: Procedures for personality and psychological research R package version 2.1.6. https://cran.rproject.org/package=psych

Rosseel, Y. (2012). lavaan: An R Package for Structural Equation Modeling. Journal of Statistical Software, 48(2), 1-36. https://doi.org/10.18637/jss.v048.i02

Salihu, A. G. (2019). Assessing teachers ability on test construction and economics content validity in Nasawara State Senior Secondary School, Nigeria. International Journal of Innovative Research in Education, Technology y Social Strategies, 6(1), 1-16. https://internationalpolicybrief.org/wp-content/uploads/2023/10/ARTICLE1-73.pdf

Sánchez-Tarazaga, L., y Fernández-Berrueco, R. (2022). Validación de un cuestionario de competencias docentes para el profesorado de educación secundaria. Tendencias Pedagógicas, (39), 95-105. https://doi.org/10.15366/tp2022.39.008

Singh, A. (2024). Status of teaching competency among pupil teachers. Educational Administration: Theory and Practice, 30(1), 3988-4003. https://doi.org/10.53555/kuey.v30i1.7709

Skedsmo, G., & Huber, S. G. (2024). Navigating data, evaluation, and incentives to improve teaching and instructional quality. Educ Asse Eval Acc, 36, 429-432. https://doi.org/10.1007/s11092-024-09447-4

Tabachnick, B. G., & Fidell, L. S. (2001). Using multivariate statistics (4ta. ed.). Allyn and Bacon

UNESCO. (2022). Transforming education from within: current trends in the status and development of teachers; World teachers' day 2022. https://unesdoc.unesco.org/ark:/48223/pf0000383002

Uysal, C., Sani-Bozkurt, S., Bozkus-Genc, G., & Gurgur, H. (2021). Empowering teachers who work in inclusive practices: E-coaching. En A. Bozkurt (ed.). Handbook of research on emerging pedagogies for the future of education: Trauma-informed, care, and pandemic pedagogy, 386-400. IGI Global. 10.4018/978-1-7998-7275-7.ch020

Velicer, W. F., & Fava, J. L. (1998). Effects of variable and subject sampling on factor pattern recovery.. Psychological Methods, 3(2), 231-251. https://doi.org/10.1037/1082-989X.3.2.231

Wang, H., & Sang, L. (2024). Interdisciplinary competence of primary and secondary school teachers: a systematic literature review. Cogent Education, 11(1), 1-16. https://doi.org/10.1080/2331186X.2024.2378277

WHO. (2022). Global competency and outcomes framework for universal health coverage. https://iris.who.int/bitstream/handle/10665/352711/9789240034662-eng.pdf?sequence=1

Wong, S. Ch. (2020). Competency definitions, development and assessment: a brief review. International Journal of Academic Research in Progressive Education and Development, 9(3), 95-114. http://dx.doi.org/10.6007/IJARPED/v9-i3/8223

Worthington, R. L., & Whittaker, T. A. (2006). Scale development research: A content analysis and recommendations for best practices. The counseling psychologist. The Counseling Psychologist, 34(6), 806-838.https://doi.org/10.1177/0011000006288127

Xia, Y., & Yang, Y. (2019). RMSEA, CFI, and TLI in structural equation modeling with ordered categorical data: The story they tell depends on the estimation methods. Behavior Research Methods, 51(1), 409-428. https://doi.org/10.3758/s13428-018-1055-2.

Yuan, K. H. (2005). Fit indices versus test statistics. Multivariate Behavioral Research, 40(1), 115-148. https://doi.org/10.1207/s15327906mbr4001_5

Zhou, Q., Li, M., Yan, Y., Chen, M., Wang, J., Yi, K., Han, X., Wang, S., & Wang, S. (2023). Teaching competency development. En J. Cheng, W. Han, Q. Zhou y S. Wang (Eds.). Handbook of teaching competency development in higher education, 63-126. https://library.oapen.org/bitstream/id/05aa1d2c-93fc-4ce2-8532-b08bb15622ee/978-981-99-6273-0.pdf

Zumstein-Shaha, M., & Grace, P. J. (2023). Competency frameworks, nursing perspectives, and interdisciplinary collaborations for good patient care: Delineating boundaries. Nursing Philosophy, 24(1), e12402. https://doi.org/10.1111/nup.12402

Author Biographies

Dr Emerson López-López: Doctor of Socio-Training and Knowledge Society from the Centro Universitario CIFE (emerson.lopezqulv.edu.mx). Associate professor on the licentiate degree in Education and Public Accounting, as well as on the master's in Education at the Universidad Linda Vista in Chiapas, Mexico. His research interests are Training researchers, competence-based education, financial education, curriculum and didactics.

https://0000-0001-6149-7856

Dr Luis Gibran Juárez-Hernández: Doctor of Biological and Health Sciences from the Universidad Autónoma Metropolitana (gibbjuarez@gmail.com). University Merit Medal for Doctoral Studies. Teacher on the master's in Training and Innovation for Health Professionals of the Faculty of Medicine and Biomedical Sciences of the Universidad Autónoma de Chihuahua

and associate professor at the Centro Universitario CIFE. He is a member of Mexico's Sistema Nacional de Investigadoras e Investigadores (National System of Researchers). His research interests are environmental diagnosis, development and evaluation of evaluation instruments, and sustainable development.

https://orcid.org/0000-0003-0658-6818