

Validity and reliability of a microteaching evaluation Instrument in biological chemical sciences

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Abstract

Introduction: Microteaching is a technique that allows the improvement of teachers' didactic skills with their students in the classroom, and in order to evaluate the performance of this technique it is necessary to have valid and reliable instruments. **Objective:** To determine the validity and reliability of the Microteaching Assessment Questionnaire (MAQ) of teachers of the QFB Career at the FES Zaragoza, UNAM. **Method:** The MAQ was applied to a non-probabilistic sample of 124 students after a 20-minute class. Results. An instrument of 49 questions distributed in three factors was obtained with a total variance of 51.57%, according to the Exploratory Factor Analysis, and Cronbach's alpha of 0.961. **Discussion:** It is considered that the validity and reliability obtained make the MAQ a useful instrument for students to evaluate the teaching skills of teachers in the QFB career.

Keywords: validity; reliability; microteaching; didactic ability; exploratory factor analysis

Validez y confiabilidad de un instrumento para evaluación de la microenseñanza en ciencias químico biológicas

Resumen

Introducción: la microenseñanza es una técnica que permite el mejoramiento de las habilidades didácticas del docente con sus estudiantes en el aula, y para evaluar la realización de esta técnica es necesario contar con instrumentos válidos y confiables. **Objetivo:** determinar la validez y confiabilidad del Cuestionario de Evaluación de Microenseñanza (CEM) de docentes de la Carrera de QFB en la FES Zaragoza, UNAM. **Método:** el CEM se aplicó a una muestra no probabilística de 124 estudiantes después de una clase de 20 minutos. Resultados: se obtuvo un instrumento de 49 preguntas distribuidas en tres factores con una varianza total de 51.57%, según el Análisis Factorial Exploratorio, y alfa de Cronbach de 0.961. **Discusión:** se considera que la validez y la confiabilidad obtenidas hacen que el CEM sea un instrumento útil para que los estudiantes puedan evaluar las habilidades didácticas de los docentes en la carrera de QFB.

Palabras clave: validez; confiabilidad; microenseñanza; habilidad didáctica; análisis factorial exploratorio

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Introduction

Microteaching is a technique for training and perfecting pedagogical skills that focuses on how teachers teach (technique) and not on what is taught (content) ([Escoto, 2001](#)). It consists of simplifying the complexities of a normal class, decreasing exposure time, content length, and duration time during training ([Escoto, 2001](#)). This technique began at Stanford University in 1963 and, with some adaptations, has spread internationally ([Dwight, 1967](#)). It was created to abate many of the deficiencies of traditional teacher training programs and to increase the understanding of the process that is established between teacher and teaching ([Secretaría de Educación Pública, 2016](#)). It is a shortened teaching encounter that has been developed to serve 3 purposes: (1) as a preliminary, hands-on teaching experience, (2) as a research vehicle to explore the effects of training under controlled conditions, and (3) as an in-service training tool for experienced teachers. They are required to teach short lessons (5 to 25 minutes) in their subject area to a small group of students (up to 5). These brief lessons provide the opportunity for intense supervision, videotaping for immediate feedback, and the collection and use of participant comments ([Dwight, 1967](#)).

For the collection of information from the students, instruments, or questionnaires have been designed to evaluate the microteaching technique. Among them, there is a great diversity of models, didactic skills used, number of questions, population, and design for the validation of each one of them, applied in different areas.

In this regard, [Dwight \(1967\)](#) elaborated a questionnaire of 35 questions for university students (newly hired teachers) divided into 7 teaching skills (reinforcement, stimulus variation, induction, reading, and use of audiovisual media, explanatory skills, and use of examples and student-initiated questions), where each question has seven levels of a Likert-type scale. Validity and reliability are not established; it is only mentioned that statistically significant results were obtained ($p = 0.001$). [Guillermo \(1997\)](#)

designed a 24-question instrument applied to teachers in a teaching program and divided into three didactic skills (reinforcement, formulation of questions, and integration), which considered 5 levels of qualification according to the Likert scale without mentioning reliability or validity of the instrument used.

On the other hand, [Capa \(2005\)](#) validated the Turkish version of the Teachers' Sense of Efficacy Scale questionnaire applied to teacher trainees. It consisted of 24 questions divided into three dimensions (effectiveness in student participation, effectiveness in instruction strategies, and effectiveness in classroom management) with nine levels of qualification according to the Likert scale. It obtained a Cronbach's alpha of 0.82, 0.86, and 0.84 for each of the skills and an instrument reliability of 0.93, using exploratory factor analysis.

[Watson's questionnaire \(2007\)](#) has 28 questions for new teachers at Universidad Peruana de Ciencias Aplicadas organized into four competencies (design and development of class sequences that promote meaningful, creative, and active learning; development and use of teaching and learning media and materials, making effective use of educational technology and ICTs; effective communication, involving students in the subject being covered; and establishment of a good relationship with students during the teaching and learning process). [Deniz \(2011\)](#) used a questionnaire for trainee teachers of a Child Development Program, which measures opinions on five teaching skills (planning and preparation for the lesson, classroom management and relationship with students, use of teaching methods, implementation of the teaching process, and evaluation) through 31 questions with five levels of ratings according to the Likert scale with an alpha reliability for the pre-test questionnaire of .94 and .91 for the post-test one.

Another instrument reported is that of the [Unidades Tecnológicas Santander \(2011\)](#). Their questionnaire applied to teachers consists of 31 questions divided into seven teaching skills (initiation and motivation, verbal and nonverbal communication, stimulus variation, formulation of questions, integration of knowledge, logical organization, and class wrap-up

[reinforcement]) with 5 levels of qualification on a Likert scale. However, the validity and reliability of the instrument is not specified. Two more questionnaires are reported: the one by [Remesh \(2013\)](#), consisting of 39 questions applied to beginner professors in the program of Medicine, very similar to the Stanford University's ([Dwight, 1967](#)), which is divided into eight teaching skills (lesson planning, presentation and explanation, exemplification, reinforcement, stimulus variation, probing or exploration questions, class management, and use of audiovisual media) and does not mention validity and reliability analysis. The other proposal is by [Toro \(2013\)](#), consisting of 19 questions applied to students of the specialization in Apparel Technology, divided into three dimensions (planning, conduction, and evaluation), and five levels of qualification on a Likert scale, with a validity by expert judgment of 88% and Cronbach's reliability coefficient of the instrument of 0.96.

Recently, [Davanindhi \(2018\)](#) employed an instrument similar to the one used at Stanford University ([Dwight, 1967](#)), applied to in-service medicine professors. It includes six domains (induction, planning, presentation, use of audiovisual media, student participation, and wrap-up) and 19 questions, but the validity and reliability of the questionnaire is not mentioned. Based on the above, it can be observed that most of the instruments do not have evidence of validity and reliability and were designed exclusively for local use.

On the other hand, the Pharmaceutical-Biological Chemistry Program (Química Farmaceutico Biológica, QFB) of the Zaragoza School of Higher Studies (FES) of Universidad Nacional Autónoma de México (UNAM) has carried out the following activities for many years teaching evaluation processes and has implemented different strategies with the purpose of strengthening these evaluations, such as proposing professor refresher courses, pedagogical training courses, academic incentives, among other actions to improve the academic performance of professors in the classroom. Among these strategies, the implementation of the microteaching technique has been proposed as a practical alternative

to improve the didactic and pedagogical skills of professors in the program. To know if this is achieved, it is necessary to have a valid and reliable instrument to evaluate the improvements in the didactic skills shown by the teachers when applying the microteaching technique through the students' opinion.

It is important to point out that, in the teaching evaluation process, a questionnaire of 22 questions is applied, nine of which consider the didactic skills of the professors (promotes student interest in the topics, promotes student participation, promotes the use of information and communication technologies [ICTs], prepares the classes, relates theory with practice, advises the student in the proposed activities, promotes collaborative work among students, generates an atmosphere of trust during academic activities, and masters the contents of the program). These are the closest to the skills in the microteaching technique, but do not evaluate all the aspects that make it up ([Facultad de Estudios Superiores Zaragoza, 2015](#)).

Based on the above, it was considered important to have a valid and reliable microteaching evaluation instrument that considers the opinion of students as a substantial part of the teaching and learning processes and that is also adequate and relevant to be applied in the QFB program at Zaragoza FES, UNAM.

A very important aspect to consider is the validity according to the evidence based on the outcomes of the tests. In this regard, Martínez Rizo et al. ([cited in Taut, 2016](#)) mention a set of criteria for good practices in validation: having logical arguments and empirical evidence to support the intended uses and outcomes; evaluating the degree to which the intended and/or desirable outcomes of the test are produced; dissemination of results in reasonable times without discrimination; informing users about the purposes and characteristics of the tests; using clear and precise language without technicalities; describing the profile and characteristics of the reference population; identifying inappropriate uses or interpretations of the test and investigating in detail when there is reliable evidence of inappropriate uses.

Method

Design

This study employed a non-probabilistic sampling by chance, where the choice of the elements does not depend on probability but on the characteristics of the research ([Hernández, 2010](#)).

Participants

Five professors with graduate studies in education or higher education and more than 20 years of experience in education in the programs of the Zaragoza FES participated in this study. The sample was made up of 124 students from different semesters of the QFB program at Zaragoza FES, UNAM (with ages ranging between 18 and 24, female participation of 51.22%, male participation of 48.78%, and a socioeconomic level corresponding to an income lower than 4 minimum wages). The selection criteria were the following: a) officially enrolled in the semester they were studying and 2) willing to participate in the project. Of the students, 17.7% were in their third semester, 30.6% in their fifth semester, 5.6% in their eighth semester, 26.6% in their ninth semester, and 19.4% in their tenth semester. Likewise, 54.8% of the students were in theoretical classes (which consist of the presentation of a logically structured topic where the main resource is oral language, where the information must activate previous knowledge, present the contents in an active way, and structure them) ([Videla, 2005](#)) and 45.2%, in laboratory practices (the objective of which is that students acquire the skills of the methods and techniques of work and scientific research; expand, deepen, consolidate, generalize, and verify the theoretical foundations of the discipline through experimentation using the necessary means) ([Rodríguez, 2017](#)).

Instruments

Microteaching Evaluation Questionnaire (Cuestionario de Evaluación de la Microenseñanza, CEM).

For the design and structuring of the didactic skills and their qualification levels for the CEM, authors such as [Dwight, A \(1967\)](#); [Guillermo,](#)

[1997](#); [Capa, \(2005\)](#); [Watson, \(2007\)](#); [Deniz, \(2011\)](#); [Unidades Tecnológicas Santander \(2011\)](#); [Remesh, \(2013\)](#); [Toro, \(2013\)](#); [Dayanindhi, \(2018\)](#) were consulted. Likewise, the nine questions on didactic skill contained in the Teaching Evaluation Questionnaire applied in the QFB program at the Zaragoza FES of the UNAM were considered.

Based on the above, the CEM considered four didactic skills for the evaluation of microteaching with different numbers of questions, considering 5 rating levels for each of the questions (0 = never, 1 = rarely, 2 = sometimes, 3 = frequently, 4 = always). The definitions of each of the didactic skills, according to [Escoto \(2001\)](#), are described in Table 1.

Opinion Instrument on the Microteaching Evaluation Questionnaire (IOCEM)

To determine whether each of the questions included, as well as the sections, were understandable for the students, the IOCEM was designed based on the questions for each of the didactic skills included in the CEM and the experience of the researchers.

Procedures

The first step was to create version one of the CEM, based on the microteaching questionnaires by various authors and the nine questions on didactic skill contained in the Student Questionnaire for the Evaluation of Teaching Exercise applied in the QFB program at Zaragoza FES. The second step was to validate the content with five expert professors in higher education, who analyzed and made suggestions and observations to improve the CEM in content, structure, congruence, wording, and scoring levels, leading to version two of the CEM. For the third step, based on this version and the experience of the researchers, questions were proposed to develop the IOCEM. After analyzing each proposal, the final questionnaire with eight questions was obtained, which allowed gathering the students' opinion on the clarity and understanding of the introduction, objectives, rating scale, and wording, as well as the extension and usefulness of the CEM.

Table 1.

Definition of the Didactic Skills Considered in the CEM

Skill	Definition	No. of questions
A) Presentation	These are those behaviors that establish a link between the teacher and student activity; includes teacher behaviors such as presenting the objectives of the topic, unit, or program to the students to direct their attention; showing the contents and activities to the students in an attractive way; linking the contents with what is unknown; presenting the contents of the class in an orderly, systematic, and continuous manner; adjusting the didactic resources to the objectives.	7
B) Verbal and non-verbal communication	Refers to the ability to transmit information, in order to control, motivate, express emotions and inform; includes teacher behaviors such as using a precise and correct vocabulary adapted to the receiver's capacity; restructuring the subject according to the questions asked; starting from what is known to what is new; favoring the continuity of ideas; modulating and regulating the volume and tone of voice; pronouncing clearly; controlling the speed of language; managing emotions when communicating the message; using the verbal approach; eliminating fillers; supporting the presentation with gesticulation; maintaining eye contact with the students and stimulating nonverbal communication.	18
C) Formulation of questions	They involve the teacher preparation with the purpose of actively involving the student and stimulating or triggering higher mental processes. including behaviors such as asking questions that focus on main ideas; encouraging convergent or divergent thinking through questions; asking questions concerning the class, time to give advice during the practical part, facilitating the development of skills and abilities, ensuring that practice is conducted in adequate conditions, solving practical problems with examples or demonstrations, and helping them understand discipline-specific concepts applied to practice	10
D) Reinforcement	They help students consolidate their knowledge and include behaviors such as consolidating main concepts and ideas before starting a new topic; reviewing the main points in order to classify them: summarize and contemplate the main ideas after analysis and discussion with the students, starting the classes by reaffirming the contents that are a prerequisite for the new topic; elaborating schemes and classification charts that condense the information that covers the objectives of the subject; promoting the application of knowledge to new situations and analyzing with the students the possibilities to use the new information.	16

The fourth step was to perform the validation of the construct and reliability of the CEM. For this purpose, a written invitation was extended to several Q.F.B. professors to whom the purpose and objective of the study and the didactic skills that would be evaluated based on the CEM were explained, requesting their authorization to attend a 20-minute class, and subsequently carry out the application of the CEM and the IOCEM to their students. In the classroom, the purpose of the study was explained to the students, as well as the objective of their participation in evaluating the teacher's microteaching technique through the application of the CEM, and the objective of the IOCEM. It is important to mention that the application of the questionnaires was anonymous to avoid any type of coercion on the part of the evaluated professors. Therefore, the participating students were assigned a number as they handed in the completed questionnaires. It should be noted that it was agreed with the professors to give them in writing the results obtained from the evaluation by their students.

The fifth step was the statistical treatment of the data using Exploratory Factor Analysis, Cronbach's Alpha, leading to the third and final version of the CEM and the frequency analysis for the IOCEM.

It is important to mention that each of the participating professors signed an informed consent form, where they were informed of the objective and purpose of their participation in the project, the request to attend a 20-minute class, the commitment to maintain the confidentiality of the information derived from the research, as well as the privacy notice of personal data.

Data Analysis

The content validity of the CEM was determined by means of expert judgment (face validity) with an analysis of the comments on the sections of the instrument, the questions, their location in each didactic skill, the rating scale, and the wording and clarity of the questionnaire. Cronbach's alpha was used to determine the reliability of the CEM. For construct validity, Exploratory Factor Analysis was used using SPSS V21 (IBM SPSS Statistics Armonk, NY, USA). Frequency analysis was used for the IOCEM.

According to [Hernández, 2010](#), Cronbach's Alpha is interpreted with the following values: 0.25 in correlation or coefficient indicates low reliability; if the result is 0.50, the reliability is medium or fair; on the other hand, if it exceeds 0.75, it is acceptable; and if it is greater than 0.90, it is high.

The EFA was conducted in 4 stages: the first stage consisted in determining the correlation matrix using Barlett's test of sphericity, which indicates that the data of all the variables (questions) correlate with each other, and the Kaiser-Meyer-Olkin measure of sample adequacy (KMO) ([Aguilar, 2003](#)). Kaiser and Rice (1974) ([cited in Ferrando, 2022](#)) proposed the KMO index, which states that the higher the value of the index, the more communality available in the correlation matrix. A whole series of values have been suggested to qualify the amount of communality available; only matrices with KMO values above .75 deserve to be studied by Factor Analysis. Phase two consisted in the estimation of factors, which was carried out by means of an Exploratory Factor Analysis (EFA) using the method of principal axis factoring. The next phase entailed the extraction of factors using Parallel Analysis (PA) ([Lloret-Segura, 2014](#)). In addition, the elbow criterion ([Hair, 1999](#)) or scree plot ([López, 2015](#)) was considered, determining the number of factors to extract based on the change in continuity in the curve. The next stage involved factor rotation, using oblique rotation by means of the Promax method with 0.35 as the saturation value of the items, which represents the correlation between the original variable and its factor ([Spector, 1992](#)).

In the last stage, the researchers conducted a conceptual analysis of the grouping and congruence of the variable to define the meaning of each of the factors or didactic skills; subsequently, the didactic skills were reorganized and renamed so that they defined the construct of microteaching ([Morales, 2011](#)).

Results

Validity

For content validation, based on the observations made to version 1 of the CEM by the expert professors, seven questions remained unchanged

(15.2%), 38 (82.6%) presented changes in their wording—mainly in the conjugation of verbs, where some of the wording was changed to make the questions more understandable, and only one question (2.1%) was eliminated. Likewise, six new questions were added: four in the verbal and non-verbal communication skill and two in the question formulation skill. The rating levels of the questions were changed to 0 = very poor, 1 = poor, 2 = average, 3 = good, and 4 = very good. Based on the above, version 2 of the CEM was made up 51 questions for 4 didactic skills, as shown in Table 2.

For the validation of the internal structure, the CEM and the IOCEM were simultaneously applied to six groups (three groups of practical activities and three groups of theoretical activities) including 124 students.

The results of the CEM AFE were as follows:

1. A normal distribution was observed in the correlation matrix, Barlett's test of sphericity indicated that all variables correlate with each other ($p < 0.0001$), and the KMO met the criteria for performing an

EFA with a value of 0.897

2. For factor estimation, performed by means of the principal axis factoring method, a distribution of the questions in 11 factors was observed.
3. Parallel analysis (SPSS macro) (Meneses, 2020) and scree plot (figure 1) were used for factor extraction. The questions were distributed into three factors. The table shows that the accumulated variance for the three factors was 51.57% (table 3).
4. The results of the oblique rotation using the Promax method are shown in the standard matrix (Table 4).

Table 4 shows the result of the oblique rotation of the three-factor pattern matrix to determine the number of variables (questions) for each factor. The questions Used gestures to lead the group/face gestures and used the blackboard were eliminated because they had factor loadings of less than 0.35.

Based on the results of the EFA and the experience of the researchers, the factors or didactic skills were regrouped and named, giving

Table 2.
Comparison of CEM Versions

Version	Didactic skills	Number of questions	Total number of questions of the CEM
1 (initial)	Presentation	7	46
	Verbal and nonverbal communication	14	
	Formulation of questions	9	
2	Reinforcement	16	51
	Presentation	7	
	Verbal and nonverbal communication	18	
	Formulation of questions	10	
3 (final)	Reinforcement	16	49
	Verbal and non-verbal communication	29	
	Formulation of questions	15	
	Use of audiovisual media and ICTs	5	

rise to CEM version 3 with 49 questions distributed in 3 factors: Factor 1 was called Verbal and non verbal communication, including 29 questions (40.83% variance); factor 2, according to the items that made it up, was named Formulation of questions and reinforcement, including 15 questions (6.05% of variance); and factor 3, according to the questions that made it up, was named Use of audiovisual media and ICTs, including 5 questions (4.67% of variance). This gave rise to the third and final version of the CEM (Table 5).

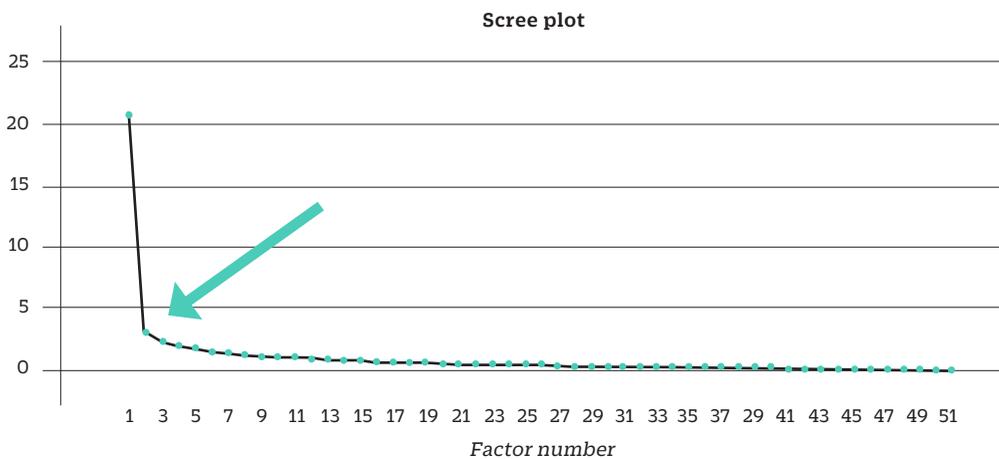
The average time it took students to answer the CEM and the IOCEM was 28 minutes.

Reliability

The Cronbach's alpha reliability value for the CEM was 0.961.

In relation to the clarity and understanding of the IOCEM (questions 1, 2, 3, and 5), an acceptance of over 85% was obtained, (one out of three students found it extensive). Of the 37.1% of the students who had doubts when answering the questionnaire, question 16 had 65.2% of doubt, followed by question 44 with 6.52%. An acceptance of over 90% was obtained to improve the quality of teaching and to be applied to the professors of the Zaragoza FES (table 6).

Figure 1.
Scree Plot



Note: The arrow shows the inflection point indicating the number of factors to be extracted.

Table 3.
Varianza total explicada para tres factores.

Factor	Autovalores iniciales		
	Total	% de varianza	% acumulado
1	20.826	40.835	40.835
2	3.090	6.059	46.894
3	2.385	4.676	51.570

Note: Extraction method: principal axis factoring.

Table 4.
Pattern Matrix of the Three Factors with Factor Loadings

Variable	Matriz de patrón		
	Factor		
	1	2	3
q6. Demonstrated confidence and mastery of the topics taught in class.	.812		
q13. Showed proper posture in the classroom.	.788		
q48. Analyzed examples of the topic studied.	.765		
q40. Avoided facial expressions of annoyance or aggression in the face of inappropriate student behaviors.	.756		
q41. Made references to student responses or interventions.	.718		
q9. Regulated the tone of voice.	.714		
q45. Emphasized the important topics of the content.	.698		
q5. Presented organization, cleanliness, and quality of didactic materials.	.634		
q44. Avoided feeling that a question or participation was silly.	.628		
q17. Turned his attention to the students.	.615		
q42. Advised students on proposed activities.	.610		
q36. Motivated student participation with the words good, excellent, good question, or good answer.	.578		
q12. Moved around the classroom.	.576		
q10. Used clear language (no stuttering, hesitation, or mumbling).	.574		
q14. Moved hands, head, and body without nervous tics.	.561		
q8. Regulated voice volume.	.553		
q4. Provided a logical sequence of class content.	.550		
q21. Behaved politely and respectfully in class.	.539		
q37. Encouraged students to participate by using expressions such as mm, yes, go ahead, perfect, among others.	.525		
q3. Provided the topics and objectives related to the program.	.519		
q49. Related the topic to other topics seen previously or to be covered in the future.	.495		
q43. Gave students the opportunity to exemplify the concept studied.	.468		
q39. Used expressions such as think, repeat again, among others to help students to give their correct answers.	.448		
q2. Personal presentation (grooming, attire, etc.).	.430		
q51. Announced the topics to be studied in the next class.	.428		
q46. Suggested how to apply what was seen in class.	.426		
q35. Allowed students to formulate questions.	.395		
q1. Motivated students at the beginning of the class.	.386		
q38. Motivated students to participate by smiling, nodding of the head, writing their contributions on the blackboard, looking and listening politely.	.369		
q28. Asked clear questions about the class topic.		1.009	
q26. Asked questions related to the topic reviewed in class.		.985	
q27. Asked questions relevant to the topic.		.984	
q29. Asked questions in a logical and coherent order.		.970	
q20. Interacted visually and verbally with the students.		.788	
q19. Made pauses to elicit answers to questions.		.746	
q31. Asked questions that motivated the group's participation.		.623	
q18. Made eye contact with students.		.555	
q30. Asked questions with different levels of complexity and difficulty.		.521	
q34. Motivated students to formulate questions.		.489	
q32. Took advantage of a student's question for the analysis of new ideas.		.482	
q7. Fostered trust and collaborative and cooperative work among students.		.428	
q33. Helped students structure their answers correctly.		.398	
q50. Related theory to practice.		.383	
q11. Used moderate speed of speech.		.370	
q24. Used Information and Communication Technologies.			.901
q23. Used audiovisual media.			.882
q47. Reinforced the most important aspects of the topic by means of classification charts, concept maps, mind maps, etc.			.623
q25. Used graphic media such as flip charts, diagrams, models, posters, scale models, among others.			.622
q16. Focused his attention on objects.			.367

Extraction method: principal axis factoring.

Rotation method: Promax with Kaiser normalization.

a. The rotation has converged in 5 iterations.

Table 5.
Microteaching Evaluation Questionnaires



**Universidad Nacional Autónoma de México
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MICROTEACHING EVALUATION QUESTIONNAIRE

Introduction

Microteaching, as a teacher training technique, began at Stanford University in 1963. Microteaching basically consists in simplifying classroom conditions by allowing a teacher to instruct a small group of students for a short period of time, trying to practice a specific teaching skill. This technique addresses various aspects of the pedagogical process of teachers, including communication in the classroom, supportive didactic resources, and the diversity of students. These aspects are worked on through the teachers' self-observation and self-reflection on their teaching practice, receiving feedback from a facilitator and peers, developing skills and abilities during the experience, achieving motivation for ongoing training and improvement, and creating bonds of support among teachers, students, and administrative personnel.

Microteaching is currently one of the most effective existing teacher training mechanisms since teachers are able to identify and intervene in problems in their practices and to create support networks in their schools to raise the achievement level of their students.

Objective

To evaluate the pedagogical and didactic skills of the Q.F.B. school professors to improve teaching practice and raise the level of student achievement.

Instructions for filling out the questionnaire.

The questionnaire consists of three columns: the first column describes the pedagogical and/or didactic skill to be evaluated for each professor; the second column describes the attributes to be evaluated according to each skill; and the third column indicates the rating given by the student to each professor attribute, according to the following scale:

1	Rating	2	Interpretation
3	0	4	Very poor
5	1	6	Deficient
7	2	8	Regular
9	3	10	Good
11	4	12	Very good

Based on the above and after a 20-minute lecture by the professor, the students will mark a ✓ in the questionnaire in the grade box (0-4) that describes the professor's attribute in their opinion.

Questionnaire

Name of professor evaluated: _____ Date: _____

Pedagogical and/ or didactic skill	No. of attribute	Professor's attributes to be evaluated	RATING				
			0	1	2	3	4
Communication Verbal and non-verbal	1	Demonstrated confidence and mastery of the topics taught in class.					
	2	Showed proper posture in the classroom.					
	3	Analyzed examples of the topic studied.					
	4	Avoided facial expressions of annoyance or aggression in the face of inappropriate student behaviors.					
	5	Made references to student responses or interventions.					
	6	Regulated the tone of voice.					
	7	Emphasized the important topics of the content.					
	8	Presented organization, cleanliness, and quality of didactic materials.					
	9	Avoided feeling that a question or participation was silly.					
	10	Turned attention to the students.					
	11	Advised students on proposed activities.					
	12	Motivated student participation with the words good, excellent, good question, or good answer.					
	13	Moved around the classroom.					
	14	Used clear language (no stuttering, hesitation, or mumbling).					
	15	Moved hands, head, and body without nervous tics.					
	16	Regulated voice volume.					
	17	Provided a logical sequence of class content.					
	18	Behaved politely and respectfully in class.					
	19	Encouraged students to participate by using expressions such as mm, yes, go ahead, perfect, etc.					
	20	Provided the topics and objectives related to the program.					
	21	Related the topic to other topics seen previously or to be covered in the future.					
	22	Gave students the opportunity to exemplify the concept studied.					
	23	Used expressions such as think, repeat again, etc., to help students give correct answers.					
	24	Proper personal presentation (grooming, attire, etc.).					
	25	Announced the topics to be studied in the next class.					
	26	Suggested how to apply what was seen in class.					
	27	Allowed students to formulate questions.					
	28	Motivated students at the beginning of the class.					
	29	Motivated the students to participate by smiling, nodding of the head, writing their contributions on the blackboard, looking and listening politely.					

Questioning and reinforcement	30	Asked clear questions about the class topic.					
	31	Asked questions related to the topic reviewed in class.					
	32	Asked questions relevant to the topic.					
	33	Asked questions in a logical and coherent manner.					
	34	Visually and verbally interacted with students.					
	35	Made pauses to elicit answers to the questions.					
	36	Asked questions that motivated the group's participation.					
	37	Made eye contact with students.					
	38	Asked questions with different levels of complexity and difficulty.					
	39	Motivated students to formulate questions.					
	40	Took advantage of a student's question for the analysis of new ideas.					
	41	Fostered trust and collaborative and cooperative work among students.					
	42	Helped students structure their answers correctly.					
	43	Related theory to practice.					
	44	Used moderate speed of speech.					
EUse of means audiovisual and ICT	45	Used information and communication technologies.					
	46	Used audiovisual media.					
	47	Reinforced the most important aspects of the topic by means of classification charts, concept maps, mind maps, etc.					
	48	Used graphic media such as flip charts, diagrams, models, posters, scale models, among others.					
	49	Focused their attention mainly on objects and not on the students.					

Acknowledgment

I thank you for your participation in answering this questionnaire; your opinions will help to improve the teaching and learning processes in the classroom, as well as to have more competent professors to train better students.

Sincerely,

M en C. Roberto Cruz González Meléndez

Project Manager

Discussion

The evaluation of teaching is a complex process where the role of students is important and necessary. In addition, the inclusion of different pedagogical techniques to teach the contents of an academic program, such as microteaching, is part of some institutional plans in Mexico ([Universidad Veracruzana \[UV\], \[2015\]](#); [Instituto Politécnico Nacional \[IPN\], \[2018\]](#)). Particularly, the evaluation of the microteaching process requires taking into account different didactic skills ([Dwight, 1967](#)), considering as an important activity currently the use of ICTs. Therefore, having current, valid, and reliable instruments to be solved by students and having parameters for comparison and feedback, both for the teacher and for the staff in charge of the academic-administrative part, is an unavoidable element in education.

The design of the CEM was intended to be congruent with the nine aspects included in the didactic skill section in the Teaching Evaluation Questionnaire applied in the QFB program, in Zaragoza FES. In addition, it was also intended that the wording was clear and understandable ([Morales, 2011](#)) so that students and professors understand it in the same way.

The CEM designed consisted of 49 questions in 3 didactic skills: verbal and nonverbal communication, formulation of questions and

reinforcement, and use of audiovisual media and ICTs. In this sense, the number of didactic skills in the previously proposed instruments are different for each author. [Watson \(2007\)](#) and [Toro \(2017\)](#) consider three skills; [Universidad Rafael Landívar \(2010\)](#) proposes six; [Dayanindhi \(2018\)](#), [Dwight \(1967\)](#), and [Unidades Tecnológicas Santander \(2011\)](#) suggest seven; and [Remesh \(2013\)](#) proposes nine didactic skills. In view of that, this instrument is in accordance with the minimum number of skills to be evaluated according to the different studies.

Based on an analysis by evaluated skill, the verbal and nonverbal communication one is considered by [Watson \(2007\)](#), [Universidad Rafael Landívar \(2010\)](#), and the [Unidades Tecnológicas de Santander \(2011\)](#); the ability to formulate questions is proposed by [Universidad Rafael Landívar \(2010\)](#) and the [Unidades Tecnológicas de Santander \(2011\)](#); and that of reinforcement is contemplated by [Dwight \(1967\)](#), [Universidad Rafael Landívar \(2010\)](#) and [Remesh \(2013\)](#), and [Landívar \(2010\)](#). Finally, the skill of use of audiovisual media and ICTs is considered by [Remesh \(2013\)](#) and [Dayanindhi \(2018\)](#), information that was considered for the development of the CEM. It should be noted that this last skill is of recent inclusion due to technological advances and, at this time, due to the need for its use because of the global contingency situation in which we find ourselves due to the COVID-19 pandemic.

Table 6.
Frequencies of IOCEM Acceptance

Ask	Acceptance Frequency (percentage)
1.- Does the introduction and objective clearly explain the purpose of the questionnaire?	123 (99.2)
2.- Are the instructions for filling out the questionnaire clear and understandable?	115 (92.7)
3.- Do you consider that the rating scale used in the questionnaire is clear and understandable?	103 (83.1)
4.- Did you find the questionnaire extensive?	43 (34.7)
5.- Do you consider that the wording of each of the questions is clear and understandable?	88 (71.0)
6.- Did you hesitate to answer any of the questions?	46 (37.1)
7.- Do you consider that the questionnaire could help to improve the quality of the professor's teaching?	121 (97.6)
8.- Do you consider that the program should implement the questionnaire for all professors?	117 (94.4)

Regarding the length of the questionnaire, it is very variable, ranging between 19 (Toro, 2013) and 38 questions (Unidades Tecnológicas de Santander, 2011), which would make the CEM a little more extensive. Undoubtedly, the didactic skills considered in each instrument, as well as the number of questions in each one, will depend largely on the objectives, purposes, and scope of each research. According to Morales (2011), there is no optimum number of questions, but the greater the initial number of questions, the greater the probability of finding in the analysis a set of definitive questions with sufficiently high reliability. As for the time of application, it was considered adequate given the length of the CEM.

For content validity, with the contributions provided by the experts, important improvements were made to produce a questionnaire with a pertinent and well-defined structure, a logical sequence, clear wording congruence with the objective of the instrument, and adequate rating levels for each question, making it understandable for both actors in the teaching-learning process. The validity of the construct was based on the opinion of the students. This study coincides with that of Toro (2013), since the application of the instrument was to students themselves, unlike the other reports that applied their instruments to new teachers or teachers in training.

For the design of the IOCEM, we sought to ensure that the structure and wording were clear and understandable (Morales, 2011) for students and professors and that it would allow information to be collected on the opinion of each section (introduction, objective, instructions for filling out, rating levels, and questions) of the CEM.

It is important to note that none of the authors consulted refer to the application of an instrument such as the IOCEM (Dwight, 1967; Guillermo, 1997; Watson, 2010; Unidades Tecnológicas de Santander, 2011; Remesh, 2013; Toro, 2013; Dayanindhi, 2018), which gathers the opinion of students on an evaluation questionnaire.

Students are considered the best sources of information on the teaching and learning process and are the ones from whose opinion the results of the teacher's performance in the classroom are obtained over time (Elizalde, 2008). The

students' perception of their learning provides a measure of the teacher's action related to the effects that this action has on their instructional experience, so that they are able to recognize in what proportion the teacher's activity affects their learning (Acevedo, 2003).

It is important to mention that the methodology of obtaining information in the teaching and learning processes from the students' opinion is not the only one, but it is one of the most used and oldest and the most widespread, recognized, and reliable in the university environment (Gómez & Gómez, 2009).

The CEM demonstrated statistical validity and reliability. The 49 questions had a normal distribution according to what is established by Castañeda (2010), while other authors do not refer to this assumption (Dwight, 1967; Guillermo, 1997; Watson, 2010; Unidades Tecnológicas de Santander, 2011; Remesh, 2013; Toro, 2013; Dayanindhi, 2018). Likewise, all the variables are related to each other, as a high correlation was found between all the questions (variables), unlike what is reported in some research that does not refer to any data on this test (Dwight, 1967; Guillermo, 1997; Watson, 2010; Unidades Tecnológicas de Santander, 2011; Remesh, 2013; Toro, 2013; Dayanindhi, 2018). Only Mergler (2010) reports a significant Bartlett's test of sphericity value ($p < 0.001$) similar to that found in this work.

In relation to the extraction of factors, it was carried out by means of a Parallel Analysis and the scree plot method, where the X axis shows the number of items and on the Y axis the eigenvalues or variance explained for each factor, obtaining three factors. It is important to mention that PA is the method recommended for the extraction of factors (Lloret-Segura, 2014; Ferrando, 2022). In this sense, most of the previous studies do not refer any data or information in this regard (Dwight, 1967; Guillermo, 1997; Watson, 2010; Unidades Tecnológicas de Santander, 2011; Remesh, 2013; Toro, 2013; Dayanindhi, 2018); however, Mergler (2010), using the principal component method and considering 12 variables, reports two components that explained 65% of the variance, which are teacher effectiveness in

the classroom—with 22% of the variance—and personal effectiveness of the teacher—with 32% of the variance.

It is important to mention that, in this study, the principal axis factoring, the oblique rotation, and the promax method were used, which are recommended for factor analysis in the social field (Lloret-Segura, 2014). In this work, the first factor found was the verbal and nonverbal communication skill, with an explained variance of 40.83%, 29 variables, and 14 initial questions. This skill was considered in the reports of [Unidades Tecnológicas de Santander \(2017\)](#) and implicitly in [Watson \(2007\)](#), in competency 3, Communicates effectively involving students in the topic developed and [Universidad Rafael Landívar \(2010\)](#), in the skill of verbal and nonverbal reinforcement.

The second factor was the question formulation and reinforcement skill, with 15 variables or questions. In this regard, in the initial version of the questionnaire, these skills were separated; the formulation of questions skill consisted of nine questions and the reinforcement skill had 16 questions. In this regard, this skill has been previously contemplated as an element to be evaluated in the studies by [Dwight \(1967\)](#), [Guillermo \(1997\)](#), [Unidades Tecnológicas de Santander \(2011\)](#), [Remesh \(2013\)](#), and [Universidad Rafael Landívar \(2010\)](#), which implicitly takes it into account in the skill referring to the ability to ask questions and get oral answers.

The third factor was the skill referring to the use of audiovisual media and ICTs, a new skill that emerged as a result of the factor analysis and had five variables that have been found in the most recent studies due to the nature of the skill assessed ([Remesh, 2013](#); [Dayanindhi, 2018](#)).

These three factors were corroborated through factor loadings since the questions included in each factor presented a correlation value greater than 0.35 in accordance with [Spector \(1992\)](#) and like the proposal of Tabachnick and Fidel (as cited in [Costello, 2005](#)). In this sense, Thurstone (as cited in [De la Fuente, 2011](#)) mentions that the factor loadings matrix should have three characteristics: each factor should have high weights and the others close to zero; each

variable should not be saturated in more than one factor; and there should be no factors with the same distribution, i.e., two different factors should have different distributions of high and low loadings. In this way, each factor will have a high correlation with one group of variables and a low correlation with the rest of the variables; hence, the CEM complied perfectly with the characteristics described by Thurstone.

On the other hand, the questionnaire showed a high degree of reliability regarding the three didactic skills when used by students, regardless of the semester they were in and whether they were evaluating professors teaching theory or practice, with a Cronbach's alpha value equal to 0.961. [Toro \(2013\)](#) reported a Cronbach's alpha equal to that obtained in the present study, and [Capa \(2005\)](#) indicated a similar reliability with the instrument applied in his research. Other studies do not mention any information regarding the reliability value of the instruments used ([Dwight, 1967](#); [Guillermo, 1997](#); [Watson 2007](#); [Universidad Rafael Landívar, 2010](#); [Unidades Tecnológicas Santander, 2011](#); [Remesh, 2013](#); [Toro, 2013](#) and [Dayanindhi, 2018](#)).

As can be seen, although there are several proposals of instruments for the evaluation of teachers working in the field of microteaching, few have obtained the parameters of validity and reliability found in this study or have considered in its design and evaluation the direct opinion of the students. According to the results obtained, we can point out that the CEM is valid and reliable for use with students in the evaluation of teachers as an instrument that measures the construct of microteaching.

Conclusions

Based on the above, it can be said that the Microteaching Evaluation Questionnaire, which includes verbal and nonverbal communication, the formulation of questions and reinforcement, and the use of audiovisual media and ICTs, is valid and reliable, and can be applied to the student population of the QFB program or any

other similar one. According to the consequential validity, the CEM was applied on a student population with an established profile that was informed about the objectives and purposes. Based on the opinion of the expert professors, a test was designed with clear and precise language, and no unforeseen or inadequate uses of the questionnaire were observed during its application; therefore, the CEM correctly evaluated the construct of microteaching.

References

- Acevedo, AR. (2003) Factores que inciden en la competencia docente universitaria. (Tesis doctoral). <http://webs.ucm.es/BUCM/tesis/edu/ucm-t26870.pdf>
- American Educational Research Association, American Psychological Association & National Council for Measurement in Education [AERA, APA & NCME] (2014). The Standards for Educational and Psychological Testing. Washington, D.C.: AERA
- Aguilar, V.M. (2003). Validación de un instrumento para evaluar el desempeño docente en las especialidades médicas (tesis de maestría). <https://repositorio.unam.mx/contenidos/validacion-de-un-instrumento-para-evaluar-el-desempeno-docente-en-las-especializaciones-medicas-92500?c=%7B>
- Capa, Y., Çakıroğlu, J., & Sarıkaya, H. (2005). The Development and Validation of a Turkish Version of the Teachers' Sense of Efficacy Scale. *Educacion and Science*, 30(137), 74-81. <https://toad.halileksi.net/sites/default/files/pdf/ogretmen-ozyeterlik-olcegi-toad.pdf>
- Costello, A.B. & Osborne, J.W. (2005). Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment, Research & Evaluation*, 10(7), 1-9. doi: <https://doi.org/10.7275/jv1-4868>
- Dayanindhi, V. K., & Hegde, S. P. (2018). Effectiveness of microteaching as a method of developing teaching competence among in-service medical teachers. *Journal of Advances in Medical Education & Professionalism*, 6(4), 155–161. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6191834>
- De la Fuente, F.S. (2011). Análisis factorial. España: Universidad Autónoma de Madrid. <https://www.fuenterrebollo.com/Economicas/ECONOMETRIA/MULTIVARIANTE/FACTORIAL/analisis-factorial.pdf>
- Deniz, S. (2011). Implications of training student teachers of pre-schooling through micro-teaching activities for a classroom with mentally- disabled students. *Educational Research and Reviews*. 6(8), 560-569. <https://academicjournals.org/journal/ERR/article-full-text-pdf/8239E6B6323>
- Dwight, A. (1967). Micro-teaching: a description. Stanford teacher education program. California: Stanford University. <https://files.eric.ed.gov/fulltext/ED019224.pdf>
- Elizalde, L. y Reyes, R. (2008). Elementos clave para la evaluación del desempeño de los docentes. *Revista Electrónica de Investigación Educativa, Especial*, 10, 1-13 <https://www.redalyc.org/pdf/155/15511127004.pdf>
- Escoto, P.L.M.C. (2001). Evaluación del cambio conductual de profesores expuestos al curso de microenseñanza de una institución de educación superior. (Tesis de Maestría). https://repositorio.unam.mx/contenidos/evaluacion-del-cambio-conductual-de-profesores-expuestos-al-curso-de-microenseñanza-de-una-institucion-de-educacion-135421?c=r300-vQ&d=true&q=*&i=1&v=1&t=search_O&as=0
- Facultad de Estudios Superiores Zaragoza (2015). Informe de evaluación de la docencia en las asignaturas teóricas de las especializaciones. Semestre 2014-1. México, D.F.
- Ferrando, P.J., Lorenzo-Seva, U., Hernández-Dorado A., Muñiz, J. (2022). Decálogo para el Análisis Factorial de los Ítems de un Test. *Psicothema*, 34(1), 7-17. doi: 10.7334/psicothema2021.456. <https://dialnet.unirioja.es/servlet/articulo?codigo=8259546>
- Gómez, BE y Gómez BY. (septiembre 2009). La evaluación de la docencia basada en la opinión de los alumnos: el perfil docente en la Licenciatura en Historia. Presentado en el X Congreso Nacional de Investigación Educativa. Veracruz, México
- Guillermo, GMC. (1997). Microenseñanza: ¿Una técnica vigente para el desarrollo de Habilidades Docentes? *Nueva Época* Vol. 1 (16), 59-68. <http://www.educacionyciencia.org/index.php/educacionyciencia/article/download/120/pdf>
- Hair, J., Anderson, R. Tatham, R., & Black, W. (1999). Análisis multivariante. (5ª ed). Madrid: Prentice Hall.
- Hernández R., Fernández C. & Baptista P. (2010). Metodología de la Investigación. (5ª. Ed). México: Mc Graw Hill.
- Instituto Politécnico Nacional (2018). Memoria Anual de Actividades 2018. Escuela Nacional de Ciencias Biológicas (ENCB). <https://www.ipn.mx/assets/files/secgenral/docs/Memorias/Memoria2018/ns/encb.pdf>

- Lloret-Segura, S., Ferreres-Traver, A.- Hernández-Baeza, A., Tomás-Marco, I. (2014). El análisis factorial exploratorio de los ítems: una guía práctica, revisada y actualizada. *Anales de psicología*, 30(3), 1151-1169.
- López, R.P & Facheli, S. (2015). Metodología de la investigación social cuantitativa. Barcelona: Universidad Autónoma de Barcelona.
- Meneses, A. (08 de Junio de 2020). *Estimación análisis paralelo utilizando SPSS*. [Obtenido de archivo de video]. Recuperado de https://www.youtube.com/watch?v=AtCIR_67IjY
- Mergler, A. & Tangen, D. (2010). Using microteaching to enhance teacher efficacy in pre-service teachers. *Teaching Education*, 21 (2). 199-210 <https://doi.org/10.1080/10476210902998466>
- Morales, V. P. (2011). El análisis factorial en la construcción e interpretación de test, escalas y cuestionarios. Madrid: España: Universidad Pontificia Comillas. <http://www.upcomillas.es/personal/peter/investigacion/AnalisisFactorial.pdf>
- Remesh, A. (2013). Microteaching, an efficient technique for learning effective teaching. *Journal of Research Medical Sciences*, 18(2), 158-163. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3724377/>.
- Rodríguez Fernández, Zenén, Chércoles Cazate, Lilia Esperanza, Santisteban Aguilera, Francisca de las Nieves, Ricardo Ramírez, José Manuel, & Uriarte Gómez, Manuel Esteban. (2017). La clase según lo establecido en reglamentos ministeriales cubanos. *MEDISAN*, 21(9), 2076-2085. Recuperado en 29 de abril de 2022, de http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1029-30192017000900015&lng=es&tlng=es.
- Secretaría de Educación Pública. (2016). Estrategias de microenseñanza para fortalecer la gestión del aula. Microenseñanza <http://www.cosdac.sems.gob.mx/eme/>
- Spector, P. E. (1992). Summating ratings scale construction: An introduction Sage University Papers Series. Quantitative applications in the social sciences. Iowa: Sage Publications. <https://home.ubalt.edu/tmitch/645/articles/Summated%20Rating%20Scales.pdf>
- Taut, S. & Palacios, D. (2016). Interpretaciones no intencionadas e intencionadas y usos de los resultados de PISA: Una perspectiva de validez consecucional. *RELIEVE*, 22(1), <https://ojs.uv.es/index.php/RELIEVE/article/view/8294>
- Toro, G. (2017). La microenseñanza y el desempeño de los estudiantes de tecnología del vestido en la práctica docente continua de la Facultad de Tecnología de la Universidad Nacional de Educación Enrique Guzmán y Valle, 2013 (tesis doctoral). Universidad Nacional de Educación "Enrique Guzmán y Valle". <https://repositorio.une.edu.pe/bitstream/handle/UNE/1618/TD%20CE%201616%20T1%20-%20Toro%20Mejia.pdf?sequence=1&isAllowed=y>
- Unidades Tecnológicas de Santander (2011). Documento rector. Diplomado sobre estrategias pedagógicas en la educación superior. Modulo 3: La microenseñanza. <https://es.calameo.com/read/00007273578fc5b662de1>
- Universidad Rafael Landívar (2010). Técnicas de didáctica universitaria: microenseñanza, *Revista Electrónica Ingeniería Primero*, 15, 13-32. https://fgsalazar.net/LANDIVAR/ING-PRIMERO/boletin15/URL_15_ING01.pdf
- Universidad Veracruzana (2015). Plan de Desarrollo de las entidades académicas (PlaDEA). Facultad de Ciencias Químicas. <https://www.uv.mx/tecnica/files/2018/01/PlaDEA-Cordoba-Orizaba-Ciencias-Quimicas.pdf>
- Videla, R. L. (2005). VIGENCIA Y DECADENCIA DE LA CLASE TEÓRICA (PARTE I). *Revista Argentina de Radiología*, 69(4),319-325.[fecha de Consulta 29 de Abril de 2022]. ISSN: 1852-9992. Disponible en: <https://www.redalyc.org/articulo.oa?id=382538438009>
- Watson, R. (2007). La microenseñanza en la UPC. *Revista Digital de Investigación en Docencia Universitaria*, 3 (1), 1-20. <https://doi.org/10.19083/ridu.3.24>