Validity and reliability of a rubric to assess didactic lesson planning of preservice teachers

Validez y confiabilidad de una rúbrica para evaluar planeaciones didácticas en la formación docente inicial

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Abstract

It is presented the results of a study whose purpose was to reliability and validity of building an analytic socioformative process rubric to evaluate didactic planning in Teachers during their training process for Basic Education. The study involved 226 teachers. At first, reliability was determined through the Alpha Coefficient by Cronbach, having as a result .703. Results show that the instrument is reliable. Afterwards, an exploratory factorial analysis (AFE in Spanish), was carried out through the Maximum Authenticity Method with promax rotation and cluster analysis. This analysis showed the existence of a factor that explains 53.046% of the variance and is consistent with didactic planning. There was no need to eliminate any item according to the results of the factorial analysis. From these studies on, it can be conclusive that the target rubric of study has the adequate levels of reliability and construct validity. It is necessary to carry on new studies to confirm the results.

Didactic lesson plan, Reliability, Rubric, Teacher training, Validity

Resumen

Se presentan resultados de un estudio de confiabilidad y validez de constructo de una rúbrica socioformativa analítica para evaluar planeaciones didácticas en docentes en proceso de formación inicial para la educación secundaria. Participaron 226 docentes. Primero se determinó la confiabilidad mediante el Coeficiente Alpha de Cronbach, la cual fue de .703, este resultado muestra que el instrumento es confiable. Posteriormente, se hizo un análisis factorial exploratorio (AFE) mediante el Método Máxima Verosimilitud, con rotación promax y con análisis de clúster. Este análisis mostró la existencia de un factor que explica el 53.046% de la varianza y es consistente con la planeación didáctica. No hubo necesidad de eliminar ningún ítem de acuerdo con los resultados del análisis factorial. A partir del estudio, puede concluirse que la Rúbrica objeto de estudio posee adecuados niveles de confiabilidad y validez de constructo. Es preciso realizar nuevos estudios para confirmar los resultados encontrados.

Confiabilidad, Formación docente, Planeación didáctica, Rúbrica, Validación

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Introduction

The professional practice of teaching implies a high degree of responsibility because through it, actions are materialized whose purpose is the achievement of the educational goals set out in the curriculum. In the case of Mexican basic education, from the initial training of teachers and their entry into the professional teaching service, there is a demand for the development of a series of competencies which will enable them to carry out such a relevant social task (DOF 2000, 2003, 2004, 2012a, 2012b, 2012c, 2012d; SEP, 2017), understanding as a competence the mobilization of diverse knowledge to face a specific challenge, situation or problem (Perrenoud, 2008). Such requirement is increasingly a priority in view of the need to have better pedagogical preparation of teachers (OECD 2010 in Nava & Rueda, 2014) and as an element to overcome the challenges that education represents in diversified contexts and even with adverse conditions (UNESCO, 2014).

In the case of Bachelor's degrees for the initial training of teachers in the last stage of basic education in Mexico¹, one of the competencies foreseen in the graduation profile refers to the design and organization of didactic strategies and activities "adapted to the needs, interests and forms of development of adolescents, as well as to the social and cultural characteristics of these and their family environment, so that the students reach the purposes of knowledge, development of skills and value formation established in the plan and programs of study of secondary education" (DOF, 2000, p.). 3), as well as the implementation of these.

Such design and organization, known as planning or didactic planning, is a fundamental element of the educational task that teachers carry out in their professional practice (Díaz, Ruiz-Tagle, Tagle & Alarcón, 2016; DOF, 2011; Perrenoud 2008; Tobón, Pimienta y García, 2016); it is also part of the observation and teaching practice activities carried out by student-teachers in training from the third to the eighth semesters of their studies (SEP, 2002a; SEP, 2002b).

This is articulated from the knowledge that they are building with the treatment of the subjects that make up the curriculum map of that degree, although they have a course aimed at the systematic study of didactic planning and the evaluation of learning in secondary education. Such planning is constituted as a reference for the evaluation of the learnings, as well as for the follow-up of the operation of the mentioned educational program of teacher training. But, how are we conceiving the didactic planning? In terms of the proposals made, we are not referring to a bureaucratic requirement or administrative element (Abdullah, Idris, Grani & Sembak; 2015; Dueñez & Barraza, 2015), but rather to an academic resource of the teachers (in service and in the process of formation) without which it would be unviable that the educational goals set forth in the curriculum be transformed into meaningful experiences to promote learning in the students. In this sense, didactic planning is an intentional, complex, reflexive, creative, dynamic and flexible process whose goal is to propose the best possible learning scenario to help students achieve the educational goals set for a given course or subject, considering the context in which the teaching activity takes place as well as the diversity of the students being served, their needs, their previous knowledge and their potential (Amer, Jamil & Ayaz, 2014; Caballero, Briones & Flores, 2014; Dueñez & Barraza, 2015; Pino, Hernández & Hernández, 2015; Young & Luttenegger, 2014. This planning can be short or long term; the first one implies preparing one or several class sessions articulated around a topic, the second one implies the preparation of a complete subject or course (Koni & Krull, 2015). It is the first one that is carried out by the student-teachers in training.

From the socio-educational point of view, didactic planning demands integral actions from the teacher to generate and organize significant situations so that students achieve an integral education by tackling the problems of the context, through collaborative work and the use of information and communication technologies, considering entrepreneurship through transversal projects, the management and co-creation of knowledge and metacognition (Tobón, Pimienta & García, 2016).

¹ Mexican basic education comprises three educational tracks: preschool, primary and secondary. The first and third are three years long each, and the second is six years long.
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In addition to comprehensive performance, suitability is required based on previous criteria established in the context of the action that account for the effectiveness and relevance of the execution; likewise, ethical commitment and continuous improvement through permanent reflection is required (López & García, 2012; Tobón, Pimienta & García-Fraile, 2010; Tobón, 2013).

The process of educational planning is made concrete in a design or written document known by the same name or as a class plan (Ascencio, 2016; Trevizo & Heiras Islands 2015; Dueñez y Barraza, 2015; Pino, Hernández & Hernández, 2015). This document is a tool that provides guidelines for continuous improvement because it allows reviewing, analyzing and reflecting on the intervention in the classroom before, during and after it (DOF, 2011; Mendoza, 2011 in Pino, Hernández & Hernández, 2015; SEP, 2011; Tobón, Pimienta & García, 2016); it also represents a device to infer the development of skills, as a result of a complex process of didactic configuration, which helps in the evaluation of learning (Marín, Guzmán, Márquez & Peña, 2013).

In the didactic planning (document) it will be necessary to express what the students are expected to learn, how and with what the didactic process will be carried out, and how the achievement of learning will be verified (Guzmán, 2013; Moreno, Irigoyen, Acuña & Yerith, 2016; SEP, 2011; Tobón, Pimienta & García, 2016). As a procedural knowledge, it demands to consider a series of criteria, among them: to select didactic strategies that propitiate the mobilization of knowledge oriented to the achievement of the expected learning and the development of competences; to design the adequate didactic situation or situations to generate such achievements and with it, the most adequate type of activities; to define performance evidences that provide information regarding the students' learning; to select the necessary resources; to define pertinent evaluative strategies and with it, the selection of techniques and the design of pertinent instruments to value the learning.

This requires relevant, reliable and valid instruments that help teachers in training to elaborate the didactic planning and make possible the continuous improvement. However, in the literature, there are no instruments that have adequate levels of validity and reliability in Mexico (Madrigal & Solís, 2016; Brito, Herrera & Florez, 2016). Although there are multiple resources for evaluation with a formative sense (Marín, Guzmán, Márquez & Peña, 2013), a socio-educational rubric was chosen because it represents an alternative that favors the evaluation of performance and contributes to the improvement of people's performance when faced with problems of the context, based on evidence, as shown by recent studies (Cardona, Vélez & Tobón, 2015, 2016; Hernández, Tobón, González & Guzmán, 2015).

In consideration of the above, the goals of the study that is the object of this article were the following: 1) to determine the reliability of a socio-educational rubric for the evaluation of didactic planning in the initial training of secondary school teachers; 2) to carry out a factorial analysis of the rubric to establish its validity as a construct; and 3) to determine if it is necessary to eliminate indicators from the rubric according to the reliability and validity analysis. In this way, it is expected to contribute to strengthen the necessary instruments to improve teaching practice, considering the challenges of the knowledge society and the application of the socio-educational approach.

Methodology

Type of Study

An instrumental study (Montero & León, 2007) was carried out on the psychometric properties of an analytical socio-educational rubric to evaluate and improve teachers' didactic planning. Specifically, a study of reliability and construct validity was made. Reliability refers to the consistency of the scores given by evaluators to a test and indicates the degree to which the instrument's items are correlated (Celina & Campos, 2005); construct validity refers to the degree to which an instrument represents and measures the theoretical concept or variable it is intended to measure (Hernández, Fernández, and Baptista, 2014).

Instrument

An analytical socioformative rubric was used for the study. This type of instrument consists of a double-entry table in which each of the criteria of the competence is related to levels of mastery of the performance indicators, whose specification of the components allows a punctual and detailed feedback on the evidence being evaluated (Hernández-Mosqueda, Tobón-Tobón & Guerrero-Rosas, 2016; Tobón, 2017). The heading used is composed of four axes 1) formal data, 2) didactic activities, 3) educational resources, and 4) evaluation of learning (Annex 1). Each dimension is evaluated through four levels of mastery, following the socio-educational taxonomy: receptive, resolutive, autonomous, and strategic. The rubric was validated from its use in the evaluation of two didactic plans for secondary schools: project for the subject of Spanish II and didactic sequence for Mathematics III.

Participants

This study involved 226 teachers (185 teachers in initial training and 41 teacher trainers) from the Escuela Normal Superior Oficial de Guanajuato (ENSOG), Mexico. This institution has two campuses, one in the capital city of Guanajuato and the other in the municipality of San José Iturbide. The participants were selected for their experience in the design of didactic plans. Of the teachers in training, 31% are women and 69% men; of the teacher trainers, 49% are men and 51% are women.

Statistical Analysis

The reliability analysis was carried out by means of Cronbach's Alpha Coefficient, which evaluates the magnitude of correlation between items. A coefficient of 0 means no reliability and 1 represents maximum reliability. In order to establish construct validity, exploratory factorial analysis (AFE) was carried out using the Maximum Likelihood Method, with promax rotation and cluster analysis to determine the grouping of items. There was one missing data (the participant marked all the descriptors of each indicator) which generated that the analysis will be carried out with 225 cases.

We began by determining whether the items are sufficiently interrelated, a necessary condition for applying the AFE (Martínez, Hernández & Hernández, 2014; Pérez & Medrano, 2010). For this purpose, Pearson's correlation coefficient 'r', Bartlett's sphericity test and Kaiser-Mayer-Olkin's (KMO) sample adequacy measure were used. In this test, the null hypothesis H0 "variables are not correlated" and the alternative hypothesis H1 "variables are correlated" were considered, with a significance level of .05. Subsequently, to identify the number of underlying factors, the percentage of variance explained by the factor structure was calculated and to confirm the factor extraction, the sedimentation plot or Scree test was used. For the statistical analyses, the software SPSS 24.

Ethical Aspects

The participation of teachers in training and teacher trainers was requested on a voluntary basis, indicating that the information they provide would be used for research purposes and that their data would be protected, in accordance with the Law on the Protection of Personal Data in force in the Mexican Republic (DOF, 2010).

Results

Reliability

The results shown in Table 1 indicate that the 4 items present in their entirety an $\alpha = .703$ and an $\alpha_{st} = .704$, which indicates that the instrument is acceptable (George & Mallery, 2003). The intercorrelation is xintercorrelational, which indicates that the items present good interdependence, with oscillation of $r^2 .303$ to $r^2 = .428$.

Variables	Ac	α_{st}	Xintercorr.	Os – R ²
4	.703	.704	.373	.303 to .428
α = Cronbach's Alpha. α_{st} = Cronbach's Alpha standardized Xintercorr. Intercorrelational mean Os- R ² =Minimum and maximum R ²				

Table 1 Cronbach's Alpha results

Validity of construction

Regarding the correlation between variables, in terms of Pearson's Correlation Coefficient 'r' and based on the data presented in table 2, it is identified that there is significant correlation between the variables (Perez & Medrano, 2010).

Pearson Correlation	Ind.1	Ind.2	Ind.3	Ind.4
Indicator (Ind.)1	1	.368**	.303 **	.380**
Indicator (Ind.)2	.368**	1	.364**	.396**
Indicator 3	.303**	.364**	1	.428**
Indicator 4	.380**	.396**	.428**	1
Sig. Bilateral = .000 N= 225				

Table 2 Correlations (Pearson's correlation coefficient 'r')

As for the Bartlett KMO Test and Sphericity Test, based on the data presented in Table 3, we can identify and confirm that the correlation of the items is acceptable (KMO = .744). Likewise, the results of the Bartlett sphericity test allow us to reject the null hypothesis H0 "the variables are not correlated" and to accept the alternative hypothesis H1 "the variables are correlated", identifying that such correlation is significant.

Kaiser-Meyer-Olkin measurement of sampling adequacy			.744
Bartlett Sphericity Test	Approx. Chi-square		147.896
	gl		6
	Sig.		.000

Table 3 KMO and Bartlett test

The above results support the relevance of the exploratory factor analysis.

Variance explained

The factorial analysis presents only one latent factor (hypothetical variable) that explains 53.046% of the variance, which shows a factor with considerable weight in the evaluation of didactic planning. The other percentage (17.590, 15.474 and 13.889, respectively) would show the weight of the other variables in the subjects' responses.

Sedimentation graph

As shown in Figure 1, according to the inflection point of the graph, there would only be one significant factor (main component).

Figure 1 Sedimentation graph

Factorial analysis

Based on the factorial analysis, whose results are presented in table 4, it is identified adequate factorial load of all items, so it is not necessary to eliminate any.

Indicator 1	.694
Indicator 2	.732
Indicator 3	.718
Indicator 4	.767

Table 4 Component Matrix

Promax rotation

As only one component has been removed, the solution cannot be rotated.

Cluster analysis

Based on the dendrogram (figure 2), we identify that the variable "indicator 1" is widely separated from the others. This leads us to point out that it is a variable with independence from the others, which could be explained because the aspect considered by this item has to do with data that frame the didactic planning (name of the school and of the participants in the teaching-learning process, curricular data - name of the subject, theme, expected learning, etc.-) which, in general, are formal aspects (except for the expected learning that is directly related to the contents of the other items). The second cluster (integrated by indicators 2, 3 and 4) represents that the values of these are closer to each other and their link is less independent; however, a subgroup is observed in the latter with items 2 and 3 themselves, which maintain a close proximity between their values.

This interrelationship between the last three items is consistent with the postulate of the construction of the instrument, and so is the relationship between items 2 and 3, which correspond to the aspects of educational activities and resources for the development of these.

Figure 2 Dendrogram of items of the heading

Discussion

The results of the study show that the analytical social-formative rubric to evaluate the didactic plans of secondary school teachers in initial training has adequate levels of reliability and validity. These are two essential aspects of the research instruments to ensure that the information they provide is useful and reliable. According to George & Mallery (2003) and DeVellis (2003), values between .70 and .80 indicate that an instrument has acceptable to good reliability. On the other hand, regarding construct validity, correlation values above .300 are reasonably high and an item is considered to identify a factor well when it has a weight of at least .700 (Morales, 2013). Therefore, in general, the aforementioned heading complies with these references in the literature.

Other instruments have been proposed to evaluate didactic planning in initial teacher training, such as the Double Entry Matrix to evaluate didactic planning of students in the last grade of the Bachelor of Arts in Secondary Education with a Specialty in Telesecondary Education (Brito, Herrera & Flores, 2016); Rubric of evaluation of teacher candidates. Appropriate Practice Model (Bryant, Maarouf, Burcham & Greer, 2016) and Instrument to evaluate the teaching practice of students in the Bachelor of Primary Education (Sariñana, 2016).

However, the analytical social-formative rubric that is the object of this study has several benefits over the referenced instruments, such as 1) it addresses the essential aspects of planning in a simple manner, focusing on the essential axes of the process, without too many details that make planning tend to be addressed in a bureaucratic manner by teachers; and 2) is based on a taxonomy focused on training people for the knowledge society, based on four levels of mastery -receptive, decisive, autonomous and strategic- (Tobón, Pimienta & García, 2016; Tobón, 2017).

The proposed rubric addresses planning from the perspective of socio-education, the latter being a training approach of Latin American origin focused on forming people with a solid ethical life project who, through transversal projects, undertake actions through collaborative work that contribute to improving and transforming the adverse situations they face in the region (Tobón, González, Nambo & Vázquez, 2015; Tobón, 2016). However, further studies are needed to help determine its validity and reliability in other settings, such as the case of teachers versus groups in secondary schools, since this research was done in the framework of a normal school that offers initial training programs for teachers at that level of education.

Appendix 1

Rubric for evaluating educational plans of SLE students

Instructions: Review the didactic planning. In the "Assessment" row of each indicator mark, using ✓, the level of achievement you consider. Finally, write down the main achievements identified, notes and specific suggestions to improve the didactic planning reviewed.

Indicators	Descriptors (Levels of achievement)			
	Under	Acceptable	Well	Excellent
1. The formal data that frame the didactic planning correspond to the curriculum and the program of the subject established by the educational authorities.	At least it contains: name of the participant s in the didactic process (group, teacher in training and tutor), subject and expected learning.	It contains the information required by the high school. It includes: name of the high school, the subject and the participants in the educational process; expected learning; name of the way of working (educational sequence, project, etc.); and number of sessions in which what is planned will be developed.	There is a correspondence between the expected learning expected and the other curricular elements described. There is a title (of the project, teaching sequence, etc.) that corresponds to the expected learning.	In the formal data, the curricular elements (expected learning, competencies that are favored, block, contents, etc.) correspond to the curriculum and program of the subject - in force - established by the educational authorities, both in content and writing. The title is creative and helps to capture the students' attention.
Weighting (optional)				
Rating				
2. The didactic activities promote the development of competences, are congruent with the didactic approach of the subject and the characteristics of the students.	The activities correspond to an external work proposal (textbook, teacher, etc.) in which the foreseen programmatic contents are addressed; or they are oriented to the learning of disciplinary knowledge (know how to know).	The activities correspond to a proposal integrated by the teacher in training; they are congruent with the expected learning and involve addressing problems of the context - real or simulated . They are articulated, at least, in three didactic moments: 1. Beginning (framing and analysis of previous knowledge), 2. It indicates what the students will do and what will be left to the teacher.	The activities correspond to the didactic approach of the subject, the characteristics of the students and the needs of the context. There is an interdependence between them and they are written in a clear, precise, concise way without spelling errors. Strategies are included that encourage the integrated mobilization of knowledge. For its approach, diversified forms of organization are proposed -individual, group, team- that allow strengthening and following up individual and interpersonal processes.	The activities encourage collaboration and inclusion, and consider the specific learning needs of each student. They address transversality and linkage with other subjects, and encourage the participation of different actors. They have an impact on the resolution of the problem with one or several relevant evidences.

Weighting (optional)				
Rating				
3. The educational resources are congruent with the didactic activities and diversities of the students.	Education al resources are available in the classroom are indicated. It is proposed to use them as teaching means or oriented to the learning of disciplinary knowledge (know how to know).	Classroom educational resources are indicated according to the teaching activities.	Diverse educational resources are indicated, taking into account the interests of the students, their multiple intelligences and learning styles. The use of information and communication technologies is established for the achievement of expected learning and the development of competencies.	Actions are indicated to manage, create and/or adapt one or several resources by the teacher in training and/or students, considering special needs and inclusion. The resources are diversified, and accessible inside and outside the high school.
Weighting (optional)				
Rating				
4. The evaluation of learning is established, through evidence and instruments, within the framework of formative evaluation.	Instrument s are noted that evaluate mainly quantitative aspects; or it is proposed to evaluate only at the end of the didactic process.	Evidence and tools congruent with the expected learning are noted.	The evaluation is proposed as part of the didactic activities, it allows the emission of judgments and the assertive feedback to improve what has been done. It is proposed to evaluate at the beginning, development and closing of the didactic process. Evidence and instruments are noted (the latter are attached) that allow the evaluation of the diverse knowledge of the competencies based on performance levels, considering the qualitative and quantitative.	Evaluation is proposed with continuous improvement activities, metacognitive and inclusive actions, as well as collaborative processes between students and student-teachers. The appropriation of the instrument s by the students is sought.
Weighting (optional)				
Rating				
EVALUATION	Achievements	Note	Suggestions for improvement	
Self-evaluation				
Co-Evaluation				
Heteroevaluation				

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