

VALIDATION OF THE ARABIC VERSION OF TEACHER PROFESSIONAL DEVELOPMENT PRACTICES AND DIGITAL EDUCATION

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Abstract

Currently, it is essential to investigate the training requirements of teachers in Tunisia, including areas like classroom management, active learning methodologies, disciplinary strategies, and an increasing focus on educational technology. Numerous scholars have suggested that ongoing professional development serves as a critical approach to remedy the deficiency in pedagogical training for educators. Nevertheless, the data on this issue at the Tunisian Ministry of National Education remains somewhat scarce. Different theoretical frameworks aid in comprehending professional development, particularly those proposed by Borko (2004) and Uwamariya & Mukamurera (2005). Two distinct models are introduced: one focusing on development and the other on professional growth. Consequently, the key challenge is to grasp the methods and reasons behind the incorporation of professional development into teaching practices. Thus, it appears essential to analyze the strategies for professional advancement adopted within the educational field to gain a clearer insight into the associated challenges. The aim of this article is to craft a program titled “Teacher Professional Development and Educational Technology” (Gros, 2025) in Arabic, tailored for primary school instructors in Tunisia. The study involved 235 teachers from Tunisia, aged between 25 and 55 years. A confirmatory factor analysis (CFA) was conducted utilizing AMOS and LISREL software. Correlation coefficients and average variances were computed with the help of AMOS, LISREL, and Excel tools. The outcomes affirmed both the convergent and discriminant validity of the instrument used. The questionnaire's reliability was established through alpha coefficients, Cronbach's alpha, and McDonald's omega coefficient. Structural equation modeling indicated an appropriate alignment of the TPDET with a two-factor model. Analyses concerning validity and reliability demonstrated a high level of internal consistency among the factors. Considering its sound psychometric attributes, the Arabic version of the “*Teacher Professional Development and Educational Technology*” (Gros, 2025) can be utilized for research aimed at enhancing the knowledge and cognitive skills of Tunisian teachers within the framework of basic education.

Keywords: Basic School, Tunisian Teachers, Professional Development Practices, Education, Digital Technology.

1. INTRODUCTION

The objective of this article is to design, in Arabic, a professional development model related to technological education for teachers of basic schools in Tunisia. Our questions about teaching and its progress in Tunisia were born from a certain frustration and a professional limitation. More precisely, we question the teaching motivations, specifically the factors that push teachers to reinvent themselves, to change their practice. Knowing that there is no single answer in teaching, we have always considered teaching practice to be imperfect and continually seek to address the questions that threaten professional

practice regarding the success of my students, the effectiveness of my pedagogical approaches, the relevance of their interventions, etc.

Obviously, through this study we always seek to improve teaching practice, hence our interest in professional development. It is always interesting to learn and know how to develop a particular taste for the exchanges that occur about education. Former teachers who started teaching at the dawn of the digital revolution caused by the advent of Web 2.0, are facing a technological constraint in education with the appearance of many digital platforms that nowadays seem harmless. All these reasons led us to create a model in Arabic that addresses the professional development practices of teachers who aim at integrating digital education. Numerous scholars within the humanities and social sciences argue that the discussion about the inclusion of digital education in classrooms is outdated. In fact, the constant presence of technology in everyday life necessitates an ongoing examination of its most effective educational applications rather than a critique of its significance within educational institutions (Karsenti and Collin, 2016). In Tunisia, it is crucial to engage in this reflection at both primary and secondary education levels.

The emergence of the internet has triggered a significant technological and social transformation. For instance, the International Telecommunication Union reported that in 2014, there were over 7 billion mobile phone subscriptions globally (International Telecommunication Union, 2017). Regarding education, the proportion of public schools in the United States connected to the internet rose from 35% in the mid-1990s to 100% ten years later (Greenhow et al., 2009). Concurrently, the fraction of classrooms with internet access increased from 14% to 94% during the same timeframe (Greenhow et al., 2009). In Tunisia, this global pattern is persistent; a recent study indicated that 57% of households, particularly in urban regions, have internet access (Tunisia telecom 2024). Additionally, 86% of Tunisians between the ages of 18 and 25 possess at least one smart device (Tunisia telecom 2024).

It is evident that digital technology is providing today's learners with opportunities to engage with the world that were previously beyond reach. The evolution of Web 2.0 has significantly changed the conventional relationship, shifting the internet from merely a space for gathering information to one focused on creating and sharing (Greenhow et al., 2009). Platforms for social media, wikis, and digital creation and sharing, including blogs and podcasts, are all examples of Web 2.0 resources that encourage user-generated content and collaborative information exchange (Greenhow et al., 2009). This internet transformation has influenced not only everyday life for users but also economic systems and global educational frameworks (Care, 2012). The achievement of these economic shifts has necessitated the involvement of workers equipped with a diverse range of specialized technological abilities (Care, 2012). Consequently, it is now the responsibility of educational institutions and systems to equip upcoming professionals with the vital skills and resources necessary to navigate the ever-evolving job market, a view supported by numerous researchers (Care, 2012; Karsenti and Collin, 2016).

The necessity to equip professionals with technological abilities and to steer the education of youth in alignment with the realities dictated by the digital world has prompted

numerous organizations to create competency frameworks. A significant document in this area is the Assessment and Teaching of Twenty-First Century Skills Project (Care, 2012). The theoretical structure of the survey outlines ten competencies grouped into four main categories: the category of cognitive approaches, which includes abilities related to creativity, innovation, metacognition, problem-solving, and critical thinking; the category of professional practices, which consists of skills associated with communication and teamwork; the category of tools for work, which comprises information and technological capabilities; and the category of global citizenship, which involves social and civic responsibility skills (Care, 2012).

Along with fostering these abilities, the prudent and educational application of digital technology provides numerous significant educational advantages such as heightened motivation and engagement among students; improved interaction between students, parents, and teachers; and enhanced collaboration among peers (Zheng et al., 2016). Furthermore, the intentional integration of digital resources in the classroom supports the development of an active, learner-centered teaching approach that aligns with contemporary understandings of learning processes, as indicated by various specialists in developmental psychology. (Levin and Schrum, 2013; McKnight et al., 2016).

Recognizing the significance of such initiatives and their effects, it is crucial to examine the local policies and practices that have been established to enhance digital education for the community. In Tunisia, this kind of initiative remains underdeveloped because of insufficient financial backing. Starting from the viewpoint that digital technology serves as a means to foster both economic and educational achievements for the community, we are working to establish a framework of competencies in Arabic aimed at the teaching profession. This framework endeavors to ease the incorporation of digital education into the teaching methods of prospective educators in Tunisia. Specifically, the Ministry of National Education has supported this initiative for training forthcoming teachers and has indicated that higher education programs must be modified to reflect the advantages that come with this initiative. This concern is grounded in various writings that advocate for research on professional growth focused on integrating digital education within the educational field. Initially, the necessity of 21st-century skills for students was emphasized. Subsequently, it became evident that numerous resources still need to be activated in Tunisia to advance the development of digital competencies.

Lastly, there is a recognized deficiency in research focused on digital technology within educational institutions at both the school and university levels. Collectively, these three factors in primary education appear to support the investigation of digital learning in basic schools across Tunisia. Following this, the critical role of teacher training for the effective integration of digital tools was highlighted. Therefore, the insufficient pedagogical training among university educators indicates an urgent need for ongoing professional development to guarantee the effective application of their educational and technopedagogical abilities. Investigating the professional growth of elementary school instructors intended for the incorporation of digital education seems essential, particularly in light of the scarcity of data for this segment. Analyzing professional development

initially and then addressing the more targeted area of digital skills seems crucial. This type of professional growth yields additional positive effects for teachers in Tunisia, especially by easing the transition in teaching approaches, a shift likely to influence student achievement, which is a significant concern at the university level (Guay et al., 2020).

To address this question, it is vital to examine the theoretical foundations associated with the primary research themes of this study, specifically: the incorporation of digital education and professional growth. In this context, it will be important to elaborate on the concept of digital education, its integration, and its application. Additionally, the theoretical elements that describe its incorporation, diverse applications, and functions will be discussed. Following that, a thorough elaboration on professional growth will be provided, along with a description of related concepts such as learning types and the influences on them. In conclusion, a definition of professional growth aimed at the integration of digital education will be presented, followed by the introduction of specific research goals.

Clear distinctions in the interpretations of digital utilization and integration are essential for the effective execution of this research project. There appears to be some confusion surrounding the definitions of these two concepts, depending on the philosophical viewpoints taken. Thus, it is crucial to differentiate between these interconnected concepts for the successful operationalization of the research.

Certainly, for certain writers, the concepts of utilizing and incorporating digital education are viewed as identical (Davies, 2011; Inan and Lowther, 2010). For a different group, especially among Francophone individuals, it appears that these two actions are quite distinct; the application of digital refers to a consistent level of employing technological instruments, while integration suggests a shift in methodology connected to a new application of educational digital (Fiévez, 2016; Schumacher and Coen, 2008). The notable differences between these notions arise from either instructivist or constructivist models of education (Martel, 2002; Mueller et al. 2008). Proponents of instructivist methods view digital education as one more tool for learning. Hence, within this framework, there are no distinctions between the two terms being examined (Martel, 2002; Mueller et al. 2008). Conversely, followers of constructivist approaches see educational digital as a cognitive resource utilized for learning and enhancing students' knowledge (Mueller et al. 2008). In this context, there exists a synergistic relationship between the ideas of integration and usage.

This matter gives rise to the overarching inquiry that guides this investigation: what is the nature of the professional development related to the incorporation of digital education within educational institutions in Tunisia? In the constructivist framework, when discussing the incorporation of digital education, innovations or changes in teaching methods are essential because of the cognitive tools they represent in this viewpoint. Ultimately, how digital resources are utilized and integrated is largely influenced by whether an instructivist or constructivist approach is embraced. For the cultural context relevant to this study, opting for constructivist ideas appears to be a wise choice, as it provides a more comprehensive and intricate understanding of educational practices.

Additionally, considering the role that digital education holds within the constructivist framework and the innovation required for its incorporation, it would be beneficial to support the integration perspective suggested by Raby in 2004. This perspective defines the integration of educational digital as a process that necessitates consistent with digital resources, resulting in active, authentic, and enduring student learning while also enhancing educational practices. Similarly, the concept of digital education as articulated by Fiévez in 2016 will also be implemented for the same justifications. His definition describes this idea as the continual use of educational digital tools that aids the teaching process. Nonetheless, several inquiries, particularly regarding the implementation of digital technology, remain. For instance, in what ways can these technologies be utilized in a classroom setting?

At present, there is a lack of suitable tools for measuring validity that consider sociocultural influences, which are necessary to assess the growth of teaching methods and digital learning. Therefore, it is crucial to create and affirm a contemporary questionnaire in Arabic focused on "Teacher Professional Development and Educational Technology" (Gros, 2025). This research intends to introduce this questionnaire in Arabic for educators and to clarify its psychometric characteristics.

2. METHODS AND MATERIALS

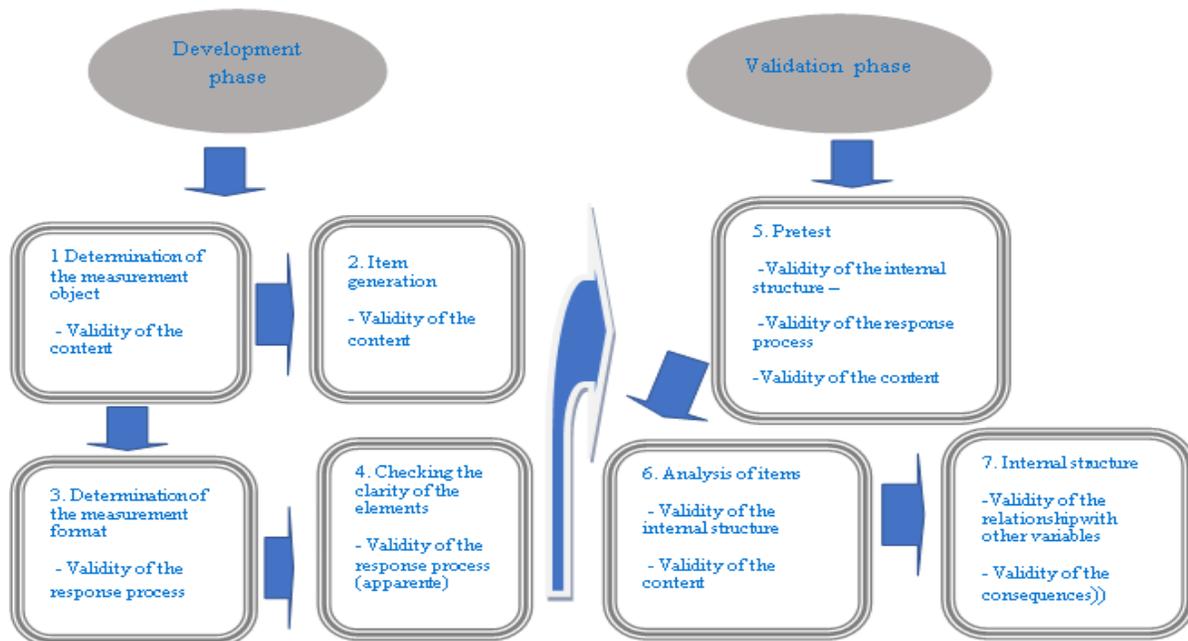


Figure 1: Instrument design (Item generation, determination of measurement format, verification of element clarity, and pre-test)

Dussault and al. (2007) propose a simple and rigorous method for developing and validating a seven-step questionnaire inspired by DeVellis (2003), as illustrated in Figure 1. The first five correspond to the elaboration and the last two correspond to the validation

process: 1- determination of the measurement object in the light of a literature review, 2- generation of items, 3- determination of a measurement format, 4- verification of the clarity of the items, 5- pre-test, 6- analysis of the items, 7- proofs of validity of constructs to which would be added those of validity, reproducibility and response to concomitant changes (see Figure 1).

Before undertaking any work to develop a measurement tool, it is first necessary to define what will and will not be evaluated (DeVellis, 2003). In this perspective, a review of the literature relevant to the subject treated has been carried out to differentiate the concepts addressed. The target population must also be determined at this stage. The design of the instrument was determined based on theoretical models of psychological performance, which represent a phenomenon inherent in the lives of students while maintaining a relationship with the dynamics of study management, school performance, and the effectiveness of the educational system (Diaz, 2008). Once the concepts covered in the questionnaire have been well established, the creation of items is possible but must respect several basic rules. All elements must be linked to the objectives of the evaluation (DeVellis, 2003). They must also be concise, present a level of language adapted to the target population, and contain only one idea. Multiple negations and ambiguous pronouns should also be avoided. By respecting the different basic rules, a quantity of four items inspired by theoretical models was built for the TPDET. It brought together questions relating to the different theoretical groupings proposed above, namely: Teacher Professional Development and Educational Technology, (Teacher Background, From 1 to 5, not verified in validity. See table 1).

Table 1: The dimensions of the Teacher Survey on Professional Development and Educational Technology (TPDET)

Dimensions	Declarations
Teacher Background	From 1 to 5 (not verified in validity)
Professional Development	From 6 to 17
Educational Technology	From 18 to 28

The determination of the form that the answers will take must be considered about the evaluation objectives pursued in the questionnaire. A knowledge questionnaire and an attitude questionnaire do not have the same type of questions. At this stage, it is necessary to choose the most appropriate measurement format for the desired questionnaire, such as "true or false" questions, multiple choice questions, Thurston or Liker-type scales (DeVellis, 2003).

Teacher Survey on Professional Development and Educational Technology was transmitted thanks to a translation into Arabic, and it was later retranslated into English after the methodological considerations for double translation and reconciliation in English during the translation and the adaptation process were taken into account to linguistic and psychological differences in the Tunisian population and the particularities of education practices through the mediation of a choice of qualified experts: knowledge of education, knowledge of psychology education, digital education and fluency in the Arabic language.

The Teacher Survey on Professional Development and Educational Technology (TPDET) is a questionnaire that aims to inform educational teachers, about the importance of Teacher professional development practices and the integration of digital education. The items, according to a Likert scale of "1 to 5", (Not important Somewhat important Important Very important Extremely important) were privileged.

This type of questionnaire is faster to fill out and easier for the education professional to understand and analyze. The "other" option was part of the answer choices for all the questions to reduce the amount of missing data. The verification of the clarity of the items comprises two elements that are added to the proof of the validity of a measuring instrument.

The apparent validity and the content constitute the first test for the elements created. The apparent validity consists in presenting the items to a representative sample of the population targeted by the evaluation. It aims to collect comments on the adequacy between the concepts discussed, the formulation of the items about the goals pursued by the questionnaire, and the understanding of the vocabulary and the level of language used (DeVellis, 2003). The validity of content differs from the apparent validity by the composition of the group to which the items are presented.

The objective of content validity is to ensure that no aspect of the concepts discussed has been neglected according to the theoretical foundations specific to this field. The comments obtained from the sample of the target population allow the researcher to modify or delete the problematic items and to add others if necessary (DeVellis, 2003). The questionnaire was designed as a self-assessment tool, using familiar and simple language in the reformulation of the various statements in a total of 28 elements : (without 5 Teacher background items).

The pre-test consists of testing the questionnaire with a new representative sample of the target population. Its purpose is to verify that each of the items is relevant in the questionnaire. The pre-test gives indications of the elements that need to be modified or completely deleted. It can also be used to check if theoretical groupings (also called categories, dimensions, or factors) are found when analyzing the data (DeVellis, 2003). The number of participants to be included in the pre-test has been the subject of several discussions.

The higher it is, the higher the power of the analysis, and the easier it is to avoid measurement errors. It is therefore necessary to seek to obtain the highest participant-item ratio insofar as the research conditions allow it (DeVellis, 2003). The preliminary version of the TPDET was tested on a population of basic school teachers from the Mahdia region (Tunisia).

A total of 235 teachers, aged 25 to 55, answered the questionnaire for the first time. The analysis of the items (discrimination index) and adjustment to the Rasch, Bond, and Fox model (2007) made it possible to identify the items to be modified or deleted to avoid redundancy. Confirmatory factor analyses suggested a better fit to a multidimensional model as suggested by theoretical models.

Translation-cultural adaptation of original questionnaire

This work was carried out by a team made up of two university professors in French literature and two university professors in Arabic literature. Initially, each of the Arabic language teachers individually translated the questionnaire “Teacher Professional Development and Educational Technology”, then a comparison of the two translations in Arabic and certain modifications were immediately made to the source questionnaire by the team of experts in order to adapt their content to the Tunisian context. In a second step, the Arabic version was discussed in the presence of the two French language experts to determine if the content in Arabic corresponds to the source in French. Finally, all the experts agreed on the structure, syntax and content of the Arabic version. In short, we had the approval of experts to test the questionnaire in Arabic version adapted to the Tunisian cultural context.

Participants and procedure

The participants in this study were teachers of basic school in Tunisia. In the tunisian school system, basic schooling comprises 6 years of primary school and 3 years in college, The available data show that this distribution is largely based on the importance of basic education in the tunisian system in general.

In this descriptive study, the participants were 235 teachers (210 males and 25 females), aged 25 to 55 years old, from different basic schools located in urban and rural areas of Mahdia. The data were collected by an anonymous written questionnaire. The questionnaire was administered at the school during a lesson. The delivery was carried out by myself, which guaranteed the teachers confidentiality of their answers (see table 2).

Table 2: Characteristics of the participants (n = 235)

Geographic area	Male	Female	Age
Mahdia (Urban and rural basic schools)	210	25	Fron 25 to 55 years

Measures

Most of the measures are based on existing scales whose formulation has been adapted to the context of this study. A pre-test was carried out on a sample of 10 teachers from the Sfax region (Tunisia). In addition to the pre-test, a focus group on the questionnaire was carried out with a group of teachers with the same characteristics as the target sample. Teachers were generally very receptive, and their comments made it possible to adapt the questionnaire, as well as the handling protocol. This study is part of a quantitative research methodology. The questionnaire used is a general information tool; it includes socio-demographic indicators such as age, gender, region, etc. This is a descriptive search. The emphasis is therefore placed here on the relevant details that will make it possible to obtain contextual information, making it possible to describe as accurately as possible the perceptions of basic school teachers regarding professional dévelepmnt. This questionnaire measures and describes the different causes perceived by teachers in Mahdia region. Its abbreviated version includes 28 statements distributed fairly on three (3) dimensions : **1) Teacher Background** (not verified in validity), 2)

Professional Development, 3) Educational Technology. Each element of the questionnaire is scored on a 5-point Likert (from 1 to 5), The answers are Not important, Somewhat important, Important, Very important, Extremely important.

The analysis of items is at the heart of the development of a measurement tool (DeVellis, 2003). It aims to identify the questions that should be kept or deleted from the questionnaire based on statistical indices to improve the information obtained (Laveault and Grégoire, 1997). It should be noted that at this stage, the theoretical foundations supporting the design of the questionnaire continue to play an important role. The statistical clues may then seem less satisfactory, but it is also important that the questionnaire is based on clinical reality. Three procedures were preferred for the analysis of TPDET items, namely the discrimination index, the internal consistency analysis, and the analysis of the adjustment of the items to the Rasch model. The discrimination index is determined by the item-total correlation coefficient. It indicates the extent to which an item succeeds in discriminating between respondents with a high score and those with a low score. The higher the coefficient, the more discriminating the item is. The internal coherence analysis consists of ensuring that the items linked to the same concept react constantly for all the respondents. These two procedures belong to the classical theory of tests, which encompasses many other possible statistical tests (Laveault and Grégoire, 1997). The theory of the response to the items allows for a more in-depth analysis of the items since it places on the same scale the degree of difficulty of the items and the level of competence of the respondents (Bertrand and Blais, 2004). Several models are derived from this theory, but the simplest, and most used, is certainly the Rasch model, which postulates that a single latent trait is responsible for the variance of the items and that all items have the same discrimination (Bond and Fox, 2007).

We will see here the proofs of the validity of the internal structure (validity of construction and reproducibility), of the relationship with other variables (concomitant validity), as well as the proof of the validity of the consequences (response to changes). The determination of the validity, therefore, of the value of a measurement tool is done by the accumulation of evidence. Some have already been collected during the previous stages, but the most important proof of validity is demonstrated at this stage. Otherwise, the validity of the construct constitutes the essential element of validity for specialists in psychometrics (DeVellis, 2003). It consists in determining to what extent the items of the questionnaire are organized in the same way as the theoretical concepts that support them (DeVellis, 2003). On the other hand, the reproducibility of the results of a measurement tool over time as well as its response to changes constitute proof of its reliability and, therefore, of the validity of its internal structure and the validity of the consequences. Finally, the concomitant validity aims to determine whether the questionnaire evaluates what it claims to measure by comparing it to a standard measurement. However, as the new questionnaire is intended to be an improvement over existing tools, a moderate correlation was expected to obtain a concomitant proof of validity. In its initial validation, it had a satisfactory internal consistency coefficient (0.82) and an intra-class correlation coefficient (0.70) with populations made up of middle school students from all governorates of Tunisia. Despite the difficulties of moving the investigators to the Tunisian

regions, the students who participated in the validation instruments filled out and personally handed over their questionnaires. To validate the reliability of the results, descriptive and inferential statistics were used from the data obtained in the field to make decisions on inter or intra factors at the origin of psychological performance.

Statistical analyses

The discrimination index is considered problematic if it is less than 0.2 (Nunnally and Bernstein, 1994). Since dichotomous data were used, the item-total point-material correlation was used for the analyses. The internal consistency is evidenced by the value of the coefficient of the Kuder-Richardson formula 20 (KR-20). This formula is preferred to Cronbach's alpha in the case of dichotomous data. Values between 0.7 and 0.9 are recognized as having a good level of internal consistency. The analyses were carried out using SPSS 28 & AMOS software. The analyses with the Rasch model were carried out using the WINSTEPS software (version 3.32) (Linacre, 2002). The fit statistics are an indication of the adequacy between the one-dimensional Rasch model and the collected data. The WINSTEPS software provides two fitting statistics for items: "infit" and "outfit" (Linacre, 2002). The "infit" presents the weighted information of the mean of the squares of the standardized residuals between the observed and expected responses according to the variance of the item and the total variance. The outfit, used as an additional reference, provides the average of the squares of the standardized residues, raising the residues to the square before the average to prevent the negative residues from compensating for the positive residues. A value of 1 in either of these statistics indicates a good fit of the item to the model, and a value between 0.5 and 1.5 is considered satisfactory (Linacre, 2002). A value ≥ 1.5 indicates a lack of homogeneity between the items, while a value ≤ 0.5 represents redundancy between the items.

Confirmatory factor analyses based on structural equation models were carried out using the EQS 6.2 software (Bentler, 1995) to obtain proof of the validity of the TPDET. Different adjustment indices were used to compare the theoretical matrix with the data: the Satorra-Bentler chi-square (the chi-square statistic used for non-normal data) and its ratio on the degrees of freedom ($SBx2/dl$), the comparative Fit Index (CFI), the Non-Normed Fit Index (NNFI) proposed by Nunnally and Bernstein, (1994) and the root of the mean Square Error of Estimation (RMSEA) recommended by Steiger (1990). The modified version of the "Akaike Information Criterion" (Consistent version of the AIC, CAIC), proposed by Bozdogan (Bozdogan, 1987) was also used to compare the models with each other.

A value of $SBx2/dl$ approaching 2.0 represents a good fit of the model to the empirical data, while a value of 5.0 indicates an acceptable fit. Models with a CFI and an NNFI greater than 0.9 are generally considered adequate (Schumacker and Lomax, 1996), while those with values of 0.95 are considered appreciable (Marsch, Ellis, Parada, Richards and Heubeck, 2005). An RMSEA value of less than 0.08 is acceptable, while a value of less than 0.05 is appreciable (Bentler, 1995). As with the CAIC, the most suitable model should be the one with the lowest value (Bentler, 1995).

Finally, considering that the analyzed data did not respect the normal law, the Maximum Likelihood estimation method (Maximum Likelihood, ML) and its robust option were used. Given the number of participants and the number of parameters to be estimated, the use of indicators was necessary for each factor. Two indicators have been constructed for each of the factors.

Bentler & Dijkstra (1985) have shown that their use is as effective as the use of all items to evaluate the adequacy of theoretical models to the data. For each factor, the indicators were designed randomly. Indicator 1 was obtained by the average of the odd items, and indicator 2 was obtained by the average of the even items. To optimize the factorial structure of the tested models, the Lagrange multiplicative test (LMTEST), which proposes the addition of parameters, has also been used (Bentler & Dijkstra, 1985). To obtain proof of concomitant validity, Spearman correlations were made between the total scores (TPDET) at each of the measurement times.

Since too high a coefficient would demonstrate too much similarity between the two executions, a coefficient between 0.4 and 0.8 is considered acceptable to demonstrate good proof of concomitant validity (Streiner and Norman, 1995). To collect other measures of reproducibility and response to changes in (TPDET), an ANOVA with repeated measurements was carried out by analyzing the evolution of the average score of the participants at each measurement time.

3. RESULTS

Implementation of the Instrument

A tool has been developed to predict which of the 3 factors identified in the literature and envisaged in its design, highlighted more in the research on digital technology at the Basic school and university level. Once the phase of evaluation of the intelligibility of the instrument had been carried out and the recommendations resulting from this phase had been formulated, we proceeded to the effective implementation of the questionnaire.

The Teacher Survey on Professional Development and Educational Technology (TPDET) was conducted among Tunisian basic school teachers - 89% male and 11% female from Mahdia from September 2025 to December 2025. We describe below, firstly, the results derived from the implementation of the questionnaire, analyzing all the factors. Then, the agreement of the instrument to the global analysis of the 3 factors associated with Teacher Survey on Professional Development and Educational Technology (TPDET), trying to identify which type of model was followed by the study.

Being aware that the 23 items ((without 5 Teacher background items), in the inventory, contained the Three components of Teacher Survey on Professional Development and Educational Technology (TPDET). Grouping items by variables allowed for the investigation of their effects on The Teacher Survey on Professional Development and Educational Technology (TPDET) based on the data collected in the field.

Table 3: F Fisher Test (ANOVA) for the analysis of the type of Teacher Professional Development and Educational Technology (TPDET)

Factors	Mean	Variance		
Professional development	3.751	10,298	Calculated value Fcal	fteo
Education technology	2.259	11,632		
Origin of variations	Sum of squares	Degree of freedom		
Among the subfactors	128.21	5	21.33	2.28
In the subfactors	4090.23	2531		
Total	4218.44	2536		

Discrimination index

The table 4 presents the results of analyzes obtained for each of the items of the "Teacher Professional Development and Educational Technology (TPDET)" at the first measurement time (T0). For the sake of brevity, similar results having been obtained at other measurement instants are not presented. No item had zero variance; all participants got the correct answer, so their discrimination index was zero. These elements were removed from subsequent analyses. They were always kept inside the "Teacher Professional Development and Educational Technology (TPDET)". Other items showed unsatisfactory discrimination indicators at T0 according to the criteria chosen. They were distributed fairly in the questionnaire and nothing seemed to connect them a priori. For the same reasons, they were kept. Particular attention was paid to them for the rest of analyzes.

Table 4: Results of the analysis of the elements at T0 of the "Teacher Survey on Professional Development and Educational Technology (TPDED)"factors

ITEMS	Rasch Model				
	M	D.S	Ind. Discr.	Infit	Comple
Professional development					
6	0.89	0.19	0.27		
7	0.98	0.39	0.30		
8	0.84	0.27	0.08		
9	0.91	0.40	0.47		
10	0.56	0.60	0.30		
11	0.40	0.56	0.39		X
12	0.16	0.33	0.34		
13	0.85	0.27	0.47		
14	0.92	0.40	0.30		X
15	0.59	0.60	0.39		
16	0.82	0.56	0.34		X
17	0.89	0.33	0.27		
Education technology					
18	0.71	0.21	0.29		X
19	0.83	0.37	0.31		
20	0.77	0.29	0.13		
21	0.88	0.43	0.46		
22	0.96	0.62	0.33		
23	0.86	0.58	0.36		

24	0.91	0.36	0.32	
25	0.73	0.26	0.43	
26	0.80	0.43	0.36	
27	0.73	0.62	0.37	
28	0.59	0.58	0.31	

Internal consistency

The coefficients of internal coherence for each of the two categories proposed by the theoretical foundations and for each of the two exams of "Teacher Professional Development and Educational Technology (TPDET1), in addition to those of "Teacher Professional Development and Educational Technology (TPDET2), are presented in Table 5. For the TPDET1, the coefficients were between 0.60 and 0.82 at each of the two measurement times when they were calculated for the entire questionnaire. The coefficients were satisfactory when the categories were considered separately, which indicates that they are rather descriptive. The coefficients of the TPDET2 were also satisfactory and justified its use as a standard measure (0.59 / 0.84).

Table 5: Internal consistency (KR-20)

Factors	T0	T1	T2	T3
Professional development	0.56	0.66	0.51	0.45
Education technology	0.61	0.56	0.13	0.28
Total TPDET2	0.59	0.84	0.72	0.71
Total TPDET1	0.60	0.82	0.68	0.64

Rasch model

Table 5 indicates the items obtained satisfactory statistics following the analysis according to the Rasch model at T0. Again, the results similar to other measurement times are not presented for the sake of brevity. All the items identified as having a satisfactory discrimination index—none of them are considered problematic according to the reported statistics.

Once again, we decided to keep all the elements inside the "Teacher Professional Development and Educational Technology (TPDET). These are essential elements of knowledge about the Teacher Professional Development and Educational Technology factors. The problematic items of the "Teacher Professional Development and Educational Technology (TPDET) are adequate according to the discrimination index, which therefore does not reflect a recurring problem from one analysis to another.

Concerning the scientific criteria proven by Streiner and Norman (1995). which indicate that if Cronbach's Alpha is greater than 0.9 the measuring instrument is excellent; in the range from 0.9 to 0.8 the instrument is good; between 0.8 and 0.7 the instrument is acceptable; in the range between 0.7 and 0.6, the instrument is weak; between 0.6 and 0.5 the instrument is bad; and if less than 0.5 is not acceptable; it is concluded that the questionnaire as an instrument for determining the factors associated with psychological performance reveals the excellent level of comprehensibility for which it was designed (see Table 6).

Table 6: Distribution of Items by Factors for the Instrument Designed

Factors	Number of items	Total of items	Alpha de Cronbach
Professional development	6-7-8-9-10-11-12-13-14-15-16-17	12	0.87
Education technology	18-19-20-21-22-23-24-25-26-27-28	11	0.87
Total		23	0.87*

Analysis of the factor structure

Table 6, presents the adjustment indices of the TPDET2 data for the models tested at T0. Similar values have been obtained at other times, but are not presented, always for the sake of brevity. The M1, with seven correlated factors, had a good fit of the model to the data, a substantial CFI, and an acceptable NNFI and RMSEA. However, it was this model that had the highest CAIC index.

The M2 (See table.7), which included a second-order factor, had slightly lower fit statistics, a good SBx2/dl, an acceptable CFI and RMSEA, but an NNFI below the set acceptability threshold. Its CAIC was lower than that of M1. About M3, although the CAIC indicated that it is the best-fitting model, CFI, NNFI and RMSEA were not acceptable. For this model, the LMTEST analysis suggested adding a correlation between the error terms of indicators 5 and 6.

As they corresponded to the same area suggested by the literature, this link was added. The M4, that is to say the M3 optimized in the light of the LMTEST then had the lowest CAIC, an RMSEA respecting the appreciable threshold, as well as values of CFI and NNFI appreciable and adequate, respectively. Figure 2 shows the standardized solution of confirmatory factor analysis.

Table 7: Fit indices of the models tested at T0

Adjustment indices	M1	M2	M3	M4
CAIC	-45,682	-53,235	-57,321	-63,133
SBx2	18,3145	23,5487	51,2541	22,1234
DI	14	16	18	15
SBx2/dl	1.27	1.31	1.41	1.33
CFI	0.755	0.864	0.878	0.7678
NNFI	0.775	0.876	0.799	0.777
RMSEA	0.085	0.077	0.084	0.062

Analysis of the factor structure

Table 6 presents the adjustment indices of the TPDET2 data for the models tested at T0. Similar values have been obtained at other times, but are not presented, always for the sake of brevity.

The M1, with two correlated factors, had a good fit of the model to the data, a substantial CFI, and an acceptable NNFI and RMSEA. However, it was this model that had the highest CAIC index.

The M2, which included a second-order factor, had slightly lower fit statistics, a good SBx2/dl, an acceptable CFI and RMSEA, but an NNFI below the set acceptability threshold. Its CAIC was lower than that of M1. About M3, although the CAIC indicated that it is the best-fitting model, CFI, NNFI and RMSEA were not acceptable. For this model, the LMTEST analysis suggested adding a correlation between the error terms of indicators 7 and 12. As they corresponded to the same area suggested by the literature, this link was added.

The M4, that is to say the M3 optimized in the light of the LMTEST then had the lowest CAIC, an RMSEA respecting the appreciable threshold, as well as values of CFI and NNFI appreciable and adequate, respectively. Figure 2 shows the standardized solution of confirmatory factor analysis.

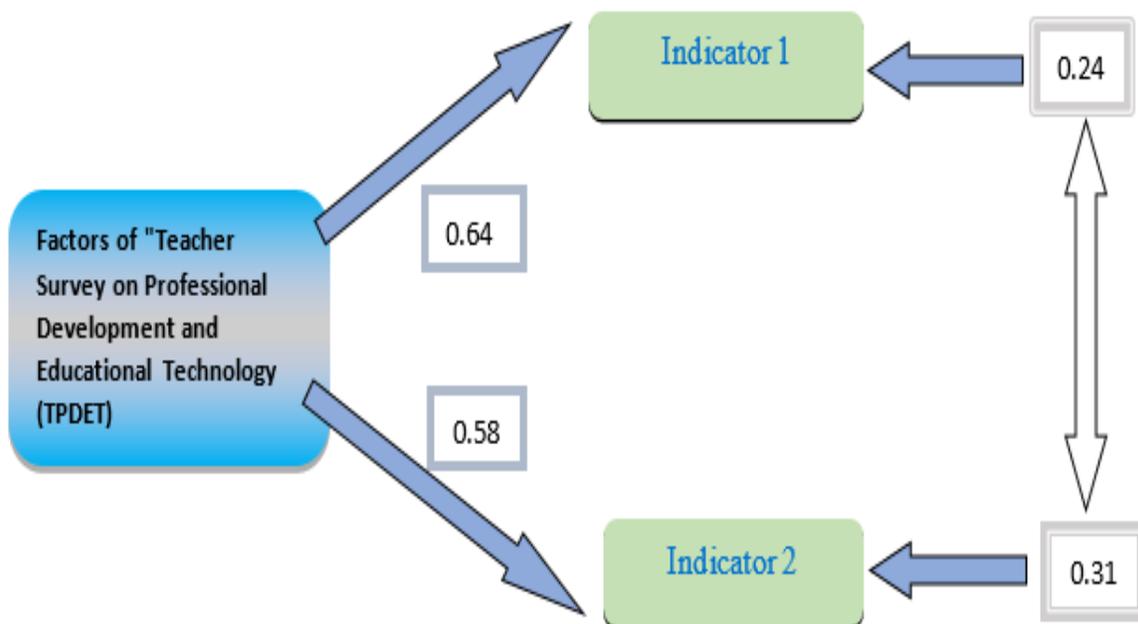


Figure 2: Standardized solution of the confirmatory factor analysis of the model

Concurrent validity

Table 8 shows the correlations between the scores obtained by the participants in the two questionnaires at each of the measurement times. The coefficients obtained show that the correlations are higher at each measurement time for the same questionnaire, as from one questionnaire to another. As expected, the correlation coefficients between TPDET2 and TPDET1 in T3 (0.591) for each of the respective measurement times were all between 0.431 and 0.591 and were significant ($p = 0.01$).

This provides proof of the concomitant validity of the TPDET2 compared to another measurement instrument respecting certain proofs of validity concerning the same concept, namely Teacher Survey on Professional Development.

Table 8: TPDET2 vs. TPDET1 Correlation coefficient

	TPDET2 T0	TPDET2 T1	TPDET2 T2	TPDET2 T3	TPDET1 T0	TPDET1 T1	TPDET1 T2	TPDET1 T3
TPDET2 T0		0.601	0.621	0.546	0.789	0.444	0.660	0.463
TPDET2 T1			0.488	0.631	0.462	0.777	0.301	0.551
TPDET2 T2				0.681	0.428	0.353	0.577	0.491
TPDET2 T3					0.531	0.467	0.431	0.591
TPDET1 T0						0.655	0.632	0.599
TPDET1 T1							0.731	0.631
TPDET1 T2								0.577
TPDET1 T3								

Reproducibility and response to changes

Table 8 shows a higher correlation between the TPDET2 scores at T1 (0.777), T2 (0.577), and T3 (0.591). Another proof of the reproducibility of the results is obtained. The average scores obtained at TSPDET2 and TSPDET1 at each of the measurement times show that the evolution of the scores is comparable for the two questionnaires. Table 9 clearly shows the comparison of the average score with the TPDET2 at each of the measurement times.

The ANOVA with repeated measurements of the TPDET2, by the Mauchly sphericity test, shows a difference in variance over time ($W(5) = 0.531$ $p < 0.05$), the intra-subject analyses (Greenhouse Geisser) attesting to a significant difference in the mean score for each measurement time ($F(2,121) = 116.114$ $p < 0.05$, $\eta^2 = 0.472$).

More precisely, the contrast analyses indicated a significant difference in small amplitude between T0 and T1 ($F(1) = 4.461$ $p < 0.05$, $\eta^2 = 0.612$) and a significant difference in higher amplitude between T1 and T2 ($F(1) = 167.061$ $p < 0.05$, $\eta^2 = 0.613$), as well as between T2 and T3 ($F(1) = 119.211$ $p < 0.05$, $\eta^2 = 0.742$).

The very close average scores obtained at T0 and T1 demonstrate the reproducibility of the questionnaire. The significant, moderate increase in scores after the rehearsal session turned out to be the response to the changes in the TPDET2.

The increase in the scores between T2 and T3 is probably due to the maturation of the concepts among the respondents, an adjustment effect being felt after having answered the same questions several times. As the scores were very similar, this mainly demonstrates post-teaching reproducibility.

Table 9 : Average TPDET2 scores at each measurement time

Measurement time Scores	T0	T1	T2	T3
TPDET2	0,789	0.777	0.577	0.591

DISCUSSION

The design and validation process of the TPDET2 provided several proofs of validity, as proposed by Downing (2003). Firstly, the validity of the content was demonstrated not only by the presence of a specialist in the field as research director but also by a literature review and consultation of existing questionnaires. The verification of the clarity of the items by a group of experts in education science is further proof of this. The apparent validity, for its part, was established by checking the items by a sample of the target population. The addition of the choice "other" and the decision to opt for a self-administered questionnaire constitute proof of the validity of the response process. The pre-test stage allowed us to examine the first proofs of validity related to the internal structure.

Other proofs of validity were obtained during the validation phase. About the internal structure, an acceptable level of internal consistency showed that the items of TPDET2 were linked to each other. The discrimination index for each item and the analysis of the items of the Rasch model did not make it possible to identify the problematic items. However, we decided to keep all the items since they constitute important knowledge that a student must know. As this questionnaire is used to orient the measurement session on the elements to be treated, it is an important issue compared to the respondent since it is associated with the control of Teacher Survey on Professional Development and Educational Technology, but from the point of view of the measurement session, this prognostic issue is of lesser importance.

Two types of analyses were used to obtain additional proof of validity. The proofs of the validity of the construct are attested by confirmatory factor analyses, which suggest a better adjustment of the TPDET2 data to a two-factor model. This analysis goes in the direction suggested by the coefficient of internal coherence; the psychological performance factors can be categorized as suggested by the theoretical models. In addition, the acceptable correlation coefficients between TPDET2 and TPDET1 constitute proof of the concomitant validity of the TPDET. The obtaining of moderate correlations between the two measures demonstrated the distinctive character of the new questionnaire. The moderate correlation shows that the TPDET2 is not a simple repetition of the TPDET1, but is intended to be a plus compared to this already existing measurement tool, in particular because it is based on theoretical concepts and that it has accumulated more evidence of validity than any other questionnaire. The comparison of the mean of the scores at each of the measurement times demonstrated the reproducibility and the response to the changes in the TPDET2. The persistence over time of the knowledge acquired through teaching (T0-T1-T2-T3) constitutes proof of the validity of the consequences of using the questionnaire. Indeed, the participants in the

study had a higher and lasting level of knowledge about their professional development causes.

To obtain additional evidence of the validity of the consequences of using the TPDET2, additional measurements should have been collected. A measurement period one year later would have made it possible to verify the retention of the information by the respondents. Additional proofs of validity could also have been obtained (inter-item correlations, generalization studies, convergent/divergent proof of validity, etc.), but their number is already large and would have only confirmed the conclusions already established. Future research could focus on differentiating the knowledge of Tunisian teachers based on the socio-demographic data collected. In addition, the validation of the TPDET2 for other populations with different characteristics, such as university students, could be considered. Finally, an intercultural validation must be planned to strengthen the generalizability of the TPDET2.

CONCLUSION

Currently, the school offers student's different experiences that help them define their life project, in addition to being an essential aspect of social learning and personal development. The objective of this study was to present a rigorous method for validating knowledge measurement tools using the example of the "Teacher Professional Development and Educational Technology questionnaire (TPDET).

This method can be reproduced for other knowledge measurement instruments in several fields, the steps remaining the same. The various proofs of validity support the proposed interpretation of the results. For the above, and concerning the design and validation of the instrument (TPDET) to determine the psychological performance factors.

We conclude the following: 1) the validations carried out on the instrument (TPDET2), whose overall internal consistency - levels of comprehensibility and ability to identify a model of psychological performance - proves to be effective and highlights the excellent parametric properties for which the questionnaire was designed. 2) By implementing the TPDET in a population of basic school teachers, it was possible to identify the model of "Teacher Professional Development and Educational Technology during their school itinerary.

Finally, the use of the TPDET in the sports field aims to inform the actors of sports education of the effect of "Teacher Professional Development and Educational Technology on the basic school teachers to increase the effectiveness of their interventions.

In doing so, the acquisition of new sociological analyses could improve the self-management skills of young teachers during their schooling. The TPDET can be generalized, to a certain extent, since it has been validated with a heterogeneous population regarding age, social space, and gender, and it is based on the most recent theoretical conceptions.

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