A Study on Decision Making and Teaching Competency: Processing Self Perception and Cognitive Schema through Neutrosophic Science

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Abstract

The objective of this research is to examine the decision-making processes of teachers and explore their self-assessments of teaching competency levels based on the competency indicators proposed by the Ministry of National Education (MoNE) in Turkey. The study adopts a constructivist perspective, offering a fresh look at the cognitive levels of teachers and their decision-making mechanisms. Additionally, it integrates neutrosophic science principles to address the uncertainties and indeterminacies present in teachers' self-evaluation and decision-making processes. Data were gathered using the "General Competencies for Teaching Profession (GCTP)" scale, which was developed according to the competencies defined by the MoNE. This new scale, featuring 15 Likert-type items, was validated and tested for reliability before being administered to a sample of 320 volunteering teachers from various disciplines in Turkey. The scale measures data within the "Professional skills" domain and captures teachers' self-perceived competency beliefs related to their professional skills, considering factors such as years of teaching experience, gender, subjects taught, and the type of school (primary or secondary) where they are employed. SPSS 16.0 was used for data analysis and to obtain descriptive statistics for the item results. The analysis revealed that primary school teachers scored higher on the GCTP scale compared to high school teachers. By incorporating neutrosophic science, the study effectively navigates the uncertainties in assessing teaching competencies, offering a more nuanced understanding of the factors that influence teachers' decision-making processes.

Keywords: Cognitive schema; Decision Making Process; Competency; Professional Skills; Teaching; Neutrosophic Science

1. Introduction

Referring to all undertaken responsibilities and skills of delivery of knowledge and assessment of learning, the teaching profession can only be taken into consideration when teachers perform their tasks competently. Prior studies dealt with the competencies of teachers, focusing on the role of teachers in the classroom rather than how they react to their perceived performances according to the pre-set competencies. With new and creative approaches to teaching and learning that emerged after 2000's, the new system pushed almost all teachers to feel ready and be prepared to teach in a class, as well as to develop their teaching and assessments. Much has been written about the teachers' general competencies over the last few decades, but relatively little that relates to the perceived competency levels of teachers on their professional skills has been discussed.

Teachers, in the latest era, are not considered as agents who transfer knowledge, skills, and values, but they are the facilitators of knowledge acquisition and the constructive agents of their students. Teachers, in daily teaching routines, deal with the current policies, new challenges, and construe their expected roles. Throughout history, they have been expected to enhance their knowledge and skills, improve and explore their teaching practices to

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grow up the new generations at schools. Therefore, all governments want teachers to be aligned with the system-challenges, which is an inevitable part of the whole system. Teachers need to understand the system of teaching in their home countries, acquire research findings and strategies, understand the information collected, select appropriate teaching methods, techniques and knowledge while teaching, and also deal with the political decisions and procedures taken in their respective countries, all of which make them knowledge constructor and reflective practitioners [1].

The times of global problems, such as Covid-19 pandemic, economic crisis, changing role of teachers, have led to immense doubts of preparing students for the future, about how we prepare the next generations in our respective nations. A considerable number of studies have been carried out on global issues, the consequences, the expected qualities of teachers' competencies, and the new set of capabilities [2, 3, 4]. There have been many debatable issues and concerns in the field of education. Restructuring teacher education and teaching as a profession, on the other hand, have been going on as a debatable and global issue for an extensive time. The governments and the changing needs of societies have brought decision makers to that point and led them to change the educational system. Consequently, all parts of this composition contributed from their side; the Higher Education Institutions (HEI) and the Ministry of National Education (MoNE) in Turkey worked on the proposals, which led to some new implementations in teacher training system, and the competency and performance expectations of the school authorities. However, it is wholly fair to say that each attempt created new needs and solutions; leaving gaps behind and making it challenging to obtain standardization in teacher education, as well as maintaining the overall quality of teachers. Since teachers are a group of employees whose roles are defined in each school by the authorities, they are also the ones who are supposed to enhance their teaching competencies and performances.

In line with the argument stated above, the Ministry of Turkish Education, starting in 2006, updated and re-published the "General Competencies for Teaching Profession" guideline in 2017 based on the feedback obtained from all fields of education in Turkey. The document provided a solid reference for the stakeholders involved in the teacher training field, as well as a set a framework for the policies for teacher education. As teachers are said to have the most effective impact on the quality of education; teacher qualification, therefore, is the main motive of the guideline, and the document accepted that there is no common and universal qualification of teachers appropriate to every country [5]. The General Competencies for Teaching Profession has been considered as a reference source indicating the expectations of MoNE from teachers in Turkey. The guideline also serves a fundamental reference to identify the knowledge, skills, attitudes, and values a teacher must possess. Accordingly, there are three proposed general teaching competency domains, which are: *Professional Knowledge, Professional Skill, Attitudes and Values.*

The teaching profession, as described in the provided text, encompasses a multifaceted range of responsibilities and competencies that must be performed competently to ensure effective knowledge delivery and learning assessment. This complexity and variability in teacher competencies can be adeptly addressed through neutrosophic science, which specializes in dealing with indeterminate, uncertain, and contradictory information. Traditional methods of evaluating teacher competencies often fall short in capturing the nuanced realities of teaching, where a teacher's self-assessment might not fit neatly into categories of 'competent' or 'incompetent.' Neutrosophic logic allows for a spectrum of evaluations, where competencies can be seen as partially true, partially false, or indeterminate. This is particularly relevant in contexts like the Turkish education system, where new guidelines and competencies are continually being introduced and assessed. Neutrosophic sets can provide a more accurate reflection of teachers' perceived competencies by acknowledging the degrees of uncertainty and variability in their self-assessments and professional environments.

Furthermore, neutrosophic science provides a robust framework for addressing the global and systemic challenges faced by the teaching profession, such as those brought about by the COVID-19 pandemic and economic crises. These global challenges introduce significant uncertainties and contradictions into the educational landscape, making it difficult for teachers to maintain consistent standards of competency and performance. Neutrosophic logic, with its ability to model and analyze complex, uncertain scenarios, offers a way to design more resilient and adaptable educational policies and practices. By incorporating neutrosophic principles, policymakers can better understand and respond to the multifaceted needs of teachers, creating training programs that are flexible and comprehensive. This approach not only enhances the precision of competency assessments but also supports the development of a more reflective and adaptive teaching profession, ultimately contributing to higher educational quality and effectiveness amidst global uncertainties.

Domain 1: *Professional Knowledge*: has three competencies -*Content Knowledge*, *Pedagogical Content Knowledge*, *Knowledge of Legislation*- along with 16 competency indicators describing the specific domain.

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Domain 2. *Professional Skills*: has four competencies -*Planning of Education and Teaching, Creating Learning Environment, Managing the Teaching and Learning Process, Assessment and Evaluation*- along with 28 competence indicators describing that specific domain.

Domain 3. *Attitudes and Values*: has four competencies -*National, Moral and Universal Values, Approach to Students, Communication and Cooperation, Personal and Professional Development*- along with 21 competence indicators describing that specific domain.

2. The Scale Development

In this study, only the first two domains (A and B provided in Figure 1), which are *Professional Knowledge* and *Professional Skill*, along with the 44 competence indicators, as an initial step, were taken into consideration. To develop a scale for this study, teachers teaching in different subjects were requested to fill out the assessment scale (see the attached competency indicators). Furthermore, to develop the scale, 114 teachers from different disciplines were asked to complete the form in Turkish. The released scale with 44 items was sent to the target group of teachers with the two domains as stated in Figure 1. However, the data processing showed that the target teacher groups considered only the *Professional Skills* as a competency domain, neglecting to rate all other indicators that belonged to *Professional Knowledge*. The finalized scale revealed that teachers from the sample population in fact considered only the professional skills as their competency indicators in their professional lives. Different reasons for not considering their professional knowledge into consideration could be present. The simplest approach for not taking knowledge into consideration would be that knowledge is not considered functional or a primary criterion, as it may be seen as off-topic while teaching and practicing in class.

After the collected data, the scale was used with 15 items (see a sample on the Attachment), and it became standard to measure competency beliefs of the teachers (teaching different subjects) on how they saw themselves based on the competence indicators proposed by the Ministry of National Education in Turkey. The 350 respondents were asked to mark the best option (referring to their reactions to the given competency indicator in the 5-point scale, 1 indicating *certainly disagree* and 5 indicating *certainly agree*). Out of the 350 participants, 320 respondents' data were valid and considered as the population of this study.

A. Professional Knowledge	**B. Professonal Skills**	**C. Attitudes and Values**
A1. Content Knowledge	**B1. Planning of Education and Teaching**	**C1. National, Moral and Universal Values**
She/he has an advanced and critical perspective on theoretical,methodologial and factual knowledgein hisher subject field.	She/he plans education and teaching processes effectively	She/he observes national,moral and universal values.
A2. Pedagogical Content Knowledge	**B2. Creating Learning Environments**	**C2. Approach Students**
She/he has a good knowledge of the curriculum and pedagogicalcontent knowledge of her/his subject area.	She/he prepares appropriate teaching materials and builds an healty and safe learning learning environments, here effective learning can be achieved for all students.	She /he has an attitude that supports the development of students.
A3. Knowledge on Legislation	**B3. Managing the Teaching and Learning Process**	**C3. Communication and Cooperation**
As an individual and teacher, she/he conducts her/himself according to the legislation related to her/his duties, rights and responsibilities.	She/he manages the teaching and learning process effectively.	She/he establishes an effective communication and cooperation with students, colleagues,families, and other educational stakehoders.

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	B4. Assessment and Evaluation	**C4. Personal and Professional Development**
	She/he uses the methods, techniques and tools of assessment and evaluation that fit for purpose	By carrying out self appraisal she/he participates in personal and professional development activities.

Figure 1: General Competencies for Teaching Profession

Professional Skills as a Competency Domain: MoNE

The domain reflects 5 competencies proposed by the MoNE, which are *Planning of Education and Teaching, Creating Learning Environments, Managing the Teaching and Learning Process,* and *Assessment and Evaluation*. These levels refer to the plans of education and teaching processes, preparations of teaching materials, learning environments, management of teaching and learning processes, and the methods, approaches, techniques and the assessment -evaluation of the learning processes. This domain includes five competencies and 28 competence indicators, as shown in Figure 2.

B	**COMPETENCY DOMAIN: PROFESSIONAL SKILLS**
	SCOPE: This competency domain covers the teacher's competencies of educational planning, creating/ learning, environments, managingthe teaching and learning process, and monitoring and evaluation regarding the his/her in-class and out-of-class practices.
COMPETENCIES	**COMPETENCE INDICATORS**
B1. PLANING OF EDUCATIONAND TEACHING She/he plans the education and teaching processes effectively.	**B1.1.** She/he prepares his/her plans in accordance with the curriculum of his/her subject area.
	B1.2. She/he plans th teaching process by taking environmental conditions, costs, and time into account.
	B1.3. She/he prepares flexible teaching plans by considering the individual differences and sociocultural characteristics of students.
	B1.4. She/he takes into account the national and moral values while planning the teaching process.
B2. CREATING LEARNING ENVIRONMENTS She/he prepares appropriate	**B2.1.** She/he organizes healthy, safe, aesthetical learning environments.
	B2.2. She/he prepares teaching materials suitable to learning outcomes of the curriculum.

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teaching materials and builds an healty and safe learning environments, where effective learning can be achieved for all students	**B2.3.** She/he organizes the learning environments by considering the individual differences and students' needs.
	B2.4. She/he organizes the learning environments by catering for learning outcomes of the curriculum.
	B2.5. She/he organizes democratic learning environments where students communicate effectively.
	B2.6. She/he creates learning environments that supports developing high-level cognitive skills of students.
	B2.7. She/he creates learning environments that helps students to internalize national and moral values.
B3. MANAGING THE TEACHING AND LEARNING PROCESS She/he manages the teaching and learning process effectively.	**B3.1.** She/he performs skills needed for education and teaching of his/her subject area.
	B3.2. She/he makes use time effectively in teaching and learning process.
	B3.3. She/he ensures active participation of students in learning processes.
	B3.4. She/he makes learning relevant to daily lives of the students.
	B3.5. When carrying out teaching and learning process, she/he takes into account he students with special needs.
	B3.6. She/he takes into account the natural,cultural, and socioeconomic characteristics of the environment she/he is working in his/her practices.
	B3.7. She/he prepares activities that help developing analytical thinking skills of students in her/his classes.
	B3.8. She/e cooperates with the related persons, instinctions, organizations,and colleagues when carrying out the educational activities.
	B3.9. She/he makes use the information and communication technologies effectively in the teaching and learning process.
	B3.10. She/he ensures effective learning by using appropriate strategies, methods, and techniques in the teaching and learning process.
	B3.11. She/he make use appropriate tools, equipments and materials effectively in the teaching and learning process.
	B3.12. She/he copes with misbehavior and undesired situations in the classrom effectively and constructively.

COMPETENCIES	**COMPETENCE INDICATORS**
B4. ASSESSMENT AND EVALUATION	**B4.1.** She/he prepares and uses assessment and evaluation tools suitable to his/her subject area and stages of growth and development of students.

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She/he uses the methods, techniques and tools of assessment and evaluation that fit for purpose.	**B4.2.** She/he make use of both formative and summative assessment methods.
	B4.3. She/he carries out an objective and fair assessmentand evaluation.
	B4.4. She/he provides accurate and constructive feedbacks to students and other stakeholders in accordance with results from assessment and evaluation.
	B4.5. She/he re-arranges the teaching and learningprocesses in accordance with the assessment and evaluation results.

Figure 2: Competencies and Competence Indicators

3. Teacher Competency

Assessing teacher competence, for a long time, has been the central focus of the personal and professional growth of language teachers and teacher candidates. Dervenis et al. explained the *skill and competence* concepts, which can sometimes be challenging to define [6]. According to the European education and training policy [7], *skill* is defined as "the ability to apply knowledge and use know-how to complete tasks and solve problems", while *competence* is "the ability to apply learning outcomes adequately in a defined context […], to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development" [as cited in 6]. Competency is an important key term in all fields, as well as teacher education, in terms of evaluating the achievement of the desired work level of teachers, having the values, knowledge, and skills required by the job, and increasing the effectiveness of the work for a sustainable education.

Teachers' competencies have been broadening with respect to reform studies in education, development of teacher education, scientific results of educational science and other fields, as well as the contribution of digital technologies [8]. A further contribution, carried out by Kress [9], points out "the previous era had required an education for stability, the coming era requires an education for instability." Kress attempts to explain why teachers' professional development should be redefined for sustainability. The aims of education change rapidly, depending on the demands of the era, requiring more capability. These demands directly affect the educational system. Since teachers are responsible for operating the educational system, they need compelling and efficient professional competencies. Teachers' competencies should be redefined depending on the development of the whole human life, consistent with the educational progress.

4. Perception

A considerable body of literature exists on how to investigate teachers' beliefs and perceptions of professional activity, job satisfaction, and motivation. Teachers' beliefs refer to the "perspective and conception of teachers' roles, positions, and teaching and learning strategy. Teachers' beliefs also identify teachers' classroom behavior, teaching methodology, strategy toward their students" [10]. The literature review shows that teachers always make decisions in teaching activities, based on their teaching knowledge, experiences, perceptions, attitudes, values and beliefs about their roles, type of activities, and the responsibilities in the field. Eggen and Kauchak [11] state that the perception of teaching profession helps teachers gain meanings, and understand the different aspects, experiences, roles, responsibilities and practices from their professional activity. They see perception as "the process by which people attach meaning to experiences" [11]. This explanation reveals that perception encourages all processes associated with the recognition, transformation, and organization of sensory information in the learning-teaching process. Teachers' self-perception is the way we judge ourselves; is the primary form of contact with the world around us cognitively. Since teaching is a complex activity, as previous studies have relied on, teachers, moment-by-moment, take decisions about the task, content, and process. In the process of teaching, teachers' content knowledge, and pedagogical content knowledge effect their beliefs of what to teach and how to teach as well as how to manage students' behaviors in class. Perception, in the context of teachers' self-assessment of their competencies, involves a complex interplay of beliefs, experiences, and attitudes that shape how educators understand and evaluate their professional roles and effectiveness. Neutrosophic science, with its focus on indeterminate, uncertain, and contradictory information, provides a valuable framework for analyzing these perceptions. Teachers' self-perceptions are not always clear-cut or binary; they often involve degrees of certainty

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and uncertainty about their abilities and the appropriateness of their teaching methods. Neutrosophic logic allows for a more nuanced representation of these perceptions by accommodating partial truths and indeterminacies. This is particularly relevant in understanding the diverse and dynamic nature of teaching, where educators must constantly adapt to new challenges and evolving educational standards. By applying neutrosophic principles, researchers and policymakers can better capture the subtle variations in teachers' self-assessments and develop more effective strategies for professional development and competency evaluation. This approach acknowledges the complexity of teaching and provides a more comprehensive understanding of how teachers perceive their roles and competencies within the educational system.

In line with the above discussions, the aim of this study is to discuss the self-perceptions of teachers about their teaching competency levels under the competency indicators proposed by the Ministry of National Education (MoNE) in Turkey. Therefore, the purpose of this study is to see the factor structure of the General Competencies for Teaching Profession (GCTP) scale, developed to measure the perception of teachers' own competencies. Whether the total scores obtained from the whole scale and the scores elicited from the sub factors of GCTP differ according to the teachers' levels of teaching, their sex, the subjects they are teaching, and their years of experiences is explored.

5. Methodology

5.1 Data Collection and the Participants

The data for this study were collected through "General Competencies for Teaching Profession" scale, developed under the defined competencies proposed by the MoNE. This competency domain describes the teacher's competencies of educational planning, creating learning environments, managing the teaching and learning process, and monitoring and evaluation regarding all in-class and out-of-class practices. To gather detailed information about the self-perceptions of teachers on their teaching competency levels under the competency indicators proposed by the Ministry of National Education (MoNE) in Turkey, the scale developed in this study was used as a research tool, and administered with 126 participants. The 126 participants are selected from volunteer Turkish teachers, teaching in all regions of Turkey; and are those who have been teaching different subjects at different levels and schools under the administration of the Ministry of Education in Turkey. They were sent the Google form prepared in Turkish and after the forms were collected, the scale development process through SPSS started in light of the given answers. The quantitative data were analyzed using descriptive statistics.

5. 2 Testing of the Validity Procedure

To provide the structure validity of the research tool, factor analysis was used in this study. There are two types of factor analyses: Explatory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). In this study, since a scale was developed, primarily, EFA was integrated to observe how the items were collected under each dimension. Then, as the second step, CFA was applied to determine the structure validity.

The Results of EFA

Firstly, KMO and Barlett Test results were examined (shown in Table 1) to see if the scale was appropriate for EFA. It was applied to 126 teachers working for the MoNE in Turkey.

Table 1: KMO and Barlett Test Results

KMO	0,915
Barlett Testi	2074,098
sd	105
p	0,00

The KMO value is bigger than 0.70; so, it can be said that the scale is appropriate according to EFA. Varimax Vertical rotation is marked for EFA. A 0.30 factor load value is chosen as a criterion representing each item's appropriateness in the concerning dimension [12]. EFA is generally used in the scale development process to

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determine which items are appropriate representatives of the measured feature and applicable under which factor [13]. To see the representatives of the measured feature, first, 44 items were applied to 126 teachers. After the rotation of the items and analysis, 15 items were grouped under 3 dimensions. The escalated items did not give consistent load the major groupings and factors; they did not represent any factor and were not meaningful under the categories. Factor loads obtained from EFA and the sub-dimensions are presented in Table 2.

Table 2: Factor Load Value and Sub-Dimensions

	Dimension 1*	Dimension 2**	Dimension 3***
Item 13	0,758		
I 14	0,758		
I 15	0,658		
I 6	0,654		
I 12	0,619		
I 7	0,484		
I 2		0,778	
I 4		0,718	
I 1		0,7	
I 5		0,64	
I 3		0,544	
I 9			0,769
I 10			0,696
I 8			0,626
I 11			0,584

Please see below the description for each Dimension mentioned in Table 2:

**Dimension 1:* the items grouped as how to *Manage Teaching and Learning Process*;

***Dimension 2:* the items grouped as how to *Plan Learning Environment*;

****Dimension 3:* the items grouped as how to *Create Teaching and Learning Process*.

After EFA in the scale development process, CFA analysis is a desired process for testing the structure validity [14].

For CFA, 320 teachers teaching different subjects and from different genders with various teaching experiences in different regions of Turkey were applied to see the perceptions of the teachers regarding their own competencies.

The items' loads and the values along with the Path diagram is shown in Figure 3.

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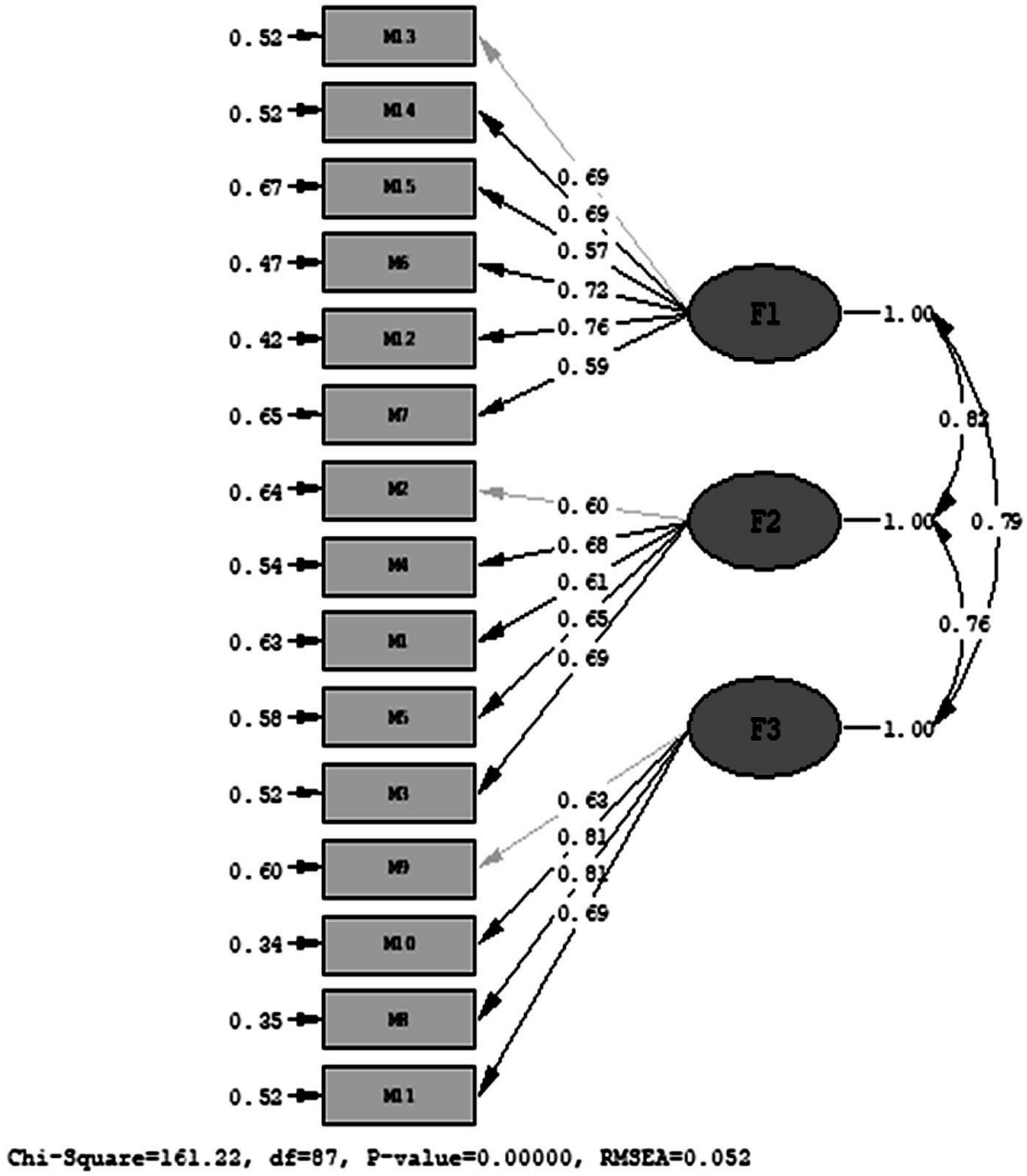

Figure 3: The CFA related Path Diagram of the Scale

Figure 3 represents the three factors (F) and the sub-dimensions of the scale items. The factor load values of the first factor is between (λ) 0,76 and 0,57; the factor load values of the second dimension is between 0,60 and 0,69. The load value of the third dimension changes between 0,81 and 0,63. The model fit indexes obtained from the CFA are compared with the criteria values, as shown in Table 3.

Table 3: The cut-off points for in structural equating model [15].

Model fit index	Criteria	Cut-off points
χ^2	p>0,05	
χ^2/sd		≤≤ 2= Perfect model fit ≤≤

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	2,5= Perfect model fit (small sampling) ≤≤ 3= Perfect model fit (big samples) ≤≤ 5= Medium model fit index
GFI AGFI CFI NNFI(TLI)	≥0,90 =≥*0,90* = Perfect model fit
RMSEA	≤0,080=≤*0,080*= Acceptable model fit ≤0,050=≤*0,050*= Perfect model fit

Table 4: Model fit indexes concerning CFA

	χ^2 (sd)	RMSEA	GFI	AGFI	CFI	NNFI(TLI)	λ	ε	Correlation between Factors
1 Level 3 FactorsML	$161,22_{(87)}$	0,052	0,99	0,99	0,98	0,98	0,81-0,57	0,67-0,34	No

Table 4 presents the results of CFA analysis of the scale named General Competencies for Teaching Profession (GCTP) with 3 factors at first level higher order, based on estimation methods. The model data fit indexes shown in Table 4 state the conformity between the target model and the expected model. The value of Chi-square calculation is found very high in this model. Since Chi-square is a fit index effected by the sample size, even when divided into the degree of freedom, the result is bigger than 3. The expression χ^2 /sd is smaller than 3, means that there is no meaningful difference between the set-up model and the existing model. When Chi-square fit index is analyzed, it is evident that a model fit index exists and it is accurate.

RMSEA is the root mean square error of approximation, and is an index of the difference between the observed covariance matrix per degree of freedom and the hypothesized covariance matrix, which denotes the model. The values of 0.01, 0.05 and 0.08 indicate excellent, good and mediocre fit respectively. It has been suggested that RMSEA values **less than 0.05** are good, values between 0.05 and 0.08 are acceptable, values between 0.08 and 0.1 are marginal, and values greater than 0.1 are poor. It can be interpreted that the given results shown on the table do not indicate acceptance fit.

Latent variables are those variables that are measured indirectly using observable variables. So, rather than measuring things that cannot be quantified, the value using variables that can be quantified is inferred. For a latent variable, the factor load value should be minimum 0.30, and the error variance should be maximum 0.90 [15]. This is a rule for factor load values in standardized solutions. When analyzed in this study, it is seen that factor load values indicate between 0.57 and 0.81. It can be concluded that the items are representing each dimension well. The error variance, on the other hand, shows that the values are between 0.67 and 0.34. The error variance above 0.90 clearly proposes that the item should be removed from the analyses. When the error variance is analyzed in this study, it can be concluded that the scale items are good representatives of the scale's sub-dimensions.

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6. Results of Reliability

For the reliability analysis, Cronbach Alfa values for whole properties of the scale, and each item composing the scale are measured. The reliability analysis procedure calculates a number of commonly used measures of scale reliability and also provides information about the relationships between individual items in the scale. It has been noticed in this study that Cronbach Alfa co-efficient is 0.70 and above (α_{Total}=0,906; $\alpha_{Dimension\ 1}$=0,829; $\alpha_{Dimension\ 2}$=0,825; $\alpha_{Dimension\ 3}$=0,753). In this regard, it can be said that the scale is measuring with a minimum error, but with a high reliability rate. With the reliability analysis, it is determined by obtaining the proportion of systematic variation in a scale, which can be done by determining the association between the scores obtained from different administrations of the scale. Reliability co-efficiency should be close to 1 in order to be considered satisfactory in a Likert type scale, according to Tezbasaran [16]. So, the association in reliability analysis is high, and the scale yields consistent results, and is therefore high-level reliable.

7. The Findings and Discussions

In this study, whether there is a significant difference according to the teaching levels of the teachers has been analyzed. Since there are more than two independent variables, and that the assumption of normality is not provided, Kruscal Wallis H test analysis was applied (as indicated in Table 5).

Table 5: Kruscal Wallis H Test Results according to the scores of Levels of Teaching-(GCTP)

	Level of Teaching	N	Mean Rank	sd (df)	χ^2	p	Significant Difference
Dimension1	primary	132	162,99	2	2,729	0,046	High School
	secondary	103	168,3				
	high	85	147,18				Primary School
Dimension2	primary	132	156,81	2	2,556	0,279	
	secondary	103	172,01				
	high	85	152,28				
Dimension3	primary	132	155,77	2	1,678	0,432	
	secondary	103	169,88				
	high	85	156,48				
Total	primary	132	158,86	2	3,158	0,206	
	secondary	103	172,37				
	high	85	148,65				

It has been observed that only one dimension, which is the teaching levels of the teachers, revealed a significant difference as a result of the scores obtained through the "General Competencies for Teaching Profession (GCTP)" scale [H_2=2,729; p<0,05]. At different teaching levels the teachers those who are teaching displayed sensitive scores obtained through the "General Competencies for Teaching Profession (GCTP)" scale. In order to analyze the significant differences between groups, and to be able to identify which groups revealed the differences according to the scores obtained from the scale, Mann Whitney U test was applied as Post-hoc test. In this test, class levels were compared in pairs (two by two). When the scores of the "General Competencies for Teaching Profession (GCTP)" scale were analyzed in regards to the level of teaching the teachers were working in, the scores of the teachers who were teaching at primary schools ($\chi-\chi_{primaryschool}$ =162,99) were higher than the scores of the teachers who had been teaching in high schools ($\chi-\chi_{highschools}$= 147,18).When the scores obtained from the other dimensions and the whole properties of the scale were analyzed, the fact that there was no significant difference according to the levels of teaching [H_2=2,556; H_2=1,678; H_2=3,158; p>0,05] was noticeable.

Table 6: T-test results according to the Sex Variable- (GCTP)

Dimension	Sex	N	X	Sx	sd	t	p
dimension1	male	152	4,5515	0,51726	318	-1,593	0,112

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	female	168	4,6349	0,41789			
dimension2	male	152	4,3579	0,64434	318	-1,497	0,135
	female	168	4,456	0,52571			
dimension3	male	152	4,5559	0,56542	318	-1,275	0,203
	female	168	4,6265	0,42029			
total	male	152	4,4882	0,50665	318	-1,687	0,043*
	female	168	4,573	0,39011			

Table 6 sets out to explain whether there was a significant difference between the sex scores obtained from all three dimensions and the scale as a whole. The unpaired samples t-test was utilized since the teachers' responses were distributed normally according to the sex variable. The statistically significant test result ($P \leq 0.05$) revealed that there was a significant difference according to the total scores of sex obtained in this study when all properties of the scale were taken into consideration- $t_{(318)\text{whole scale}}$ =-1,678; p<0,05. With the results derived from the "General Competencies for Teaching Profession (GCTP)" scale, female teachers' scores were higher than the male teachers according to the scores obtained from the whole scale ($\bar{\chi}_{\text{Whole scale (Female)}}$=4,6265; $\bar{\chi}_{\text{Whole scale (Male)}}$=4,4882). The sub dimensions of the GCTP did not release any significant difference; this was how the results could be interpreted accordingly-$t_{(318)\text{Dimension 1}}$=-1,593; $t_{(318)\text{Dimension 2}}$=-1,497; $t_{(318)\text{Dimension 3}}$=-1,275; p>0,05.

Table 7: Kruscal Wallis H Test results according to Teaching Subjects Variable- (GCTP)

Dimension	Branch	N	Mean Rank.	sd	χ2	p	Significant Difference
dimension1	1	20	133,63	12	10,873	0,54	No
	2	7	150,21				
	3	12	129,92				
	4	139	165,69				
	5	40	136,83				
	6	4	135,38				
	7	35	182,29				
	8	7	181,57				
	9	16	157,31				
	10	14	189,21				
	11	11	161,14				
	12	7	174,07				
	13	8	152,88				
dimension2	1	20	107,23	12	12,303	0,422	No
	2	7	159,36				
	3	12	119,25				
	4	139	166,78				
	5	40	163,84				
	6	4	136,63				
	7	35	170,23				
	8	7	190,14				
	9	16	157,44				
	10	14	176,46				
	11	11	163,27				
	12	7	139,57				
	13	8	166,81				
dimension3	1	20	114,68	12	12,163	0,433	No
	2	7	139,21				
	3	12	160,13				
	4	139	168,68				

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	5	40	148,43				
	6	4	112,13				
	7	35	166,59				
	8	7	220				
	9	16	153,28				
	10	14	162,82				
	11	11	166,18				
	12	7	162				
	13	8	159,31				
total	1	20	111,3	12	12,244	0,426	No
	2	7	155,07				
	3	12	128,88				
	4	139	168,87				
	5	40	147,89				
	6	4	123,63				
	7	35	172,71				
	8	7	199,14				
	9	16	155,72				
	10	14	180,07				
	11	11	163,41				
	12	7	154,21				
	13	8	161,38				

In this part, with Table 7, the aim is to check if there are significant differences according to the teaching subjects of the teachers. Since there were more than two independent variables, and that the assumption of normality was not provided, Kruscal Wallis H test analysis was applied. When all scores credited for the dimensions and the whole sub-parts of the scale were analyzed, it could be said that there was no meaningful difference regarding the teaching subjects of the teachers [H_{12}=10,873; H_{12}=12,303; H_{12}=12,163; H_{12}=12,244; p>0,05].

Table 8: Kruscal Wallis H Test Results according to the Teachers' Years of Experience -(GCTP)

Dimensions	Experience	N	Mean Rank.	sd	$\chi 2$	p	Significant Difference
dimension1	0-5 years	104	163,49	3	1,923	0,589	No
	6-10 years	62	168,46				
	11-15 years	39	166,49				
	15 above	115	151,48				
dimension2	0-5 years	104	161,46	3	0,166	0,983	No
	6-10 years	62	163,64				
	11-15 years	39	157,15				
	15 above	115	159,07				
dimension3	0-5 years	104	164,92	3	1,814	0,612	No
	6-10 years	62	169,85				
	11-15 years	39	153,74				
	15 above	115	153,75				
total	0-5 years	104	161,21	3	0,961	0,811	No
	6-10 years	62	169,28				
	11-15 years	39	160,5				
	15 above	115	155,12				

This part of the paper, with Table 8, reveals whether there was a significant difference according to the teachers' teaching experiences. Teachers' experiences were considered under 4 categories (those who had been teaching between 0 to 5 years; from 6- to 10 years; from 11 to 15 years, and those who had been teaching more than 15

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years). Since there were more than two independent variables, and that the assumption of normality was not provided, Kruscal Wallis H test analysis was applied.

When the specific dimension and the whole sub-parts of the scale were analyzed, it was observed that there was no meaningful difference according to years of experience of the teachers [H_3=1,923; H_3=0,166; H_3=1,814; H_3=0,961; p>0,05].

8. Findings and Discussion

While developing the scale for this study, *Professional Knowledge, Professional Skill* were primarily taken into consideration to determine the knowledge and skill relationship of teachers' self-perception on how they see themselves. However, the road path, without foreseeing, ended up with one focus only: *Professional Skills*. The participating teachers perceived their competencies limited with how they perform their skills in classroom and what they did in the classroom. Competency as a term was associated with skill rather than knowledge and skill relationship. Skill became the only dimension of the participating teachers; while performing their duties, "the ability to apply knowledge and use know-how to complete tasks and solve problems" became their main concerns and perceptions. In this study, teachers' gender, at which level they were teaching, which subjects they were teaching, and the years of experiences were taken into consideration as variables.

According to the analyzed SPSS data, there was a meaningful difference when the test scores of the "General Competencies for Teaching Profession (GCTP)" scale were analyzed in regards to the *level of teaching the teachers are working at*; the competency scores of the teachers who were teaching at primary schools ($\chi\text{-}_{primaryschool}$ =162,99) were higher than the scores of the teachers who had been teaching in high schools ($\chi\text{-}_{highschools}$= 147,18). This could be interpreted that primary school teachers perceive themselves more involved in educational planning, creating learning environment and deal with the learning process, and they monitor and evaluate their students' in/out of class activities. This may be due to the fact that primary school teachers, while dealing with the young learners, spend more efforts and use their professional skills, in direct relation to their competencies.
While this study dealt with the teachers' perceptions, the study, carried out by Koksal [17] identified the general teaching competency levels and professional attitudes of preservice teachers who were going to graduate from four-year education faculties. Data in her study were collected using the "general teaching competencies self-assessment form" and the "scale for attitudes towards the teaching profession". The results showed a positive and meaningful relationship between general teaching competency perceptions and attitudes towards the profession. This paper explores the teachers' perceptions who teach different subjects at all levels and in different regions, age groups, sex groups and experiences.

In the article, the statistical analysis conducted on teachers' perceptions of their competencies incorporates various methodologies to understand the underlying factors and validity of the scales used. This analysis includes exploratory factor analysis (EFA) and confirmatory factor analysis (CFA), which help identify and confirm the structure of the scale measuring teachers' professional skills. The application of these statistical methods involves handling data with inherent uncertainties and indeterminacies, which is where neutrosophic science can provide an enhanced analytical framework.

9. Neutrosophic Equation in Statistical Analysis

In traditional statistical analysis, such as the one performed in this study, factor loadings, variances, and reliability measures (e.g., Cronbach's alpha) are used to quantify the relationships and consistency within the data. However, these measures often assume a level of certainty that might not be present in real-world data. Neutrosophic science introduces a way to handle this uncertainty by allowing each variable to have a degree of truth, indeterminacy, and falsity.

Consider the neutrosophic representation for a statistical measure S (such as a factor loading or reliability coefficient), which can be expressed as a neutrosophic equation:

$$S = T + I + F$$

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where:

T is the degree of truth (certainty or consistency in the measurement).

I is the degree of indeterminacy (uncertainty or variability in the measurement)

F is the degree of falsity (error or inconsistency in the measurement).

For instance, in the context of the CFA results discussed in the article, the factor loadings (λ) can be interpreted using neutrosophic sets. Let's denote a factor loading (λ, i) for item (i):

$$\lambda\_i = T\_\{\lambda\_i\} + I\_\{\lambda\_i\} + F\_\{\lambda\_i\}$$

Here, $(T\_\{\lambda\_i\})$ represents the certainty that the item loads onto the factor as expected, $(I\_\{\lambda\_i\})$ captures the indeterminacy or the ambiguous variance that cannot be definitively attributed, and $(F\_\{\lambda\_i\})$ accounts for the error or misfit..

Incorporating neutrosophic logic into the statistical analysis allows for a more comprehensive understanding of the data, acknowledging that not all measurements are precise and some degree of uncertainty is always present. This approach provides a richer, more flexible interpretation of the scale's validity and reliability, particularly useful in complex fields like education where human factors introduce significant variability.

By applying neutrosophic principles, the study can better handle the complexities and inherent uncertainties in teachers' self-assessment of competencies, leading to more robust and adaptable educational policies and practices. This not only enhances the precision of competency assessments but also supports the development of a more reflective and adaptive teaching profession.

10. Conclusion and Suggestion

The MoNE's "General Competencies for Teaching Profession", as a reference text and a guideline, should be taken into consideration when teachers' level of competencies and performances are evaluated in addition to the training needs for their development, and when identifying the needs for their professional development and planning actions to be met. The guideline- serving as a fundamental reference- proposes general teaching competency domains, which are: *Professional Knowledge, Professional Skill, Attitudes and Values.* Limited research has studied the teachers' self- perception on their general teaching competencies. While this paper provides valuable insight about the general competencies and the teachers' self -perceptions on their competency levels according to some variables, there is a need to continue this line of investigations for analyzing the ongoing developments and further needs. It is also inevitable to continue to examine how pre-service teacher education/ postgraduate programs can best provide the knowledge and skills required in schools.

Attachment: A Sample from the Scale "General Competencies for Teaching Profession (GCTP)"

	Kesinlikle Katilmiyorum				**Kesinlikle Katiliyorum**
Maddeler	**1**	**2**	**3**	**4**	**5**
1. B1.3. Ogrencilerin bireysel farkliliklarini ve sosyokulturel ozelliklerini dikkate alarak esnek ogretim planlari hazirlarim.					
2. B2.1. Saglikli, guvenli ve estetik ogrenme ortamlari					
3. B2.2. Kazanimlara uygun ogretim materyalleri hazirlarim.					

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4. B2.3. Ogrenme ortamlarini ogrencilerin bireysel farkliliklarini ve ihtiyaclarini dikkate alarak duzenlerim.					
5. B2.6. Ogrencilerin ust duzey bilissel becerilerini gelistirici ogrenme ortamlari olustururum.					
6. B3.1. Alanimin egitim ve ogretimi icin gerekli olan becerileri sergilerim.					
7. B3.2. Ogretme ve ogrenme surecinde zamani etkin kullanirim.					
8. B3.3. Ogrencilerin ogrenme sureclerine aktif katilimlarini saglarim.					

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