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A Novel Neutrosophic Likert Scale Analysis of Perceptions of Organizational Distributive Justice via a Score Function: A Complete Statistical Study and Symmetry Evidence Using Real-Life Survey Data

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Abstract: In this study, ten questions measuring distributive justice on classical Likert and neutrosophic Likert scales consisting of two subdimensions—distributive and procedural justice—were used. Participants responded to the same questions for both the classical Likert and neutrosophic Likert scales within a single survey, with the neutrosophic method applied, for the first time, to the questions included in the scale. The neutrosophic scale responses were answered in percentages to resemble natural language, and the answers received for each question were reduced to the range [−1, 1] to grade the agreement approach through a score function used in neutrosophic decision-making theory. In this study, the neutrosophic scale, a scaling method with strong theoretical foundations, was compared with the traditional Likert scale. The results of the statistical analyses (exploratory factor analysis, reliability analysis, neural network analysis, correlation analysis, paired samples *t*-test, and one-way and two-way ANOVAs) and evaluations of the scales were compared to measure organizational justice within a single study. In this article, the symmetric and non-symmetric properties of statistical analysis that are specific to this paper in addition to general symmetric and non-symmetry properties are discussed. These symmetric and non-symmetric features are conceptualized according to the features on which each statistical analysis focuses. Finally, although this study presents a new area of research in the social sciences, we believe that the neutrosophic Likert scale and survey approach will contribute to collecting detailed and sensitive information on many topics, such as economics, health, audience perceptions, advertising responses, and product, market, and service purchase research, through the use of score functions.

Keywords: ANOVA; fuzzy scale; Likert scale; neural network; neutrosophic Likert scale; organizational justice; score function; symmetry; non-symmetry

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1. Introduction

Because of the large number of concepts and topics in this study, we have divided this section into the following subsections for readability: organizational justice, Likert scale, neutrosophy and neutrosophic set, neutrosophic Likert scale, and score function. As for the general organization of the study, we follow a descriptive and instructive path by keeping this section broad, shedding light on qualitative and quantitative research.

1.1. Organizational Justice

The theory of organizational justice concerns the extent to which employees perceive that justice occurs in work-related issues [1]. Equity theory suggests that perceptions of fairness arise from an individual's comparison of his or her contributions with subsequent

rewards or consequences [2]. Employees want to believe that they are compensated as a result of their performance, a reward which they desire.

The concept of social justice is very helpful in understanding behavioral characteristics. It has been discovered that assessments of the suitability of group processes and results have an impact on both individual and systemic elements, including overall performance, organizational commitment, cooperative behavior, outcome satisfaction, and faith in authority [3]. Three different aspects of justice—interactional, distributive, and procedural—have been used to conceive organizational justice in the published literature. The concept of interactional justice pertains to how employees view the fairness and quality of their interactions with decision-makers, including how well they are treated and whether that treatment is with dignity and respect [4].

Distributive justice, on the other hand, refers to the fairness of decision-making outcomes [5,6], whereas procedural justice concerns workers' perceptions related to the decision-making procedures used to determine the distribution of the outcomes [2,6,7]. According to Colquitt, Greenberg, and Zapata-Phelan, scientific interest in organizational justice can be divided into four main waves of research and theory development, and the period from 1950 to 1970 can be referred to as the distributive justice wave [8,9]. In an organizational setting, perceptions of distributive injustice have been associated with poorer performance, decreased commitment, and increased withdrawal [10,11].

1.2. Likert Scale

The popular psychometric Likert scale, used in the social sciences to measure respondents' attitudes with survey questions, was first proposed by the American social psychologist Likert in 1932. This scale asks participants to indicate their levels of agreement through questions. For example, for a 5-point Likert scale, agreement levels are evaluated by the integer values 1 (strongly disagree) to 5 (strongly agree), and the results are obtained by taking the sum or average of each participant's scores [12].

Likert scales are widely used because they are easy to administer, score, and understand. Additionally, researchers can collect large amounts of effective and inexpensive data in less time and conduct analyses using easy mathematical calculations. Moreover, it is a suitable method for making statistical inferences with good reliability, producing appropriate results.

Although the Likert scale is useful, it also has several disadvantages, such as uncertainty regarding whether responses and measured data should be on an ordinal or interval level. It is assumed that the Likert method has the characteristics of an interval scale [12]. However, many argue that the Likert scale is ordinal [13,14]. An interval scale dictates that there must be an equal interval between any two consecutive scales. For example, for a 5-point Likert scale, each level of agreement is expressed as follows: 1 = "strongly disagree"; 2 = "disagree"; 3 = "neutral"; 4 = "agree"; and 5 = "strongly agree". Here, although the emotional intensity between "strongly disagree" and "disagree" is considered to be equivalent to the emotional intensity between other consecutive categories, participants may not understand the distances between two points of the scale as equal [15]. In this case, this scale will fail to measure actual responses.

When responding to a question on a Likert-type scale, participants must transform their feelings and thoughts into a linguistic expression that is coded with natural numbers and characterized by a ranking order, which can result in information loss, uncertainty, and inaccuracy [16]. Furthermore, the fact that participants' replies may be influenced by earlier questions and their tendency to avoid selecting extreme possibilities on the scale both pose issues.

Because of the difficulties and uncertainties mentioned above, it was thought that the Likert scale may not be the best scale to measure the level of importance among various attributes. Therefore, this has led many researchers to propose different types of scales. In one study, to obtain superior measurements, a neutrosophic approach based on fuzzy set theory was used as an alternative to the Likert scale. Between November and December

2022, a survey was conducted among 1160 young clinical nurses from five hospitals in China's Henan province to investigate the effect of organizational justice on young nurses' turnover intention. The organizational justice scale, turnover intention scale, organizational climate scale, and emotional labor scale were used. The organizational justice scale was scored on a 5-point Likert scale (1 = "strongly disagree"; 2 = "disagree"; 3 = "undecided"; 4 = "agree"; and 5 = "strongly agree"). It was concluded that organizational justice had a significant effect on turnover intentions among the young nurses through the chain mediation of organizational climate and emotional labor [17].

In addition, a survey was conducted with 400 employees to investigate the relationship and impact of organizational justice on employee creativity through the mediating role of leadership styles for academics and staff at Dhofar University in Oman. All items were rated on a 5-point Likert scale. Organizational justice was discussed along the following four dimensions: distributive, procedural, interpersonal, and informational. The results revealed that organizational justice had a positive and significant impact on the distributive, interpersonal, and informational dimensions of employee creativity, whereas procedural justice had a negative and significant impact on employee creativity [18]. Aiming to examine the relationship between organizational justice (procedural, distributive, informational, and interpersonal justice) and organizational citizenship behavior, a survey was administered to 121 faculty members working in ten private universities in Bangladesh. The participants were required to respond to all items using a 5-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The study also provided the necessary guidelines on ways organizations can increase citizenship behavior, with an emphasis on fairness and inclusion in the workplace [19].

To develop a strategy to improve the working conditions of nurses in Japan, a survey was administered to nurses using a 5-point Likert scale (1 = "strongly disagree"; 2 = "disagree"; 3 = "undecided"; 4 = "agree"; and 5 = "strongly agree") using three scales: ease of work and organizational justice; organizational citizenship behavior; and job satisfaction. A significant positive correlation between interactional justice and job satisfaction was reported fairly consistently [20]. To determine the effects of organizational support and organizational justice, a survey was applied to trainees in Basque cuisine during the 2022–2023 academic year. In the study, a 7-point Likert-type scale was used. It was concluded that organizational support and organizational justice structures positively affected the happiness parameter at work [21].

In another study, a survey was administered to employees in various sectors in China, including manufacturing, construction, finance, information technology services, and wholesale and retail sectors, to examine the effects of information justice on employees' retention of information through organizational identification and to investigate how justice sensitivity moderates these effects. In this context, informational justice, justice sensitivity, organizational identity, and information hiding scales were used. All items forming the scale were evaluated using a 5-point Likert scale [22]. To show the importance of organizational justice and citizenship behavior in employees' compliance behaviors toward ISPs (information security policies), a survey was conducted on IS users in public and private banks in Ethiopia. A 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree") was used for all measurements in the study. Additionally, an empirical determination was made regarding the mediating role of organizational citizenship behavior between the dimensions of organizational justice and willingness to comply with ISPs [23].

To understand the antecedents of organizational justice, the authors of a previous study conducted a national survey of library employees and compared the predictive power of perceived organizational support, job autonomy, job feedback, and job stress. Organizational justice consisted of four subdimensions: distributive justice (four items), procedural justice (seven items), interpersonal justice (four items), and informational justice (five items). Responses were received from the participants to each statement on a 5-point Likert scale (1 = "strongly disagree"; 2 = "disagree"; 3 = "undecided"; 4 = "agree"; and

5 = "strongly agree"). As a result, they found that providing meaningful and timely work feedback, as well as strengthening perceptions of institutional support and autonomy, can be effective in increasing librarians' overall perceptions of fairness [24]. A survey was conducted to determine the impact on the innovative work behavior of employees operating in the Chinese telecommunication industry. Distributive, procedural, and interactional justice items, representing three subdimensions of organizational justice, were included in a 5-point Likert scale (1 = "strongly disagree"; 2 = "disagree"; 3 = "undecided"; 4 = "agree"; 5 = "strongly agree"). The study concluded that organizational justice has a significant and positive effect on employees' innovative work behaviors and knowledge sharing [25].

The "Fair Learning Environment Scale", which was developed by Özer and Demirtaş (2010) [26] and Lizzio, Wilson, and Hadaway (2007) [27], was used in a Turkish validity and reliability study. The Kaiser–Meyer–Olkin (KMO) value of the scale was determined to be 0.83 by Özer and Demirtaş (2010) [26], and the internal consistency coefficient was determined to be 0.87 for the total scale. A scale with ten questions measuring distributive justice, which consisted of two subdimensions, distributive and procedural, was used.

In the study, several one-sample *t*-tests were conducted, confirming their significant influence on the effectiveness of industrial parks in Iran. The Kruskal–Wallis statistical test was used to prioritize the factors. Furthermore, the Weighted Aggregates Sum Product Assessment (WASPAS), a multi-criteria decision-making method, was employed to rank 15 industrial parks in the Khorasan province of Iran based on the identified factors. It was concluded that the infrastructure facilities factor has the highest priority in influencing the effectiveness of industrial parks [28]. In order to evaluate the efficiency of academic disciplines, a prioritization scale was introduced to rank evaluation factors. Undergraduate programs at Yazd University in Iran were prioritized based on specific factors. These key factors were subsequently weighted and ranked utilizing pairwise comparison (PC) and Analytic Hierarchy Process (AHP) methods. The study findings indicated that the employment rate, the vision of Yazd Province, and the entrance exam scores of incoming students were the most significant factors [29].

This study aimed to explore and prioritize the barriers to tourism growth in rural India by collecting qualitative and quantitative responses from 16 tourism and hospitality management experts from central India. To achieve this goal, interpretive structural modeling (ISM) and decision-making trial and evaluation laboratory (DEMATEL), which are multi-criteria decision-making (MCDM) methods, were integrated [30]. A questionnaire was conducted using a fuzzy Likert scale to evaluate the viewpoints of 24 chicken meat store managers in Arak city. Fuzzy set theory and fuzzy decision-making techniques were employed to rank the six suppliers under investigation. Following the analysis, it was concluded that Dorsa Chicken Company (Supplier 6) exhibited the highest performance, while Fakhrar Company (Supplier 2) demonstrated the lowest performance [31]. In this study, a hybrid fuzzy multi-criteria decision-making approach was employed in the Tehran construction industry, comprising two stages. Initially, the enhanced fuzzy Delphi method was utilized to refine the identified factors, followed by the application of the cybernetic parsimonious fuzzy analytic hierarchy process to prioritize these factors. The study identified "on-site sorting, reuse, and recycling of waste materials", "various procurement models", and "effective implementation of waste management regulations and plans" as the most critical factors [32]. This study aimed to explore distance education alternatives and assess their impact on students' academic performance and attendance. To determine the most suitable options, the study combined the results of the weighted sum method (WSM), weighted product method (WPM), and analytical hierarchy process (AHP), which are widely used multi-criteria decision-making (MCDM) techniques. The findings indicated that a participatory learning environment enhances students' attention, fosters meaningful learning experiences, facilitates high levels of student achievement, and cultivates higher-order critical thinking skills [33].

In this research, the factors determining turnover intention, organizational justice and nursing core competencies of nurses working in tertiary and general hospitals in

South Korea were examined. Organizational justice was assessed using the Justice Scale and nursing core competence was assessed using the Korean Nursing Core Competency Scale. Data collected using online questionnaires were evaluated by multiple regression analysis. They concluded that the way organizational justice type influences turnover intention varies according to clinical experience [34]. In another study, cluster, factor, and item network analyses were used to determine the optimal mathematical design of the Bean Counter Profiling Scale. In addition, a hierarchical clustering analysis using the uncontrolled fuzzy c-means method, an exploratory factor analysis, and item network analysis methods were also applied. A six-element structural architecture of the 68 items of the Bean Counter Profiling Scale was revealed as a result of all statistical techniques used [35].

This study explored the impact of transactional and transformational leadership, along with factors derived from equity theory and goal-setting theory, such as distributive justice and goal clarity, on organizational citizenship behavior (OCB). The research utilized survey data collected from 4133 public employees across central and local governments in Korea, which were analyzed using ordinary least squares regression models. As a result, a negative relationship was observed between distributive justice and OCB, while a positive relationship was observed between goal clarity and OCB [36]. This research examined the effects of COVID-19 layoffs on global hospitality giants like Airbnb. The crisis had underscored issues such as organizational justice, employee satisfaction, and management trust. Throughout the research process, detailed interviews were conducted with laid-off employees, revealing that even during the crisis, empathetic and proactive practices maintained laid-off employees' perceptions of justice. Furthermore, it was emphasized that negative effects can be mitigated through careful practices, highlighting the importance of organizational justice during times of crisis [37].

1.3. Neutrosophy and Neutrosophic Set

Neutrosophy [38] is a philosophical and mathematical framework developed by Florentin Smarandache in the late 20th century. It deals with problems and concepts that involve indeterminacy, ambiguity, and contradictions. Neutrosophic logic extends classical, fuzzy, and intuitionistic fuzzy logic, representing indeterminate, contradictory, and ambiguous information. In classical logic, statements are either true or false, whereas in neutrosophic logic, statements can be true, false, and indeterminate simultaneously. This allows for a more nuanced and flexible approach to reasoning.

Neutrosophic set theory extends the classical, fuzzy, and intuitionistic fuzzy set theories to include sets with indeterminate or uncertain elements. An element in classical set theory is either a member of a set or not. Within the framework of neutrosophic set theory, an element can have varying degrees of membership in a set or have no degree of membership in the set.

The classical theory of probability is extended by neutrophilic probability to handle unpredictable and uncertain occurrences, and events have clearly defined probabilities between 0 and 1. Events in neutrosophic probability can be correlated with degrees of truth, falsehood, and indeterminacy, enabling a more thorough representation of uncertainty. Neutrosophy has found applications in various fields, including artificial intelligence [39], decision-making [40–42], information fusion [43], and risk analysis [44], in which handling uncertainty and ambiguity is essential. It provides a formal framework for dealing with situations in which classical logic and probability theory may need to be revised because of contradictory or indeterminate information. The membership of elements in a set is interpreted in binary terms according to a binary case. In fuzzy set theory, introduced by Zadeh [45], a gradual assessment of the membership of elements in a set is permitted by a membership function that takes values in the real unit interval [0, 1]. Classical binary sets are usually called crisp sets in fuzzy set theory, which is a generalization of the classical set theory.

Intuitionistic fuzzy sets are those whose elements have degrees of membership and nonmembership. The intuitionistic fuzzy set was introduced by Atanassov [46] as an extension of the notion of the fuzzy set, which itself extends the classical notion of a set. Elegant generalizations of intuitionistic fuzzy sets, classical sets, fuzzy sets, dialetheist sets, paradoxist sets, tautological sets, and intuitionistic fuzzy sets based on neutrosophy are provided using neutrosophic set theory [38]. When an element x(T,I,F) has a degree of $T \in [0, 1]$, it is true in the set; when it has a degree of $I \in [0, 1]$, it is indeterminate; and when it has a degree of $F \in [0, 1]$, it is false. Next, we present basic definitions and concepts concerning single-valued neutrosophic sets, fuzzy sets, and intuitionistic fuzzy sets.

Definition 1 ([45]). *A fuzzy set X in U is a set of ordered pairs, defined as* $X = \{(x, \ _X(x))|x \in U\}$, *where* $_X : U \to [0, 1]$ *is termed the membership function of X, and* $_X(x)$ *is the degree of membership of the element x in X given a universal set U and a generic element, represented by x.*

Definition 2 ([46]). *An intuitionistic fuzzy set X exists over a discourse-level world. The representation of U is given by* $X = \{(x, \ _X(x), \ \nu_X(x))|x \in U\}$, *where the terms "membership function of X" and "non-membership function of X" for x in X are, respectively,* $_X : U \to [0, 1]$ *and* $\nu_X : U \to [0, 1]$. *The formula for determining the degree of nonmembership of an element, x, in X is* $_X(x) + \nu_X(x) \leq 1$. *The hesitation degree of an element x is defined by* $\pi_X(x) = 1 - (_X(x) + \nu_X(x))$.

Definition 3 ([38,47]). *Let U be a discourse universe.* $N = \{(x, \ T(x), \ I(x), \ F(x)) : x \in U\}$ *is a neutrosophic set, denoted by a truth-membership function,* $TN : U$ ß$]-0, 1+[$*; an indeterminacy-membership function,* $IN : U$ ß$]-0, 1+[$*; and a falsity-membership function,* $FN : U$ ß$]-0, 1+[$.

Definition 4 ([47]). *Let U be a discourse universe. A single-valued neutrosophic set is defined as* $N = \{(x, \ T(x), \ I(x), \ F(x)) : x \in U\}$, *which is identified by a truth-membership function,* $T_N : U \to [0, 1]$*; indeterminacy-membership function,* $I_N : U \to [0, 1]$*; and falsity-membership function,* $F_N : U \to [0, 1]$, *with* $0 \leq T_N(x) + I_N(x) + F_N(x) \leq 3$.

1.4. Neutrosophy in Social Sciences

Neutrosophic sociology (or neutrosociology) is defined, by Smarandache [48], as the study of sociology using neutrosophic scientific methods. The questionnaire is regarded as a highly important instrument in a survey [49] measuring the opinions of social groupings. Although it has been established that fuzzy replies to survey questions are more suitable than crisp responses, there may be indeterminacy; thus, fuzzy processing may not precisely capture the notion that a responder wishes to communicate, owing to doubts, confusion, and hazy thinking, etc. Modeling such a scenario using neutrosophic sets offers responders a wider variety of possible replies, making it more relevant.

In this study, we present a method for developing single-valued neutrosophic sets from questionnaires applied to social groups. The study in [50] defined, illustrated, and proposed neutrosophic statistical approaches for use in the social sciences. Often, data presented in social sciences research have discrepancies owing to mistakes, conflicting information and sources of knowledge, lack of impartiality, and other causes. As a result, the authors state that, in some circumstances, data in the form of intervals may be required.

1.5. Neutrosophic Score Function

Martinez et al. [49] used a score function ($s : [0, 1] \to [0, 3], \ s(a) = 2 + T - I - F$) to measure neutrosophic values and compare them with each other in a social sciences-based approach. However, we focus on interpreting the measurement of the effects of group decision-making on social choices, and this score function was not used in a study employing a Likert-type scale. The score function was used for the first time with a Likert scale [49], showing that it can be used safely in the social sciences. The function $s(a) = (1 + T - 2I - F)/2$, found in [51], was used in this study; we evaluated it to be

appropriate for taking into account the negative, neutral, and positive effects by spreading the score values to the $[-1, 1]$ range in keeping with the nature of neutrosophic research.

1.6. Neutrosophic Likert Scale

A neutrosophic Likert scale was applied for the first time in [52]. Classical satisfaction with life-scale Likert questions were transformed to numerical values between 0 and 100, as it was expected that participants would be able to respond with the following options: "I agree with this statement (. . .)", "I am neutral (or undetermined) about this statement (. . .)", and "I disagree with this statement (. . .)". The results of the study show that the neutrosophic scale is reliable, which also supports the reliability of the classical scale because the Cronbach's alpha constant was at an acceptable level for the three dimensions.

In the current study, transformations were performed within a framework of direct percentages to achieve an effect closer to natural language. There is a connection between fuzzy sets and neutrosophic Likert scales in the way they handle imprecision and uncertainty. Neutrosophic sets and, thus, neutrosophic Likert scales enable an even broader representation that incorporates indeterminacy as a core component, whereas fuzzy sets enable the representation and manipulation of data that are not exactly specified. For survey responses in which participants' opinions not only vary across a spectrum (as accommodated by fuzzy sets) but also may include a degree of indecision or neutrality that is difficult to capture using traditional fuzzy logic or crisp Likert scales, neutrosophic Likert scales are, therefore, particularly well suited.

1.7. Correlation Analysis

Correlation analysis is a basic statistical method used to measure the strength and direction of a relationship between two variables, and it is widely used in various fields, including the social sciences, economics, biology, and finance. Pearson correlation and Spearman correlation are two common methods used to measure the strength and direction of an association between two variables.

The Pearson correlation coefficient (r) measures the linear relationship between two continuous variables, and it assumes that the variables are normally distributed and have a linear relationship.

The Spearman correlation coefficient measures the strength and direction of an association between two variables, but it does not require the variables to be linearly related. Spearman correlation is appropriate when relationships among variables are nonlinear or the data are ordinal or non-normally distributed.

Both Pearson and Spearman correlation coefficients range from -1 to 1, where values closer to 1 or -1 indicate a stronger relationship between the variables, whereas values closer to 0 indicate a weaker relationship.

1.8. Paired Samples t-Test

The paired samples *t*-test, also known as the dependent samples *t*-test, is a statistical method used to compare the means of two related samples. Each observation in one sample is paired with an observation in the other sample. The paired samples *t*-test, like most statistical procedures, uses the null hypothesis and alternative hypothesis. The null hypothesis states that there is no difference between the mean values of the two paired data sets. The alternative hypothesis states that there is a statistically significant difference between the mean values of the two paired data sets.

1.9. ANOVA

ANOVA, or analysis of variance, is a statistical method used to analyze the differences among group means in a sample. It assesses whether the means of two or more groups are statistically significantly different from each other. ANOVA is a powerful tool for understanding group differences and identifying factors that contribute to variability. There are several types of ANOVA, including the following.

One-way ANOVA is a statistical test used to determine whether any statistically significant differences exist among the means of three or more independent groups.

Two-way ANOVA is an extension of the one-way ANOVA and is used in the case of two independent variables (i.e., factors) to study the interaction effect between them on a continuous dependent variable. It allows for examining whether the effect of one independent variable on the dependent variable is contingent on the level of another independent variable, as well as the main effects of each independent variable.

In summary, ANOVA is a versatile statistical method used to compare means across different groups or conditions, and the specific type of ANOVA chosen depends on the design of the study and the number of independent variables involved.

2. Data and Likert Questionnaires

The questionnaires were designed and implemented using Google Forms, which is an effective data collection tool. In the data collection step, the number of participants determined for inclusion in the survey was 119, according to G*Power 3.1.9.4 software. Additionally, a 10-question survey was administered to 126 university students, 10 of whom were selected to aid in determining the attitude of the 5-point Likert scale (1 = "strongly disagree", . . ., 5 = "strongly agree"), as shown in Table 1.

Table 1. Likert scale questions (answers must be filled in as a check mark for a single option).

Questions	Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
Staff at this school care about students' opinions.	☑	☐	☐	☐	☐
Students' opinions and needs are taken into consideration when making decisions.	☐	☐	☐	☐	☑
Students' rights are important to university staff.	☑	☐	☐	☐	☐
Staff at the university ask students for their ideas on how things could be improved.	☐	☑	☐	☐	☐
When staff make a mistake, they apologize to students.	☐	☐	☑	☐	☐
Staff listen to students' concerns and problems.	☐	☐	☐	☐	☑
Rules and procedures are applied consistently and fairly to all students.	☐	☐	☐	☑	☐
Students' suggestions are ignored or not taken seriously.	☐	☐	☑	☐	☐
Students are evaluated according to clear and objective criteria.	☐	☐	☐	☐	☑
Assessment methods give students a fair opportunity to demonstrate their mastery.	☐	☐	☐	☐	☑

The participants completed the survey by marking only one of these five agreement values. The research data can be accessed from the following link: https://osf.io/xd4t7 (accessed on 28 January 2024).

The neutrosophic scale (a: degree of agreement; b: degree of indeterminacy; c: degree of disagreement) was applied toward measuring organizational justice. These selected questions are shown in Table 2. Survey participants (the same participants previously

surveyed, as shown in Table 1) selected a, b, c, and one percentile value each. According to the single-valued neutrosophic set approach, the sum of the percentiles (% values) of a + b + c was between 0 and 300; then, we took one percent of these percentage values and mapped them to the closed interval [0, 1].

Table 2. Neutrosophic scale questions (answers are to be filled out as percentages).

Questions	Agreement Degree	Indeterminacy Degree (Neither Agree Nor Disagree)	Disagreement Degree
Staff at this school care about students' opinions.	50	50	50
Students' opinions and needs are taken into consideration when making decisions.	10	20	30
Students' rights are important to university staff.	100	30	0
Staff at the university ask students for their ideas on how things could be improved.	0	5	75
When staff make a mistake, they apologize to students.	50	30	20
Staff listen to students' concerns and problems.	90	40	45
Rules and procedures are applied consistently and fairly to all students.	30	0	45
Students' suggestions are ignored or not taken seriously.	60	45	40
Students are evaluated according to clear and objective criteria.	30	70	100
Assessment methods give students a fair opportunity to demonstrate their mastery.	50	50	25

Table 3 shows the profile information of the survey participants.

Table 3. Profile information of the survey respondents (N = 126).

Variables	Categories	Number of Cases	Percentage (%)
Gender	Female	82	65.08
	Male	44	34.92
Age	18–21	45	35.71
	22–24	47	37.30
	25–30	24	19.05
	31–40	5	3.97
	41+	5	3.97
Faculty	Vocational School of Hizan	39	30.95
	Vocational School of Health Services	19	15.08
	School of Physical Education and Sports	10	7.94
	Vocational School of Tatvan	8	6.35
	Faculty of Science and Letters	18	14.29
	Faculty of Fine Arts	4	3.17
	Faculty of Health Sciences	7	5.55
	Vocational School of Güroymak	5	3.97
	Faculty of Islamic Sciences	16	12.70
Marital status	Married	9	92.86
	Single	117	7.14

The answers provided by the participants using the Likert and neutrosophic scales are presented in the tables below (Tables 4–7).

Table 4. Responses given by the participants on a Likert scale.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Strongly disagree	10	14	10	12	19	15	19	24	12	10
Disagree	14	24	23	28	20	12	18	31	23	18
Neither agree nor disagree	34	17	21	26	27	26	22	23	22	32
Agree	38	43	43	37	39	45	40	38	55	48
Strongly agree	30	28	29	23	21	28	27	10	14	18

Table 5. Participants' answers on a neutrosophic scale.

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Disagree	15	15	15	18	19	19	13	22	14	17
Neither agree nor disagree	68	65	64	67	62	53	64	73	66	57
Agree	43	46	47	41	45	54	49	31	46	52

Table 6. Likert scale responses to all questions.

	All Questions
Strongly disagree	12
Disagree	21
Neither agree nor disagree	28
Agree	41
Strongly agree	24

Table 7. Neutrosophic scale answers to all questions.

	All Questions
Disagree	9
Neither agree nor disagree	76
Agree	41

Agree and strongly agree, measured on a 1-point Likert scale, ultimately indicate agreement and are selected at a much higher rate than that of agree neutrosophically. Disagree and strongly disagree, measured on a 2-point Likert scale, ultimately represent disagreement and are selected at a much higher rate than that of disagree neutrosophically. Examining the undecided answers used in both scales, it can be seen that the number of undecideds measured using the neutrosophic scale (76) was much higher than the Likert scale (28). In this situation, some of those who answered "agree" strongly agree, and some are close to undecided; some who answered "disagree" strongly disagree, and some are close to undecided. However, a single option does not provide clarity in decision-making and, on the other hand, the answers received are neutrosophic. This can be explained by the fact that it provides a clearer result by expressing freer thinking and the weight of each option.

3. Statistical Analysis

Data analyses were performed with SPSS 26.0 (IBM Corp., Armonk, NY, USA) and MATLAB R2015a software, and an alpha level of 0.05 was considered statistically significant. Exploratory factor analysis (EFA) is a statistical technique widely used to identify the underlying structure of a set of variables and to reduce the complexity of data by identifying meaningful dimensions. An exploratory factor analysis was conducted to reveal the structure of the factors of the Likert and neutrosophic scales for measuring organizational justice. Two tests were applied to the suitability of the scales for an exploratory factor analysis. Firstly, the Kaiser–Meyer–Olkin (KMO) values were calculated as 0.936 and

0.928, respectively; values greater than 0.60 are considered adequate for exploratory factor analysis. Secondly, the results of the Bartlett's test for the Likert scale and neutrosophic scale were $x^2 = 1019.885$ ($p < 0.05$) and $x^2 = 840.290$ ($p < 0.05$), respectively. The findings indicate that the correlations among the items are large enough for an exploratory factor analysis.

As a result of the exploratory factor analysis, it was determined that the Likert scale and the neutrosophic scale, both consisting of 10 items, explained 65.277% and 61.287% of the total variance, respectively. Accordingly, it was concluded that the Likert scale and the neutrosophic scale were valid, suggesting that a single component (a unidimensional construct) was sufficient for both scales, as shown in Figures 1 and 2.

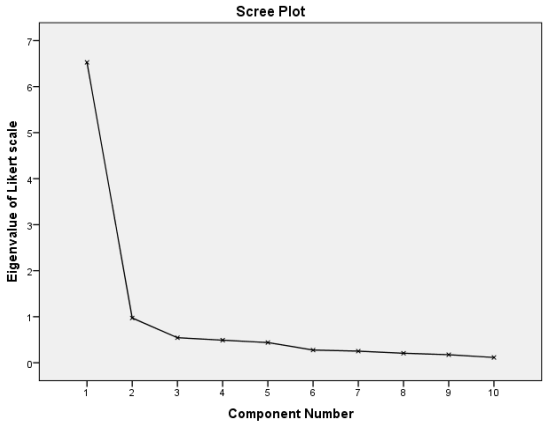

Figure 1. The scree plot of Likert scale by factor analysis.

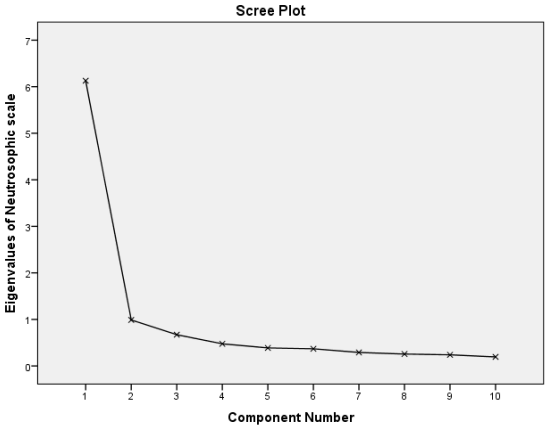

Figure 2. The scree plot of neutrosophic scale by factor analysis.

The descriptive statistics of 126 participants calculated to measure organizational justice using both scales are presented in Table 8.

In terms of descriptive statistics, because the Likert scale took values in the range [1, 5] separately and once, the mean was 33.024, and because the neutrosophic scale took values in the range [−1, 1], the mean was 1.977. Furthermore, the Likert scale's variance was 98.311, whereas the neutrosophic scale's variance was 13.632, showing that the neutrosophic scale's arithmetic mean and standard deviation were smaller. The two scales' standard errors of skewness and kurtosis were the same. Skewness and kurtosis are statistical measures that describe the shape of a distribution. The fact that the standard errors of skewness and kurtosis of the two different scales were the same indicates that the variability in the estimated skewness and kurtosis values is consistent among them.

Table 8. Descriptive statistics.

	Likert Scale	Neutrosophic Scale
Mean	33.024	1.977
Median	36.000	1.200
Mode	46.000	−3.680
Std. deviation	9.915	3.692
Variance	98.311	13.632
Skewness	−0.475	0.037
Std. error of skewness	0.216	0.216
Kurtosis	−0.701	−0.593
Std. error of kurtosis	0.428	0.428
Range	37.000	17.165
Minimum	11.000	−7.710
Maximum	48.000	9.455

Table 9 shows that the data measured using the Likert scale and those measured with the neutrosophic scale have a distribution that differs from normal at a 0.05 level of statistical significance. Additionally, according to the results of the Kolmogorov–Smirnov normality test, the Likert scale and the neutrosophic scale are not suitable for a normal distribution. However, especially in studies in the social sciences, skewness and kurtosis values can be useful in making statistical inferences about the underlying distributions of the data in scales. Skewness and kurtosis values of ±1.0 are considered excellent for most psychometric purposes [53]. In this case, because the skewness and kurtosis values of both scales were ±1.0, a parametric analysis was performed, accepting that they were suitable for a normal distribution.

Table 9. Normal distribution testing using the Kolmogorov–Smirnov test.

	Kolmogorov–Smirnov		
	Statistic	**Df**	**Sig.**
Likert scale	0.126	126	0.000
Neutrosophic scale	0.109	126	0.001

Cronbach's alpha was applied to determine the reliability of the scales [54]. Examining the results (Table 10), the scores obtained with the neutrosophic scale are also highly reliable, as with the Likert scale.

Table 10. Cronbach's alpha coefficient.

Cronbach's Alpha Constant	Variables
0.924	SCORE1, SCORE2, SCORE3, SCORE4, SCORE5, SCORE6, SCORE7, SCORE8, SCORE9, SCORE10
0.894	VAR1a, VAR2a, VAR3a, VAR4a, VAR5a, VAR6a, VAR7a, VAR8a, VAR9a, VAR10a
0.922	VAR1b, VAR2b, VAR3b, VAR4b, VAR5b, VAR6b, VAR7b, VAR8b, VAR9b, VAR10b
0.900	VAR1c, VAR2c, VAR3c, VAR4c, VAR5c, VAR6c, VAR7c, VAR8c, VAR9c, VAR10c
0.933	VAR1, VAR2, VAR3, VAR4, VAR5, VAR6, VAR7, VAR8, VAR9, VAR10

According to the results of the neural network analysis of the two scales in Table 11, Score1 made the least contribution to the classical variable at 16.2%, while Score8 contributed the most at 100.0%.

Table 11. Independent variable importance.

	Importance	Normalized Importance
Score1	0.026	16.2%
Score2	0.077	47.6%
Score3	0.078	48.2%
Score4	0.096	59.7%
Score5	0.113	70.3%
Score6	0.037	23.1%
Score7	0.123	76.2%
Score8	0.161	100.0%
Score9	0.134	83.4%
Score10	0.155	96.2%

According to the Spearman's rho correlation coefficient in Table 12, there is a significant positive correlation between the Likert scale and neutrosophic scale in general, depending on the agree option (except for question 8). On the other hand, because the eighth question is reverse-coded, there is a negative relationship between the Likert scale and neutrosophic scale in terms of the agree option.

Table 12. Correlation among classical items, neutrosophic items, and scores.

		VAR1a	**VAR1b**	**VAR1c**	**Score1**
VAR1	Correlation Coefficient	0.542 **	0.131	−0.069	0.132
	p	0.000	0.144	0.442	0.139
	N	126	126	126	126
		VAR2a	**VAR2b**	**VAR2c**	**Score2**
VAR2	Correlation Coefficient	0.626 **	0.131	−0.161	0.229 **
	p	0.000	0.144	0.072	0.010
	N	126	126	126	126
		VAR3a	**VAR3b**	**VAR3c**	**Score3**
VAR3	Correlation Coefficient	0.540 **	0.021	−0.219 *	0.268 **
	p	0.000	0.817	0.014	0.002
	N	126	126	126	126
		VAR4a	**VAR4b**	**VAR4c**	**Score4**
VAR4	Correlation Coefficient	0.649 **	0.047	−0.296 **	0.280 **
	p	0.000	0.597	0.001	0.001
	N	126	126	126	126
		VAR5a	**VAR5b**	**VAR5c**	**Score5**
VAR5	Correlation Coefficient	0.599 **	−0.024	−0.232 **	0.282 **
	p	0.000	0.789	0.009	0.001
	N	126	126	126	126
		VAR6a	**VAR6b**	**VAR6c**	**Score6**
VAR6	Correlation Coefficient	0.423 **	−0.033	−0.187 *	0.165
	p	0.000	0.717	0.036	0.064
	N	126	126	126	126

Table 12. *Cont.*

		VAR7a	**VAR7b**	**VAR7c**	**Score7**
VAR7	Correlation Coefficient	0.517 **	−0.120	−0.308 **	0.347 **
	p	0.000	0.182	0.000	0.000
	N	126	126	126	126
		VAR8a	**VAR8b**	**VAR8c**	**Score8**
VAR8	Correlation Coefficient	−0.299 **	−0.244 **	0.334 **	−0.047
	p	0.001	0.006	0.000	0.605
	N	126	126	126	126
		VAR9a	**VAR9b**	**VAR9c**	**Score9**
VAR9	Correlation Coefficient	0.334 **	0.021	−0.252 **	0.215 *
	p	0.000	0.812	0.004	0.016
	N	126	126	126	126
		VAR10a	**VAR10b**	**VAR10c**	**Score10**
VAR10	Correlation Coefficient	0.590 **	0.027	−0.153	0.260 **
	p	0.000	0.764	0.088	0.003
	N	126	126	126	126

** Correlation is significant at the 0.01 level. * Correlation is significant at the 0.05 level.

According to the Likert scale, the mean value of the students' perceptions of fairness in the learning environment was found to be 3.302, and this mean value is considered as mid-level. Therefore, it can be concluded that the students mostly preferred to agree. Analyzing the questions as neutrosophic, it is supported by the positive correlation obtained that they give higher scores to the agree option. Likewise, the positive correlation of the scores obtained with the neutrosophic scale supports this outcome.

According to Table 13, there is a mid-level positive (r = 0.302) and statistically significant ($p < 0.05$) relationship between the Likert scale and neutrosophic scale.

Table 13. Correlation between neutrosophic scale and Likert scale.

		Likert Scale
Neutrosophic scale	Pearson Correlation (r)	0.302
	p	0.001
	N	126

A paired samples *t*-test was conducted to evaluate whether a statistically significant difference existed between the mean Likert scale and neutrosophic scale. That is, this test was used to examine the means of two different methods on the same survey group. As can be seen in Table 14, the results of the paired samples *t*-test were significant, t(125) = 36.763, $p < 0.05$, indicating that there was a significant difference in the Likert scale (M = 33.024, SD = 9.915, $n = 126$) compared to the neutrosophic scale (M = 1.977, SD = 3.692, $n = 126$). According to Cohen's rules, the effect size was very large [54]. The mean difference was 31.047, with the 95% confidence interval for the difference between the means of 29.376 and 32.718. The null hypothesis was rejected.

Table 14. Paired samples *t*-test results for the Likert and neutrosophic scales.

		Mean	SD	T	Df	*p*	d
Pair 1	Likert scale–Neutrosophic scale	31.047	9.480	36.763	125	0.000	3.275

d = Effect size.

The attitude toward organizational justice, as measured using the Likert scale and neutrosophic scale, is shown in Table 15 (Table 7 in [55]).

Table 15. Population mean and standard deviation of attitudes toward organizational justice measured using the Likert scale and neutrosophic scale.

Item	Likert Scale		Neutrosophic Scale	
	μ	σ	μ	σ
Staff at this school care about students' opinions.	3.508	1.198	0.187	0.45
Students' opinions and needs are taken into consideration when making decisions.	3.373	1.319	160	0.437
Students' rights are important to university staff.	3.46	1.25	0.236	0.477
Staff at the university ask students for their ideas on how things could be improved.	3.246	1.257	0.148	0.476
When staff make a mistake, they apologize to students.	3.183	1.311	0.193	0.517
Staff listen to students' concerns and problems.	3.468	1.269	0.278	0.515
Rules and procedures are applied consistently and fairly to all students.	3.302	1.358	0.217	0.499
Students' suggestions are ignored or not taken seriously.	2.833	1.27	0.074	0.448
Students are evaluated according to clear and objective criteria.	3.286	1.172	0.229	0.477
Assessment methods give students a fair opportunity to demonstrate their mastery.	3.365	1.136	0.255	0.49

In Table 15, the arithmetic mean (μ) and standard deviation (σ) are presented for the Likert and neutrosophic scales. The arithmetic mean is the most commonly used measure of central tendency. Measures of central tendency are the values around which data tend to cluster in the distribution of a data group and which summarize the data group. The measure of the central tendency does not provide information about the distribution of the data. In this case, measures of dispersion were used.

The most commonly used measure of dispersion is the standard deviation, which measures the variation, or dispersion, of a data set, and a low standard deviation denotes that the data points tend to be close to the mean, whereas a high standard deviation denotes that the data span a wide interval of values. In this case, for the neutrosophic scale, it tended to spread in a narrower interval and close to the mean.

As can be seen in Table 16, A nine (faculty type) X five (age) one-way ANOVA was applied to investigate the single effect. The effect of faculty type on the Likert scale was not statistically significant ($F = 0.744$, $p > 0.05$). On the other hand, the effect of age group on the Likert scale was found to be statistically significant ($F = 2.674$, $p < 0.05$). The difference between the averages of students in the 18–21 age group and the averages of students in the 25–30 age group was found to be statistically significant ($p < 0.05$). At the same time, a significant difference was found between the averages of students in the 22–24 age group and the 25–30 age group. The Likert scale score of students in the 25–30 age group ($M = 38.08$) is higher than that of students in the 18–21 ($M = 31.02$) and 22–24 age groups ($M = 31.80$).

Table 16. One-way ANOVA results for the Likert and neutrosophic scales.

Scale	Effect	Mean Square	F	Significance Level
Likert scale	Faculty	74.340	0.744	0.653
	Age	249.510	2.674	0.035
Neutrosophic scale	Faculty	19.558	1.479	0.172
	Age	17.817	1.320	0.266

The effect of faculty type (F = 1.479, $p > 0.05$) and age group (F = 1.320, $p > 0.05$) on the neutrosophic scale was not found to be statistically significant.

As can be seen in Table 17, Nine (faculty type) X two (gender), nine (faculty type) X five (age), and two (gender) X five (age) two-way ANOVAs were conducted to investigate the single effects and interaction effects of faculty and gender, faculty and age, and gender and age. The individual effects of faculty type (F = 1.231, $p > 0.05$) and gender (F = 2.370, $p > 0.05$) on the Likert scale were statistically insignificant. At the same time, the interaction effect of faculty type and gender on the Likert scale was insignificant (F = 1.623, $p > 0.05$). The single effect of both faculty type (F = 1.135, $p > 0.05$) and gender (F = 0.475, $p > 0.05$) on the neutrosophic scale was statistically insignificant. In addition, the neutrosophic scale did not differ according to the interaction effect of the faculty type and gender (F = 0.515, $p > 0.05$).

Table 17. Two-way ANOVA results for the Likert and neutrosophic scales.

Scale	Single and Interaction Effect	Mean Square	F	Significance Level
Likert scale	Faculty	115.199	1.231	0.288
	Gender	221.773	2.370	0.127
	Faculty X Gender	151.888	1.623	0.136
Neutrosophic scale	Faculty	15.492	1.135	0.346
	Gender	6.489	0.475	0.492
	Faculty X Gender	7.030	0.515	0.821
Likert scale	Faculty	103.403	1.109	0.364
	Age	121.605	1.304	0.274
	Faculty X Age	103.998	1.116	0.350
Neutrosophic scale	Faculty	28.286	2.263	0.029
	Age	20.610	1.649	0.168
	Faculty X Age	16.653	1.332	0.186
Likert scale	Gender	28.130	0.306	0.581
	Age	240.887	2.624	0.038
	Gender X Age	144.901	1.579	0.185
Neutrosophic scale	Gender	10.940	0.836	0.362
	Age	15.716	1.201	0.314
	Gender X Age	28.538	2.181	0.075

The single effect of the faculty type (F = 1.109, $p > 0.05$) and age group (F = 1.304, $p > 0.05$) did not significantly affect the Likert scale. Moreover, the effect of the Likert scale did not differ according to the interaction of the faculty type and age group (F = 1.116, $p > 0.05$). The individual effect of the faculty type on the neutrosophic scale was statistically significant (F = 2.263, $p < 0.05$). The difference between the average of the students in the vocational school of health services and the students in the physical education and sports school was found to be statistically significant ($p < 0.05$). At the same time, the difference between the averages of the students in the vocational school of health services and the students in the Faculty of Islamic Sciences was found to be significant ($p < 0.05$). The neutrosophic scale score of the students in the vocational school of health services (M = 3.38) was higher than the students in both the School of Physical Education and Sports (M = 0.38) and the Faculty of Islamic Sciences (M = 0.99). The effect of age group alone

(F = 1.649, $p > 0.05$) and the interaction of the faculty type and age group (F = 1.332, $p > 0.05$) on the neutrosophic scale were statistically insignificant.

The individual effect of male and female students on the Likert scale was statistically insignificant (F = 0.306, $p > 0.05$). The individual effect of the age group on the Likert scale was statistically significant (F = 2.624, $p < 0.05$). A statistically significant difference was found between the averages of students in the 18–21 age group and those in the 25–30 age group ($p < 0.05$). At the same time, the difference between students in the 22–24 age group and 25–30 age group was found to be statistically significant ($p < 0.05$). Although students in the 25–30 age group had the highest Likert scale scores, the students in the 18–21 age group had the lowest Likert scale scores. The effect of the interaction was statistically insignificant (F = 1.579, $p > 0.05$). The single effect of gender (F = 0.836, $p > 0.05$) and age group (F = 1.201, $p > 0.05$) was statistically insignificant on the neutrosophic scale. At the same time, the effect of the interaction was found to be insignificant (F = 2.181, $p > 0.05$).

In general, when viewed both in Likert and neutrosophic terms, although the effect of demographic variables on perceived distributive justice varied individually according to age and faculty type, no effect of the variables together was found. The results show that the perception of distributive justice increased as age increased. Older people have more realistic expectations based on their life experiences, and as age decreases, expectations increase. As a result of rising expectations, the perceived level of distributive justice decreases. The difference in the perceptions of distributive justice according to faculty types can be explained by the different environments offered by the faculties.

4. Conclusions

The issue of scale is extremely important in the production of information in social sciences research, because scale involves measuring the quality or quantity of entities. Scale development and the validation of measurements still require challenging efforts. Social scientists have developed a number of valid scales, especially in the field of education. These scales are designed to contribute to the measurement of abstract concepts.

In this work, each item of a Likert-type scale was converted into a neutrosophic scale, and responses were received for both scales in a single survey. These classical and neutrosophic Likert scales provided evidence of the answers to ten questions. Although a Likert scale does not fully meet the desires of participants in terms of answer options, the desired answer can be expressed more clearly as a percentage with the neutrosophic scale. When a comparison of the data quality was made, the arithmetic mean and standard deviation for the neutrosophic scale were lower than those for the Likert scale. Therefore, it was concluded that the neutrosophic scale is more suitable for analysis using statistical inferences. Most importantly, both scales are normally distributed, indicating that inferential statistics are appropriate for the analysis, which are extremely important for inferring, drawing conclusions, and making decisions about a population on the basis of the information obtained from the sample.

In this study, item 8 was included by reversing the Likert scale. This can be considered a disadvantage of the Likert scale, because the item's reversal and negative value may confuse participants and cause internal consistency. The neutrosophic scale may be preferred because it was found to be easier to understand and answer by the participants. For example, for the question "The staff at this school care about students' opinions", the participant can choose a level between "agree" and "strongly agree" on a Likert scale. However, if the participant wants to answer closer to "strongly agree", the Likert scale cannot accommodate this exact answer. The desired answer can be expressed more clearly with percentages on the neutrosophic scale.

Additionally, although Likert's method includes a number of lexical scale terms, the neutrosophic approach uses only three lexical scale terms (agree, neutral, and disagree). Therefore, it is easier to find equivalents for "agree", "neutral", and "disagree" in different languages, which can reduce problems of incompatibility in the literal meaning. Moreover, although the Likert scale contains options indicating the decision direction, the percentages

of answers are still not clear. With the neutrosophic scale, individuals can express their choices more freely and, thus, more precisely numerically. Although individuals respond according to the most dominant side of the Likert scale, they do not indicate the ratio to other options. However, individuals who choose the same option have different feelings and thoughts compared to the other options. While we do not have a chance to measure this with the Likert scale, clearer results can be obtained with a neutrosophic scale by allowing individuals to express their opinions on a subject with positive, negative, and indecision rates at the same time.

As a result of the exploratory factor analysis performed on both scales, it was seen that they had a one-dimensional factor. Moreover, it was determined that the neutrosophic scale had high reliability, like the Likert scale.

The "Fair Learning Environment Questionnaire", used in a validity and reliability study conducted by Özer and Demirtaş [26] and developed by Lizzio, Wilson, and Hadaway [27] for the Turkish version of the Fairness Perception Regarding the Learning Environment, was used. The Kaiser–Meyer–Olkin (KMO) value of the scale was determined to be 0.83 by Özer and Demirtaş [26], and the internal consistency coefficient was determined to be 0.87 for the total scale.

Another factor taken into account in this study is whether there was a significant difference with the two scales according to the faculty of the participants. The results show that participants were able to evaluate similarly using the two methods, regardless of the faculty in which they studied. Additionally, the effects of faculty and gender on the scales, both individually and in interaction, were examined. It was concluded that neither the individual effect nor the interaction of the participants' faculty and gender created a significant difference with the two scales. The individual effect of faculty type on the neutrosophic scale was statistically significant, and this situation can be explained by the different environments provided by the faculties. It can be said that different practices and conditions affect students' perception of distributive justice. The individual effect of faculty type on the Likert scale was statistically insignificant. It can be said that the difference obtained with the neutrosophic scale arises from the students' ability to express their thoughts other than their standard common answers.

When both the marginal effect and the interaction effect of faculty and gender were examined for the two scales, it was concluded that neither the individual effect nor the interaction of the participants' faculty and gender led to a significant difference. The individual effect of age group on the Likert scale was found to be statistically significant. The results show that the perception of distributive justice increases as age increases, and it can be said that older people have more realistic expectations based on their life experiences, and as age decreases, expectations increase. In addition, the perceived level of distributive justice decreases as a result of rising expectations.

Paired samples *t*-test has an invariance feature. That is, even if the order of measurements is changed, the result of the paired samples *t*-test does not change as long as the matching between measurements is maintained. This property makes the paired samples *t*-test a robust method for comparing two groups or conditions of interest.

In general, the symmetric properties of the analyses used in this study are as follows.

In a correlation analysis, symmetry (Table 18) means that the relationship between two variables is reciprocal and remains balanced regardless of which variable is perceived as the predictor or outcome. Spearman's rho correlation coefficient indicates the direction and degree of the monotonic relationship between two variables (Table 12). In this case, we observed symmetrical structures. Similarly, the Pearson correlation coefficient measures the linear relationship between two variables and assumes symmetry because $Corr(X, Y) = Corr(Y, X)$. The linear relationship between the Likert and neutrosophic scales had a symmetrical structure, as tested by Pearson correlation (Tables 13 and 18).

Table 18. Tabulation and explanation of symmetric and non-symmetric concepts.

	Likert Scale		Neutrosophic Scale	
	General	**Specific**	**General**	**Specific**
Exploratory factor analysis (Here, symmetric refers to number of factor of two scales)				
Symmetric	☐	☑	☐	☑
Non-symmetric	☑	☐	☑	☐
Correlation analysis (this symmetric feature is explained in the conclusion)				
Symmetric	☑	☑	☑	☑
Non-symmetric	☐	☐	☐	☐
One-way ANOVA and two-way ANOVA (Generally speaking, it is non-symmetric regarding group means; specifically, it is non-symmetric regarding the significance of the test)				
Symmetric	☐	☐	☐	☐
Non-symmetric	☑	☑	☑	☑

In one-way and two-way ANOVA, symmetry (Table 18) concerns the equality of variances and homogeneity of group means at different levels of independent variables. An assumption of variance equality in an ANOVA suggests that the variances of the groups are equal. The homogeneity of group averages means that the groups have similar central tendencies. If there is equality of variance in an ANOVA but the group means are not homogeneous, this means that the groups have different variances but may have the same central tendencies. In this case, it may not be appropriate to address the issue of symmetry. Symmetry is when the data distribution is in some way balanced. When the group means of the data set are not homogeneous, it is possible to make an assessment of whether the data distribution is symmetrical, but it cannot be directly related to the ANOVA results. Symmetry may depend on the distribution of the data set and differences between groups, and ANOVA results do not provide specific information on this issue. Therefore, the information on the equality of variance and homogeneity of group means obtained from ANOVA results can be used to understand the distribution of the data set and differences between groups, but it is not sufficient to make a specific judgment about symmetry.

On the other hand, while correlation coefficients are used to understand the nature of the relationship between two variables, ANOVA is used to compare the means of more than one group, so naturally the symmetry concepts between the two concepts and analyses are different from each other.

In addition, as a result of exploratory factor analysis, it was determined that both scales could be reduced to a single factor and had a symmetrical structure. In addition, according to the one-way ANOVA results, it was proven that the faculty type was not statistically significant in terms of Likert and neutrosophic scales and showed non-symmetrical features. Similarly, in the two-way ANOVA analysis, the individual and interaction effects of faculty and gender variables were not statistically significant for both scales, indicating a non-symmetrical structure.

In possible future study, we plan to use machine learning models to predict demographic data, such as age, education, marital status, and sex, from the answers provided to questions in the classical Likert and neutrosophic Likert scales. Another possible future study direction can involve the help of the newly developed RANCOM method, which focuses on making weighted judgments about the evaluations of experts in different fields who evaluate neutrosophic Likert scale data [56].

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