Hindawi
Discrete Dynamics in Nature and Society
Volume 2023, Article ID 9834272, 1 page
https://doi.org/10.1155/2023/9834272

Retraction

Retracted: A Decision-Making Framework for University Student Sports Study Psychological Healthy Evaluation with 2-Tuple Linguistic Neutrosophic Numbers

Discrete Dynamics in Nature and Society

Received 15 August 2023; Accepted 15 August 2023; Published 16 August 2023

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

[1] X. Yang and W. Shi, "A Decision-Making Framework for University Student Sports Study Psychological Healthy Evaluation with 2-Tuple Linguistic Neutrosophic Numbers," *Discrete Dynamics in Nature and Society*, vol. 2022, Article ID 2182207, 16 pages, 2022.

Hindawi
Discrete Dynamics in Nature and Society
Volume 2022, Article ID 2182207, 16 pages
https://doi.org/10.1155/2022/2182207

Research Article

A Decision-Making Framework for University Student Sports Study Psychological Healthy Evaluation with 2-Tuple Linguistic Neutrosophic Numbers

Xiaoping Yang and Wensheng Shi

School of Physical Education, Yulin University, Yulin 719000, Shaanxi, China

Correspondence should be addressed to Wensheng Shi; shiwensheng@yulinu.edu.cn

Received 14 July 2022; Revised 2 August 2022; Accepted 10 August 2022; Published 30 August 2022

Academic Editor: Darko Božanić

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A healthy body is the foundation of education, and the guiding ideology of health first requires that all educational work in schools should take the health of students as the starting point and be responsible for the health of students. Taking the development of students as the foundation, its essential meaning is to make students develop into a "complete person," that is, to integrate and unify students' morality, intelligence, physique, beauty, life, habits, morality, skills, and other elements. The establishment of the evaluation index system of sports health literacy is a complex evaluation system with multiple factors and multiple indicators. The university student sports study psychological healthy evaluation is always looked as the multiple attribute decision-making (MADM) issue. In this paper, based on the generalized Heronian mean (HM) operator and generalized weighted HM (GWHM) operator, the generalized 2-tuple linguistic neutrosophic HM (G2TLNHM) operator and generalized 2-tuple linguistic neutrosophic weighted HM (G2TLNWHM) operator are proposed with 2-tuple linguistic neutrosophic sets (2TLNSs). Finally, an example of university student sports study psychological healthy evaluation is used to show the proposed methods. Some comparative studies and parameter influence analysis on the final result are fully given. The results show that the built algorithms method is really useful for university student sports study psychological healthy evaluation.

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1. Introduction

Multiple attribute decision-making (MADM) refers to integrating and ranking the criterion values of multiple schemes under multiple criteria [1–5]. The MADM theories and methods are widely used in the engineering fields, technology fields, economics fields, management fields, and military fields. Multi-attribute decision-making usually has the following characteristics. (1) Multiple options: before making a possible decision, the DMs must first measure the number of feasible options as an evaluation option [6–8]. (2) Multiple possible attributes: before making a possible decision, the decision maker needs to consider the number of feasible attributes and propose multiple attributes that affect the decision-making of the scheme. The relationship between the attributes can be independent or related to each other [9–12]. (3) Attributes weight: for different evaluation attributes, decision-makers may have different preference information and assign different weights to different evaluation attributes. Thus, generally speaking, the weight distribution of attributes may have different effects on evaluation results [13–18]. The MADM refers to the process in which decision-makers use specific methods to compare and select alternatives with multiple attributes on the basis of existing decision-making information [19–25]. Due to the complexity of the decision-making environment and the limited cognition of decision-makers, it is difficult for decision-makers to give accurate evaluation information in actual decision-making [26–29]. DMs often only consider the decision-making information of the current period, while ignoring the importance of historical information, so their understanding of the decision-making object is not

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comprehensive enough [30–32]. In addition, most relevant studies are based on expected utility theory, so they cannot properly characterize the irrational behavior of decision-makers when faced with risks [33–36]. In this case, how to effectively solve the above problems and make more reasonable decisions is particularly important. In 1986, Atanassov [37] expanded on the fuzzy theory proposed by Zadeh [38], adding the degree of nonmembership and hesitation to describe the degree of uncertainty of "one or the other," which can be more delicate than fuzzy sets. Therefore, it is more flexible and applicable than fuzzy sets and has been widely used in many fields such as economy, management, and engineering design, especially in the field of soft decision-making. Xu [39] studied a class of MADM problems in which the attribute value is IFNs and the decision maker has a preference for the scheme, defined a series of judgment matrices, and used the linear programming model to determine the weight of the attribute. Xia and Xu [40] established a similarity measurement method of intuitionistic fuzzy sets for MADM and extended the matching function to define the positive ideal intuitionistic fuzzy set and negative ideal intuitionistic fuzzy set of expert decision-making attributes, and the positive ideal intuitionistic fuzzy set takes all attributes. Szmidt and Kacprzyk [41] proposed intuitionistic fuzzy set kernels and consistency criteria for imprecise information decision-making and used intuitionistic fuzzy sets to construct a group decision-making method. Liao et al. [42] aimed at the problem of information loss caused by eliminating expert opinions with a large deviation in the existing group decision-making methods, and the combination of group decision-making and intuitionistic fuzzy set preference relationship improves the process of achieving consistency. Khaleie and Fasanghari [43] used intuitionistic fuzzy entropy to comprehensively consider subjective and objective factors and calculate the weight of experts and introduced an evidence reasoning method to deal with the information with zero membership degree of evaluation value and carried out a fuzzy information fusion method. Gu et al. [44] improved the MADM theory and method under expected utility theory from the perspective of prospect theory and proposed an intuitionistic fuzzy MADM scheme optimization method based on correlated information and prospect theory and introduced prospect theory to construct a group clustering method. Mishra et al. [45] focused their research on this application area, constructing a composite APPROACH of SWAA and COPRAS in an intuitively ambiguous environment to address the best decisions for bioenergy production technologies. Pei et al. [46] believed that in the traditional consensus model, the gradual increase in the degree of consensus will lead to a decrease in collective intelligence, and the distrust relationship within the group will help to explore a better decision-making space, so they study the group decision-making problem with low consensus characteristics based on the intuitionistic fuzzy theory. Ren et al. [47] used intuition to fuzzy information and constructed fuzzy decision-making models based on regret theory and the principle of comprehensively perceived utility maximization and selected the best solutions. Scholars such as Xiong et al. [48] have developed the BWM method, the WASPAS method, and the TOPSIS method in an intuitively ambiguous environment to deal with the evaluation of green suppliers in management. Smarandache [49] put forward the concept of neutrosophic sets (NSs) in 1999, which can quantify uncertain and inconsistent information, and reflect the dynamic information of things, phenomena, or ideas. The NSs describe the relationship between the event and the fuzzy concept represented by the membership degree of the element and the set. Each element of it contains the true membership function, the uncertain membership function, and the distortion membership function. Compared with IFSs, the NSs add an independent uncertainty measure, which is an extension and generalization of fuzzy sets and IFSs. Since the theory of NSs was put forward, it has been widely used in many fields such as social problems [50–52], artificial intelligence and control systems [53–56], image processing, medical diagnosis [57–61], and enterprise management [62–65]. Wang, Wei, and Wei [66] defined the 2TLNSs in which all decision values are expressed by 2TLs. Wang et al. [67] proposed the 2TLNN-TODIM for MAGDM. Wu et al. [68] defined some new Hamy mean fused information operators along with 2TLNNs. Wang et al. [69] built the novel 2TLNN-EDAS method for MAGDM. Wang et al. [70] built the novel 2TLNN-CODAS for MAGDM.

In practical MADM, the aggregation operator is an important mathematical tool to fuse all fuzzy information. As an effective aggregation operator, heronian mean (HM) [71] can consider the relationship between any number of parameters and has been studied by a large number of scholars. Li et al. [72] proposed some novel SVNNHM fused operators. Liu et al. [73] analyzed some new given IULHM information operators. Yu et al. [74] proposed some aggregation models in combination with linguistic hesitation fuzzy numbers information and HM. Liu et al. [75] provided some HM operators under uncertain linguistic settings. Wei et al. [76] defined some HM operators under q-ROFN settings. Yu et al. [77] built some novel HM fused operators in the double hesitation fuzzy settings. Yu [78] analyzed the geometric HM fused operators under the given IFSs. Liu et al. [79] investigated the HM fused operator under 2TLSs settings.

To improve the level of students' physical health literacy, the key is to start from the root. Students' theoretical knowledge, basic skills, and emotional attitudes are cultivated. Among them, the knowledge goal requires students to understand sports-related knowledge, physiology-related knowledge, and other basic knowledge related to sports and health; in the skill goal, in addition to requiring students to master basic sports ability, also students are required to master the ability to maintain their own health; emotional goals are required to teach students the importance of developing good habits and maintaining a healthy lifestyle. The relationship between health and lifestyle is emphasized in the goals of college physical education. The cultivation of healthy life and living habits of college students, such as the development of physical exercise habits, regular physical health checks, and so on, also needs to be based on students' life behavior. It is fully integrated with university physical education teaching to help students master nutritional knowledge and improve students' lifestyles more comprehensively. The university student sports study psychological healthy evaluation is always looked at as the MADM issue. In this paper, the G2TLNHM operator and G2TLNWHM operator are built to solve the MADM issues. Finally, an example of university student sports study psychological healthy evaluation is used to show the proposed methods. In order to do so, the structure of our paper is organized. In the next section, the concept of 2TLNNSs is introduced. In Section 3, the G2TLNHM and G2TLNWHM operator is built. In Section 4, an example is given for university student sports study psychological healthy evaluation. Section 5 concludes this paper.

2. Preliminaries

Wang et al. [66] proposed the 2TLNSs.

2.1. 2TLSs

Definition 1 (see [80, 81]). Let $ls_0, ls_1, \ldots, ls_T$ be a given linguistic term set. Any l_i shows a defined linguistic variable, and ls is as follows:

$$ls = \left\{ \begin{array}{c} ls_0 = \text{extremely poor}, ls_1 \\ = \text{very poor}, ls_2 \\ = \text{poor}, ls_3 \\ = \text{medium}, \\ ls_4 = \text{good}, ls_5 \\ = \text{very good}, ls_6 \\ = \text{extremely good}. \end{array} \right\}. \tag{1}$$

2.2. SVNSs. Let X be a fixed set, the SVNSs η is as follows [82]:

$$\eta = \{ (x, \phi\eta(x), \varphi\eta(x), \gamma\eta(x)) | x \in X \}, \tag{2}$$

where $\phi\eta(x), \varphi\eta(x)$, and $\gamma\eta(x) \in [0,1]$ represent the membership, the indeterminacy, and the nonmembership which meet the given condition $0 \le \phi\eta(x) + \varphi\eta(x) + \gamma\eta(x) \le 3$.

2.3. 2TLNNSs

Definition 2 (see [66]). Let $l\delta_j \quad (j = 0, 1, \ldots, T)$ be a given 2TLSs. If $l\delta = \langle (ls_t, \xi), (ls_i, \psi), (ls_f, \zeta) \rangle$ is defined for $(ls_t, \xi), (ls_i, \psi), (ls_f, \zeta) \in \delta, \xi, \psi, \quad \zeta \in [0, k]$ where $(s_t, \xi), (s_i, \psi)$ and (s_f, ζ) depict the membership, indeterminacy, and nonmembership by using the 2TLSs, then the 2TLNNSs are expressed as follows:

$$l\delta_j = \left\langle \left(ls_{t_j}, \xi_j \right), \left(ls_{i_j}, \psi_j \right), \left(ls_{f_j}, \zeta_j \right) \right\rangle, \tag{3}$$

where $0 \le \Delta^{-1}(ls_{t_j}, \xi_j) \le k, 0 \le \Delta^{-1}(ls_{i_j}, \psi_j) \le k, 0 \le \Delta^{-1}(ls_{f_j}, \zeta_j) \le T$, and $0 \le \Delta^{-1}(ls_{t_j}, \xi_j) + \Delta^{-1}(ls_{i_j}, \psi_j) + \Delta^{-1}(ls_{f_j}, \zeta_j) \le 3T$.

Definition 3 (see [66]). Let $l\delta = \langle (ls_t, \xi), (ls_i, \psi), (ls_f, \zeta) \rangle$ be a 2TLNN. Then, the score function $e(\delta)$ and accuracy function $h(\delta)$ are defined as follows:

$$\begin{aligned} e(l\delta) &= \frac{\left(2T + \Delta^{-1}(ls_t, \xi) - \Delta^{-1}(ls_i, \psi) - \Delta^{-1}\left(ls_f, \zeta \right) \right)}{3T}, \quad e(l\delta) \in [0, 1], \\ h(l\delta) &= \Delta^{-1}(ls_t, \xi) - \Delta^{-1}\left(ls_f, \zeta \right), h(l\delta) \in [-T, T]. \end{aligned} \tag{4}$$

Definition 4 (see [66]). Let $l\delta_1 = \langle (ls_{t_1}, \xi_1), (ls_{i_1}, \psi_1), (ls_{f_1}, \zeta_1) \rangle$ and $l\delta_2 = \langle (ls_{t_2}, \xi_2), (ls_{i_2}, \psi_2), (ls_{f_2}, \zeta_2) \rangle$ be two 2TLNNs, then

(1) If $e(l\delta_1) \prec e(l\delta_2)$, then $l\delta_1 \prec l\delta_2$

(2) If $e(l\delta_1) \succ e(l\delta_2)$, then $l\delta_1 \succ l\delta_2$

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(3) If $e(l\delta_1) = e(l\delta_2), h(l\delta_1) \prec h(l\delta_2)$, then $l\delta_1 \prec l\delta_2$ and if $e(l\delta_1) = e(l\delta_2), h(l\delta_1) = h(l\delta_2)$, then $\delta_1 = \delta_2$

Definition 5 (see [66]). Let $l\delta_1 = \langle (ls_{t_1}, \xi_1), (ls_{i_1}, \psi_1), (ls_{f_1}, \zeta_1)\rangle$, $l\delta_2 = \langle (ls_{t_2}, \xi_2), (ls_{i_2}, \psi_2), (ls_{f_2}, \zeta_2)\rangle$, and $l\delta = \langle (ls_t, \xi), (ls_i, \psi), (ls_f, \zeta)\rangle$ be three 2TLNNs, then

$$l\delta_1 \oplus l\delta_2 = \left\{ \begin{array}{c} \Delta\left(T\left(\frac{\Delta^{-1}(ls_{t_1}, \xi_1)}{T} + \frac{\Delta^{-1}(ls_{t_2}, \xi_2)}{T} - \frac{\Delta^{-1}(ls_{t_1}, \xi_1)}{T} \cdot \frac{\Delta^{-1}(ls_{t_2}, \xi_2)}{T}\right)\right), \\ \Delta\left(T\left(\frac{\Delta^{-1}(ls_{i_1}, \psi_1)}{T} \cdot \frac{\Delta^{-1}(ls_{i_2}, \psi_2)}{T}\right)\right), \Delta\left(T\left(\frac{\Delta^{-1}(ls_{f_1}, \zeta_1)}{T} \cdot \frac{\Delta^{-1}(ls_{f_2}, \zeta_2)}{T}\right)\right) \end{array} \right\};$$

$$l\delta_1 \otimes l\delta_2 = \left\{ \begin{array}{c} \Delta\left(T\left(\frac{\Delta^{-1}(ls_{t_1}, \xi_1)}{T} \cdot \frac{\Delta^{-1}(ls_{t_2}, \xi_2)}{T}\right)\right), \\ \Delta\left(T\left(\frac{\Delta^{-1}(ls_{i_1}, \psi_1)}{T} + \frac{\Delta^{-1}(ls_{i_2}, \psi_2)}{T} - \frac{\Delta^{-1}(ls_{i_1}, \psi_1)}{T} \cdot \frac{\Delta^{-1}(ls_{i_2}, \psi_2)}{T}\right)\right), \\ \Delta\left(T\left(\frac{\Delta^{-1}(ls_{f_1}, \zeta_1)}{T} + \frac{\Delta^{-1}(ls_{f_2}, \zeta_2)}{T} - \frac{\Delta^{-1}(ls_{f_1}, \zeta_1)}{T} \cdot \frac{\Delta^{-1}(ls_{f_2}, \zeta_2)}{T}\right)\right) \end{array} \right\}; \tag{5}$$

$$\alpha l\delta = \left\{\Delta\left(T\left(1 - \left(1 - \frac{\Delta^{-1}(ls_t, \xi)}{T}\right)^{\alpha}\right)\right), \Delta\left(T\left(\frac{\Delta^{-1}(ls_i, \psi)}{T}\right)^{\alpha}\right), \Delta\left(T\left(\frac{\Delta^{-1}(ls_f, \zeta)}{T}\right)^{\alpha}\right)\right\}, \quad \alpha > 0;$$

$$l\delta^{\alpha} = \left\{\Delta\left(T\left(\frac{\Delta^{-1}(ls_t, \xi)}{T}\right)^{\alpha}\right), \Delta\left(T\left(1 - \left(1 - \frac{\Delta^{-1}(ls_i, \psi)}{T}\right)^{\alpha}\right)\right), \Delta\left(T\left(1 - \left(1 - \frac{\Delta^{-1}(ls_f, \zeta)}{T}\right)^{\alpha}\right)\right)\right\} \quad \alpha > 0.$$

2.4. HM Operators. The HM operator [71] and geometric HM (GHM) operator [78] are defined.

Definition 6 (see [71]). Let $la_i\,(i = 1, 2, \cdots, m)$ be a set of nonnegative numbers. Then,

$$HM(al, la_2, \ldots, la_m) = \frac{2}{m(m+1)} \sum_{i=1}^{m} \sum_{j=i}^{m} \sqrt{la_i la_j}. \tag{6}$$

Definition 7 (see [78]). Let $\theta, \vartheta > 0$ and $la_i \quad (i = 1, 2, \ldots, n)$ be a set of nonnegative numbers. Then, $\mathrm{GHM}^{\theta,\vartheta}$ is

$$GHM^{\theta,\vartheta}(la_1, la_2, \ldots, la_m) = \frac{1}{\theta + \vartheta}\left(\prod_{i=1, j=i}^{m} (\theta la_i + \vartheta la_j)\right)^{2/m(m+1)}. \tag{7}$$

3. Some Generalized HM Operators with 2TLNNs

3.1. The G2TLNHM Operator. The G2TLNHM operator is given in this section.

Definition 8. Assume $l\delta_j = \langle (ls_{t_j}, \xi_j), (ls_{i_j}, \psi_j), (ls_{f_j}, \zeta_j)\rangle$ be a group of 2TLNNs. Let $\theta, \vartheta > 0$, the G2TLNHM operator is built:

$$\mathrm{G2TLNHM}^{\theta,\vartheta}(l\delta_1, l\delta_2, \ldots, l\delta_m) = \left(\frac{2}{m(m+1)} \mathop{\oplus}_{i=1}^{m} \mathop{\oplus}_{j=i}^{m} \left(l\delta_i^{\theta} \otimes l\delta_j^{\vartheta}\right)\right)^{1/\theta+\vartheta}. \tag{8}$$

Theorem 1. *Assume $l\delta_j = \langle (ls_{t_j}, \xi_j), (ls_{i_j}, \psi_j), (ls_{f_j}, \zeta_j)\rangle$ be a set of 2TLNNs. The fused result by G2TLNHM operators is*

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$$
\begin{aligned}
&\mathrm{G2TLNHM}^{\theta,\vartheta}\left(l\delta_1, l\delta_2, \ldots, l\delta_m\right) = \left(\frac{2}{m(m+1)} \overset{m}{\underset{i=1}{\oplus}} \overset{m}{\underset{j=i}{\oplus}} \left(l\delta_i^{\theta} \otimes l\delta_j^{\vartheta}\right)\right)^{1/\theta+\vartheta} \\
&\left\{
\begin{array}{c}
\Delta\left(T\left(1-\left(\prod_{i=1,j=i}^{m}\left(1-\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\cdot\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right)\right)^{\dfrac{2}{m(m+1)}}\right)^{1/\theta+\vartheta}\right), \\
\Delta\left(T\left(1-\left(1-\left(\prod_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)\right)^{2/m(m+1)}\right)^{1/\theta+\vartheta}\right)\right), \\
\Delta\left(T\left(1-\left(1-\left(\prod_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)\right)^{2/m(m+1)}\right)^{1/\theta+\vartheta}\right)\right)
\end{array}
\right\}
\end{aligned}
\tag{9}
$$

Proof.

$$
\begin{aligned}
l\delta_i^{\theta} &= \left\{
\begin{array}{c}
\Delta\left(T\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\right), \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\right)\right), \\
\Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\right)\right)
\end{array}
\right\}, \\
l\delta_j^{\vartheta} &= \left\{
\begin{array}{c}
\Delta\left(T\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right), \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)\right), \\
\Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)\right)
\end{array}
\right\}.
\end{aligned}
\tag{10}
$$

Thus,

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$$l\delta_i^{\theta} \otimes l\delta_j^{\vartheta} = \left\{ \begin{array}{c} \Delta\left(T\left(\frac{\Delta^{-1}\left(ls_{t_i}, \xi_i\right)}{T}\right)^{\theta} \cdot \left(\frac{\Delta^{-1}\left(ls_{t_j}, \xi_j\right)}{T}\right)^{\vartheta} \right), \\ \Delta\left(T\left(1 - \left(1 - \frac{\Delta^{-1}\left(ls_{i_i}, \psi_i\right)}{T}\right)^{\theta} \cdot \left(1 - \frac{\Delta^{-1}\left(ls_{i_j}, \psi_j\right)}{T}\right)^{\vartheta} \right)\right), \\ \Delta\left(T\left(1 - \left(1 - \frac{\Delta^{-1}\left(ls_{f_i}, \zeta_i\right)}{T}\right)^{\theta} \cdot \left(1 - \frac{\Delta^{-1}\left(ls_{f_j}, \zeta_j\right)}{T}\right)^{\vartheta} \right)\right) \end{array} \right\}. \tag{11}$$

Thereafter,

$$\mathop{\oplus}_{i=1}^{m} \mathop{\oplus}_{j=i}^{m} \left(l\delta_i^{\theta} \otimes l\delta_j^{\vartheta}\right) = \left\{ \begin{array}{c} \Delta\left(T\left(1 - \prod_{i=1, j=i}^{m} \left(1 - \left(\frac{\Delta^{-1}\left(ls_{t_i}, \xi_i\right)}{T}\right)^{\theta} \cdot \left(\frac{\Delta^{-1}\left(ls_{t_j}, \xi_j\right)}{T}\right)^{\vartheta} \right)\right)\right), \\ \Delta\left(T \prod_{i=1, j=i}^{m} \left(1 - \left(1 - \frac{\Delta^{-1}\left(ls_{i_i}, \psi_i\right)}{T}\right)^{\theta} \cdot \left(1 - \frac{\Delta^{-1}\left(ls_{i_j}, \psi_j\right)}{T}\right)^{\vartheta} \right)\right), \\ \Delta\left(T \prod_{i=1, j=i}^{m} \left(1 - \left(1 - \frac{\Delta^{-1}\left(ls_{f_i}, \zeta_i\right)}{T}\right)^{\theta} \cdot \left(1 - \frac{\Delta^{-1}\left(ls_{f_j}, \zeta_j\right)}{T}\right)^{\vartheta} \right)\right) \end{array} \right\}. \tag{12}$$

Furthermore,

$$\frac{2}{m(m+1)} \mathop{\oplus}_{i=1}^{m} \mathop{\oplus}_{j=i}^{m} \left(l\delta_i^{\theta} \otimes l\delta_j^{\vartheta}\right) \left\{ \begin{array}{c} \Delta\left(T\left(1 - \left(\prod_{i=1, j=i}^{m} \left(1 - \left(\frac{\Delta^{-1}\left(ls_{t_i}, \xi_i\right)}{T}\right)^{\theta} \cdot \left(\frac{\Delta^{-1}\left(ls_{t_j}, \xi_j\right)}{T}\right)^{\vartheta} \right)\right)^{2/m(m+1)} \right)\right), \\ \Delta\left(T\left(\prod_{i=1, j=i}^{m} \left(1 - \left(1 - \frac{\Delta^{-1}\left(ls_{i_i}, \psi_i\right)}{T}\right)^{\theta} \cdot \left(1 - \frac{\Delta^{-1}\left(ls_{i_j}, \psi_j\right)}{T}\right)^{\vartheta} \right)\right)^{2/m(m+1)} \right), \\ \Delta\left(T\left(\prod_{i=1, j=i}^{m} \left(1 - \left(1 - \frac{\Delta^{-1}\left(ls_{f_i}, \zeta_i\right)}{T}\right)^{\theta} \cdot \left(1 - \frac{\Delta^{-1}\left(ls_{f_j}, \zeta_j\right)}{T}\right)^{\vartheta} \right)\right)^{2/m(m+1)} \right) \end{array} \right\}. \tag{13}$$

Therefore,

$$\mathrm{G2TLNHM}^{\theta,\vartheta}\left(l\delta_1, l\delta_2, \ldots, l\delta_m\right) = \left(\frac{2}{m(m+1)} \mathop{\oplus}_{i=1}^{m} \mathop{\oplus}_{j=i}^{m} \left(l\delta_i^{\theta} \otimes l\delta_j^{\vartheta}\right)\right)^{1/\theta+\vartheta}$$

$$\left\{\begin{array}{c} \Delta\left(T\left(1-\left(\prod_{i=1, j=i}^{m}\left(1-\left(\frac{\Delta^{-1}\left(ls_{t_i}, \xi_i\right)}{T}\right)^{\theta} \cdot \left(\frac{\Delta^{-1}\left(ls_{t_j}, \xi_j\right)}{T}\right)^{\vartheta}\right)\right)^{2/m(m+1)}\right)^{1/\theta+\vartheta}\right), \\ \Delta\left(T\left(1-\left(1-\left(\prod_{i=1, j=i}^{m}\left(1-\left(1-\frac{\Delta^{-1}\left(ls_{i_i}, \psi_i\right)}{T}\right)^{\theta} \cdot \left(1-\frac{\Delta^{-1}\left(ls_{i_j}, \psi_j\right)}{T}\right)^{\vartheta}\right)\right)^{2/m(m+1)}\right)^{1/\theta+\vartheta}\right)\right), \\ \Delta\left(T\left(1-\left(1-\left(\prod_{i=1, j=i}^{m}\left(1-\left(1-\frac{\Delta^{-1}\left(ls_{f_i}, \zeta_i\right)}{T}\right)^{\theta} \cdot \left(1-\frac{\Delta^{-1}\left(ls_{f_j}, \zeta_j\right)}{T}\right)^{\vartheta}\right)\right)^{\frac{2}{m(m+1)}}\right)^{1/\theta+\vartheta}\right)\right) \end{array}\right\}. \quad (14)$$

Hence, (8) is satisfied.

The G2TLNHM has the following three properties. □

Property 1 (idempotency). If $l\delta_j = \langle (ls_{t_j}, \xi_j), (ls_{i_j}, \psi_j), (ls_{f_j}, \zeta_j)\rangle$ $(j = 1, 2, \ldots, m)$ are equal, then

$$\mathrm{G2TLNHM}^{\theta,\vartheta}\left(l\delta_1, l\delta_2, \ldots, l\delta_m\right) = l\delta. \quad (15)$$

Property 2 (monotonicity). Let $l\delta_{x_j}$ and $l\delta_{y_j}$ $(j = 1, 2, \ldots, m)$ be two sets of 2TLNNs, if $l\delta_{x_j} \leq l\delta_{y_j}$, for all j, then

$$\mathrm{G2TLNHM}^{\theta,\vartheta}\left(l\delta_{x_1}, l\delta_{x_2}, \ldots, l\delta_{x_n}\right) \leq \mathrm{G2TLNHM}^{\theta,\vartheta}\left(l\delta_{y_1}, l\delta_{y_2}, \ldots, l\delta_{y_n}\right). \quad (16)$$

Property 3 (bBoundedness). Let $l\delta_j$ $(j = 1, 2, \ldots, m)$ be a set of 2TLNNs. If $l\delta^{+} = (\max_j (ls_{t_j}, \xi_j), \min_j (ls_{i_j}, \psi_j), \min_j (ls_{f_j}, \zeta_j)), l\delta^{-} = (\min_j (ls_{t_j}, \xi_j), \max_j (ls_{i_j}, \psi_j), \max_j (ls_{f_j}, \zeta_j))$, then

$$l\delta^{-} \leq \mathrm{G2TLNHM}^{\theta,\vartheta}\left(l\delta_1, l\delta_2, \ldots, l\delta_m\right) \leq l\delta^{+}. \quad (17)$$

3.2. The G2TLNWHM Operator. To consider the attribute information weights, the G2TLNWHM operator is defined.

Definition 9. Let $l\delta_j = \langle (ls_{t_j}, \xi_j), (ls_{i_j}, \psi_j), (ls_{f_j}, \zeta_j)\rangle$ $(j = 1, 2, \ldots, m)$ be a set of 2TLNNs, weight is $w = (w_1, w_2, \ldots, w_m)^T$, and $w_i \in [0,1], \sum_{i=1}^{m} w_i = 1$. Let $\theta, \vartheta > 0$, then

$$\mathrm{G2TLNWHM}_{w}^{\theta,\vartheta}\left(l\delta_1, l\delta_2, \ldots, l\delta_n\right) = \left(\mathop{\oplus}_{i=1}^{m} \mathop{\oplus}_{j=i}^{m}\left(w_i w_j \left(l\delta_i\right)^{\theta}\left(l\delta_j\right)^{\vartheta}\right)\right)^{1/\theta+\vartheta}. \quad (18)$$

Theorem 2. *Let $l\delta_j = \langle (ls_{t_j}, \xi_j), (ls_{i_j}, \psi_j), (ls_{f_j}, \zeta_j)\rangle$ $(j = 1, 2, \ldots, m)$ be a set of 2TLNNs. The fused result by G2TLNWHM operator is*

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$$\mathrm{G2TLNWHM}_w^{\theta,\vartheta}\left(l\delta_1, l\delta_2, \ldots, l\delta_n\right) = \left(\mathop{\oplus}_{i=1}^{m}\mathop{\oplus}_{j=i}^{m}\left(w_i w_j \left(l\delta_i\right)^{\theta}\left(l\delta_j\right)^{\vartheta}\right)\right)^{1/\theta+\vartheta}$$

$$= \left\{\begin{array}{c} \Delta\left(T\left(1-\prod_{i=1,j=i}^{m}\left(1-\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\cdot\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right)^{w_i w_j}\right)^{1/\theta+\vartheta}\right), \\ \Delta\left(T\left(1-\left(1-\prod_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)^{w_i w_j}\right)^{1/\theta+\vartheta}\right)\right), \\ \Delta\left(T\left(1-\left(1-\prod_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)^{w_i w_j}\right)^{1/\theta+\vartheta}\right)\right) \end{array}\right\}. \tag{19}$$

Proof

$$l\delta_i^{\theta} = \left\{\begin{array}{c} \Delta\left(T\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\right), \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\right)\right), \\ \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\right)\right) \end{array}\right\},$$

$$l\delta_j^{\vartheta} = \left\{\begin{array}{c} \Delta\left(T\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right), \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)\right), \\ \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)\right) \end{array}\right\}. \tag{20}$$

Thus,

$$l\delta_i^{\theta}\otimes l\delta_j^{\vartheta} = \left\{\begin{array}{c} \Delta\left(T\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\cdot\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right), \\ \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)\right), \\ \Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)\right) \end{array}\right\}. \tag{21}$$

Thereafter,

$$
\begin{aligned}
& w_i w_j (l\delta_i)^{\theta}\left(l\delta_j\right)^{\vartheta}, \\
& = \left\{
\begin{array}{l}
\Delta\left(T\left(1-\left(1-\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\cdot\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right)\right), \\
\Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right), \\
\Delta\left(T\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right)
\end{array}
\right\}.
\end{aligned}
\tag{22}
$$

Furthermore,

$$
\overset{m}{\underset{i=1}{\oplus}}\ \overset{m}{\underset{j=i}{\oplus}}\left(w_i w_j (l\delta_i)^{\theta}\left(l\delta_j\right)^{\vartheta}\right), = \left\{
\begin{array}{l}
\Delta\left(T\left(1-\prod\limits_{i=1,j=i}^{m}\left(1-\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\cdot\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right)\right), \\
\Delta\left(T\prod\limits_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right), \\
\Delta\left(T\prod\limits_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right)
\end{array}
\right\}.
\tag{23}
$$

Therefore,

$$
\begin{aligned}
& \mathrm{G2TLNWHM}_{w}^{\theta,\vartheta}\left(l\delta_1, l\delta_2, \ldots, l\delta_n\right) = \left(\overset{m}{\underset{i=1}{\oplus}}\ \overset{m}{\underset{j=i}{\oplus}}\left(w_i w_j (l\delta_i)^{\theta}\left(l\delta_j\right)^{\vartheta}\right)\right)^{1/\theta+\vartheta}, \\
& = \left\{
\begin{array}{l}
\Delta\left(T\left(1-\prod\limits_{i=1,j=i}^{m}\left(1-\left(\dfrac{\Delta^{-1}\left(ls_{t_i},\xi_i\right)}{T}\right)^{\theta}\cdot\left(\dfrac{\Delta^{-1}\left(ls_{t_j},\xi_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right)^{1/\theta+\vartheta}\right), \\
\Delta\left(T\left(1-\left(1-\prod\limits_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{i_i},\psi_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{i_j},\psi_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right)^{1/\theta+\vartheta}\right)\right), \\
\Delta\left(T\left(1-\left(1-\prod\limits_{i=1,j=i}^{m}\left(1-\left(1-\dfrac{\Delta^{-1}\left(ls_{f_i},\zeta_i\right)}{T}\right)^{\theta}\cdot\left(1-\dfrac{\Delta^{-1}\left(ls_{f_j},\zeta_j\right)}{T}\right)^{\vartheta}\right)^{w_iw_j}\right)^{1/\theta+\vartheta}\right)\right)
\end{array}
\right\}.
\end{aligned}
\tag{24}
$$

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Hence, (18) is satisfied. □

Example 1. Assume $\langle (ls_1, 0.2), (ls_3, -0.4), (ls_4, 0.3)\rangle$, $\langle (ls_3, 0.2), (ls_2, 0.2), (ls_4, -0.3)\rangle$, and $\langle (ls_2, 0.4), (ls_3, -0.1), (ls_2, -0.4)\rangle$ be three 2TLNNs and $\theta = 1, \vartheta = 2$, and $w = (0.2, 0.3, 0.5)$, then based on formula (18), we have

$$
\begin{aligned}
&\mathrm{G2TLNWHM}_w^{\theta,\vartheta}(l\delta_1, l\delta_2, \ldots, l\delta_n) = \left(\mathop{\oplus}_{i=1}^{m}\mathop{\oplus}_{j=i}^{m}\left(w_i w_j \left(l\delta_i\right)^{\theta}\left(l\delta_j\right)^{\vartheta}\right)\right)^{1/\theta+\vartheta},\\
&= \left\{ \begin{array}{l}
\Delta\left(6\left(1-\left(\begin{array}{l}
\left(1-\left(\frac{1.2}{6}\right)^1\times\left(\frac{1.2}{6}\right)^2\right)^{0.2\times 0.2}\times\left(1-\left(\frac{1.2}{6}\right)^1\times\left(\frac{3.2}{6}\right)^2\right)^{0.2\times 0.3}\\
\times\left(1-\left(\frac{1.2}{6}\right)^1\times\left(\frac{2.4}{6}\right)^2\right)^{0.2\times 0.5}\times\left(1-\left(\frac{3.2}{6}\right)^1\times\left(\frac{3.2}{6}\right)^2\right)^{0.3\times 0.3}\\
\times\left(1-\left(\frac{3.2}{6}\right)^1\times\left(\frac{2.4}{6}\right)^2\right)^{0.3\times 0.5}\times\left(1-\left(\frac{2.4}{6}\right)^1\times\left(\frac{2.4}{6}\right)^2\right)^{0.5\times 0.5}
\end{array}\right)\right)^{1/\theta+\vartheta}\right),\\
\Delta\left(6\left(1-\left(1-\left(\begin{array}{l}
\left(1-\left(1-\frac{2.6}{6}\right)^1\times\left(1-\frac{2.6}{6}\right)^2\right)^{0.2\times 0.2}\times\left(1-\left(1-\frac{2.6}{6}\right)^1\times\left(1-\frac{2.2}{6}\right)^2\right)^{0.2\times 0.3}\\
\times\left(1-\left(1-\frac{2.6}{6}\right)^1\times\left(1-\frac{2.9}{6}\right)^2\right)^{0.2\times 0.5}\times\left(1-\left(1-\frac{2.2}{6}\right)^1\times\left(1-\frac{2.2}{6}\right)^2\right)^{0.3\times 0.3}\\
\times\left(1-\left(1-\frac{2.2}{6}\right)^1\times\left(1-\frac{2.9}{6}\right)^2\right)^{0.3\times 0.5}\times\left(1-\left(1-\frac{2.9}{6}\right)^1\times\left(1-\frac{2.9}{6}\right)^2\right)^{0.5\times 0.5}
\end{array}\right)\right)^{1/1+2}\right)\right),\\
\Delta\left(6\left(1-\left(1-\left(\begin{array}{l}
\left(1-\left(1-\frac{4.3}{6}\right)^1\times\left(1-\frac{4.3}{6}\right)^2\right)^{0.2\times 0.2}\times\left(1-\left(1-\frac{4.3}{6}\right)^1\times\left(1-\frac{3.7}{6}\right)^2\right)^{0.2\times 0.3}\\
\times\left(1-\left(1-\frac{4.3}{6}\right)^1\times\left(1-\frac{1.6}{6}\right)^2\right)^{0.2\times 0.5}\times\left(1-\left(1-\frac{3.7}{6}\right)^1\times\left(1-\frac{3.7}{6}\right)^2\right)^{0.3\times 0.3}\\
\times\left(1-\left(1-\frac{3.7}{6}\right)^1\times\left(1-\frac{1.6}{6}\right)^2\right)^{0.3\times 0.5}\times\left(1-\left(1-\frac{1.6}{6}\right)^1\times\left(1-\frac{1.6}{6}\right)^2\right)^{0.5\times 0.5}
\end{array}\right)\right)^{1/1+2}\right)\right)
\end{array}\right\}. \qquad (25)\\
&= \left\{(s_2, 0.2176), (s_3, 0.0167), (s_3, -0.3178)\right\}.
\end{aligned}
$$

The G2TLNWHM has the following three properties.

Property 4 (idempotency). If $l\delta_j = \langle (ls_{t_j}, \xi_j), (ls_{i_j}, \psi_j), (ls_{f_j}, \zeta_j)\rangle$ $(j = 1, 2, \ldots, m)$ are equal, then

$$\mathrm{G2TLNWHM}_w^{\theta,\vartheta}(l\delta_1, l\delta_2, \ldots, l\delta_m) = l\delta. \qquad (26)$$

Property 5 (mMonotonicity). Let $l\delta_{x_j}, l\delta_{y_j}$ $(j = 1, 2, \ldots, m)$ be two set of 2TLNNs, if $l\delta_{x_j} \le l\delta_{y_j}$, for all j, then

$$
\begin{aligned}
&\mathrm{G2TLNWHM}_w^{\theta,\vartheta}\left(l\delta_{x_1}, l\delta_{x_2}, \ldots, l\delta_{x_n}\right)\\
&\quad \le \mathrm{G2TLNWHM}_w^{\theta,\vartheta}\left(l\delta_{y_1}, l\delta_{y_2}, \ldots, l\delta_{y_n}\right).
\end{aligned} \qquad (27)
$$

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Table 1: 2TLNNs decision values matrix.

	OO_1	OO_2	OO_3	OO_4
US_1	$<(ls_4,0), (ls_2,0)\ (ls_4,0)>$	$<(ls_1,0), (ls_2,0)\ (ls_2,0)>$	$<(ls_2,0), (ls_4,0)\ (ls_3,0)>$	$<(ls_1,0), (ls_4,0)\ (ls_4,0)>$
US_2	$<(ls_5,0), (ls_1,0)\ (ls_2,0)>$	$<(ls_4,0), (ls_1,0)\ (ls_1,0)>$	$<(ls_4,0), (ls_1,0)\ (ls_2,0)>$	$<(ls_5,0), (ls_1,0)\ (ls_2,0)>$
US_3	$<(ls_2,0), (ls_2,0)\ (ls_4,0)>$	$<(ls_2,0), (ls_4,0)\ (ls_4,0)>$	$<(ls_1,0), (ls_3,0)\ (ls_4,0)>$	$<(ls_1,0), (ls_2,0)\ (ls_4,0)>$
US_4	$<(ls_3,0), (ls_1,0)\ (ls_3,0)>$	$<(ls_2,0), (ls_3,0)\ (ls_4,0)>$	$<(ls_4,0), (ls_3,0)\ (ls_3,0)>$	$<(ls_2,0), (ls_3,0)\ (ls_1,0)>$
US_5	$<(ls_2,0), (ls_2,0)\ (ls_4,0)>$	$<(ls_3,0), (ls_1,0)\ (ls_1,0)>$	$<(ls_3,0), (ls_2,0)\ (ls_4,0)>$	$<(ls_4,0), (ls_2,0)\ (ls_2,0)>$

Table 2: The fused results by G2TLNWHM operator.

	G2TLNWHM operator
US_1	$<(ls_1, 0.2757), (ls_5, 0.3503), (ls_6, -0.2315)>$
US_2	$<(ls_2, -0.3324), (ls_4, -0.3265), (ls_5, 0.1657)>$
US_3	$<(ls_1, -0.1325), (ls_5, 0.2508), (ls_6, -0.1657)>$
US_4	$<(ls_3, 0.3687), (ls_1, -0.2436), (ls_4, -0.3269)>$
US_5	$<(ls_1, -0.1865), (ls_5, 0.1478), (ls_6, -0.0336)>$

Table 3: The score values of the university students.

	G2TLNWHM operator
US_1	0.6476
US_2	0.5723
US_3	0.5027
US_4	0.5118
US_5	0.6073

Table 4: Order of the university students.

	Order
G2TLNWHM operator	$US_1 > US_5 > US_2 > US_4 > US_3$

Property 6 (boundedness). Let $l\delta_j \quad (j = 1, 2, \ldots, m)$ be a set of 2TLNNs. If $l\delta^+ = (\max_j\ (ls_{t_j}, \xi_j), \min_j (ls_{i_j}, \psi_j), \min_j (ls_{f_j}, \zeta_j))$ and $l\delta^- = (\min_j\ (ls_{t_j}, \xi_j), \max_j\ (ls_{i_j}, \psi_j), \max_j\ (ls_{f_j}, \zeta_j))$, then

$$l\delta^- \leq \mathrm{G2TLNWHM}_w^{\theta,\vartheta} (l\delta_1, l\delta_2, \ldots, l\delta_m) \leq l\delta^+. \tag{28}$$

4. Numerical Example and Comparative Analysis

4.1. Numerical Example. College physical education in our country already has a relatively mature curriculum system, which has clear educational and teaching objectives, content, methods, and assessments, and stipulates the total class hours, semesters, and weeks in the syllabus, and most colleges and universities have standardized venues and facilities. It is an important guarantee for the cultivation of students' physical health literacy. As the birthplace of teaching concept innovation and student education development, colleges and universities are no exception to the cultivation concept of sports health literacy. Students can have the opportunity to directly experience the results or benefits brought by these concept innovations in colleges and universities. In addition to having a mature physical health education curriculum system, colleges and universities also have excellent teacher conditions, a teaching atmosphere, and good venue facilities. These are the conditions that other individuals participating in the training do not have. At the same time, colleges and universities should act as leaders among the many training individuals: become the direction that leads the training and development of college students' physical health literacy, such as organization training joint training groups, jointly formulating and implementing the sports health literacy training program for college students, and evaluating the implementation and results of the training program. Due to the strong practicality of sports itself, it is easier to cultivate the interest in physical exercise than in other disciplines, cultivate students' awareness of "lifelong sports," cultivate students' good lifestyle, and behavior habits; at the same time, students' individual subjective initiative is stimulated; let students get out of the misunderstanding that sports only exist in the school curriculum, so that students understand the importance of physical exercise, and can take the initiative to participate in sports practice activities, relying on the quality of perseverance to cultivate students' physical health literacy. It is also a social responsibility to maintain one's own physical and mental health. The university student sports study psychological healthy evaluation is frequently viewed as the MADM issue. Therefore, it is of important significance to cope with the psychological health evaluation of university students. In this section, a practical example is provided for university student sports study psychological healthy evaluation by using the proposed G2TLNWHM aggregation operators. Assume that five possible university students $US_i\,(i = 1, 2, 3, 4, 5)$ to be assessed and four criteria are used to assess these university student sports study psychological healthy evaluation: ① OO_1 is the healthy lifestyle and behavior; ② OO_2 is the basic sports skills; ③ OO_3 is the utilization of essential public health service capacity; and ④ OO_4 is the basics and philosophy of the sport. The five possible university students $US_i\,(i = 1, 2, 3, 4, 5)$ are to be assessed through 2TLNNs under the four chosen attributes (attribute weight $\omega = (0.24, 0.34, 0.14, 0.28)$), which are depicted in Table 1.

In the following, we employ the approach built for university student sports study psychological healthy evaluation.

Step 1. According to Table 1, we can fuse all 2TLNNs $\tilde{r}_{ij}$ by G2TLNWHM operator to get the given overall 2TLNNs $US_i\,(i = 1, 2, 3, 4, 5)$ of the university students $\tilde{\delta}_i$. Suppose that $\theta = 2, \vartheta = 3$, then the fused results are depicted in Table 2.

Table 5: Order results for different parameter values of the G2TLNWHM operator.

(θ, ϑ)	$e(US_1)$	$e(US_2)$	$e(US_3)$	$e(US_4)$	$e(US_5)$	Order
(1, 1)	0.5981	0.4751	0.3473	0.437	0.5436	$US_1 > US_5 > US_2 > US_4 > US_3$
(3, 3)	0.6558	0.5632	0.4116	0.5222	0.6212	$US_1 > US_5 > US_2 > US_4 > US_3$
(5, 5)	0.6784	0.599	0.4351	0.5561	0.6567	$US_1 > US_5 > US_2 > US_4 > US_3$
(7, 7)	0.6921	0.6197	0.4483	0.5756	0.6777	$US_1 > US_5 > US_2 > US_4 > US_3$
(9, 9)	0.7016	0.6334	0.4571	0.5886	0.6914	$US_1 > US_5 > US_2 > US_4 > US_3$
(3, 4)	0.6632	0.5753	0.4194	0.5337	0.6315	$US_1 > US_5 > US_2 > US_4 > US_3$
(3, 5)	0.6697	0.5856	0.426	0.5434	0.6408	$US_1 > US_5 > US_2 > US_4 > US_3$
(3, 6)	0.6754	0.5945	0.4318	0.5518	0.649	$US_1 > US_5 > US_2 > US_4 > US_3$
(4, 3)	0.6628	0.5742	0.4191	0.5326	0.6334	$US_1 > US_5 > US_2 > US_4 > US_3$
(5, 3)	0.669	0.5837	0.4255	0.5417	0.644	$US_1 > US_5 > US_2 > US_4 > US_3$
(6, 3)	0.6744	0.592	0.4308	0.5496	0.6531	$US_1 > US_5 > US_2 > US_4 > US_3$

Table 6: Order of the university students.

	Order
2TLNNWA operator [66]	$US_1 > US_5 > US_2 > US_4 > US_3$
2TLNNWG operator [66]	$US_1 > US_5 > US_2 > US_4 > US_3$
2TLNN-EDAS method [69]	$US_1 > US_5 > US_2 > US_4 > US_3$
2TLNN-CODAS method [70]	$US_1 > US_5 > US_2 > US_4 > US_3$
G2TLNWHM operator	$\widetilde{\delta}_1 > \widetilde{\delta}_5 > \widetilde{\delta}_4 > \widetilde{\delta}_2 > \widetilde{\delta}_3$

Step 2. According to the fused results in Table 2, the score values of the university students are depicted in Table 3.

Step 3. According to the score values, the order is given in Table 4.

4.2. Parameter Influence Analysis. In order to depict the effects on the order results by altering parameter values of θ, ϑ in the G2TLNWHM information operators, all the fused results are given in Table 5.

The results reveal that the parameter values of the fused operators indeed have a very important impact on the orders of given alternatives.

4.3. Comparative Analysis. Then, the G2TLNWHM operator is used to compare with the 2TLNNWA operator and 2TLNNWG operator [66], 2TLNN-EDAS method [69], and 2TLNN-CODAS method [70]. The comparative analysis results are given in Table 6.

From the above studies analysis, it can be seen that the six built models have the same optimal selection, and the order of the six methods is the same. This proves that the G2TLNWGHM operator is reasonable and effective. The six given models have their advantages: (1) the 2TLNNWG operator focuses on group decision-making; (2) the 2TLNNWG operators emphasize the influence of individual decisions; (3) the 2TLNN-EDAS method requires less computation although it results in the same ranking of alternatives. Unlike TOPSIS and VIKOR, the evaluation of alternatives in the 2TLNN-EDAS method is based on the distance metric of each standard from the average solution; (4) in the 2TLNN-CODAS method, the overall performance of the alternatives is measured by the Euclidean distance and Hamming distance of the negative ideal point; (5) 2TLNN-TODIM is an interactive MADM method based on the value function of prospect theory; and (6) as an efficient aggregation operator, the G2TLNWGHM operator can consider the relationship between any number of parameters and has been studied by a large number of scholars.

5. Conclusion

In recent years, the reform of the physical education curriculum is guiding the transfer of physical education teaching ideas to the overall development of students' body and mind, emphasizing the importance of students' learning process, personal progress, and emotional attitude. These changes have brought about profound changes in the whole process of physical education implementation. Among them, the evaluation of students' physical education is also shifting to adapt to the new physical education teaching thought, emphasizing the process evaluation, downplaying the general standard evaluation, emphasizing the evaluation of personal progress and emotional attitude, and the evaluation content, methods, means, and tools are becoming more and more diversified. However, due to the influence of traditional teaching experience, this kind of "health first" evaluation that focuses on the development of students' physical, psychological, and social adaptation is difficult, especially for students' mental health in the process of emotional attitude and other physical activities. Due to the lack of corresponding evaluation tools and standards, the evaluation indicators are not easy to measure and quantify; the scientificity and fairness of evaluation and the in-depth implementation of the idea of physical education curriculum reform have been greatly affected. How to adapt a comprehensive evaluation method to fully reflect the reform of the physical education curriculum has become an important research topic in the reform physical education curriculum. In this paper, considering the interrelationship among the 2TLNNs, some HM operators are defined under 2TLNNs: G2TLNHM operator and G2TLNWHM operator. The novel MADM method based on the G2TLNWHM operator is built. The numerical example for university student sports study psychological healthy evaluation is proposed to show the new MADM method, and some comparisons studies are also done to further show some advantages.

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There may be some possible study limitations of this given research, which could be further investigated in our future research. (1) The physical health level of students is related to the future development of the country, and the importance of cultivating students' physical health literacy is self-evident. However, how to correctly evaluate the level of students' physical health literacy is not only the core of establishing the evaluation index system but also a very careful consideration. At present, the common evaluation methods include the dispersion method, the percentile method, the analytic hierarchy process, and other various index evaluation methods. However, if the evaluation index system is to be perfect, it is necessary to adapt a multi-dimensional and multi-indicator method for comprehensive evaluation. Due to different data types, evaluation objectives, and evaluation feedback, each method has shortcomings. Therefore, the research needs to be polished through expansion and linkage to form static, dynamic, weighted, and other methods to be complete. (2) Sports health literacy includes cognitive attitudes, related knowledge and skills, physical exercise habits, and other aspects of sports and health, so its training is a long-term systematic project, which requires targeted, step-by-step, and complete and effective measures, and methods are implemented. At present, the most urgent task is to find out the basic status and main problems of college students' sports health literacy, find out the fundamental factors that affect the cultivation of sports health literacy, and clarify which of these factors have an essential impact and which have an indirect impact, and the relationship between these influencing factors can make the research more targeted. (3) In subsequent models studies, the application studies and analysis of 2TLNNs need to be coped with along with any other uncertain MADM circumstances [83–85]. (4) The built models and methods could be extended to *n*-valued refined neutrosophic logic settings [86].

Data Availability

The data used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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