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# A Comparative Study of Different Approaches to Multi-Criteria Decision-Making Models

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**Abstract**
In this research paper, he proposes a new concept ranking technique for similarity ranking preference with an ideal solution on fuzzy soft set theory to solve the multi-criteria decision-making problem of selecting a suitable work area in the candidate fuzzy phase. And it also presents a study on dyslexia and deals with the problem of choosing an appropriate treatment for inner play. Here, a comparative study is made between fuzzy soft set, weighted sum model (WSM), fuzzy matrix in decision making and the newly proposed method.

**Keywords :-**
★ **TECHNIQUE FOR ORDER OF PREFERENCE BY SIMILARITY TO IDEAL SOLUTION**
★ **APPLICATION OF RANKING ORDER OF SOFT TOPSIS- MULTI CRITERIA DECISION MAKING**
★ **Mathematical modelling of MCDM problem**
★ **OVERVIEW OF THE DISEASE DYSLEXIA**
★ **Problem procedure for fuzzy soft set**
★ **Problem procedure for Weighted Sum Model**
★ **Problem procedure for fuzzy matrix in decision making**
★ **NEW APPROACH USING MULTI-CRITERIA DECISION MAKING METHOD FOR SELECTING SUITABLE INDOOR GAME TREATMENT FOR DYSLEXIA**
★ **RESULTS AND DISCUSSION**

## I. INTRODUCTION :-

Workers can work in any field. But their work performance and mindset will depend on their environment, job position and distance from family and friends. Dissatisfaction with the choice of field leads to worker unhappiness, which affects his performance. Therefore, it is important that individuals carefully evaluate suitable workspace alternatives based on the factors that are considered important to them. This article dealt with the selection of job areas of difficulty of the players who are all participating in the counseling (government job) according to the sports quota.

Sports Quota is a specific quota for players to get government jobs easily. Players will be called for counseling (government jobs) in the order of their merit. Players must analyze their available work area for the consultation date and time in advance, as the player can only choose the work area available on that day. The player must choose a suitable desktop. At that time, players will have a lot of confusion when choosing a work area. In order to avoid these misunderstandings, we proposed an algorithm for ranking the TOPSIS-Multi criteria decision problems using fuzzy soft sets. This research paper with a new MCDM approach and mathematical modeling of the problem. Applications and comparisons between different approaches are presented in the table of contents and discussion.

### TECHNIQUE FOR ORDER OF PREFERENCE BY SIMILARITY TO IDEAL SOLUTION

The Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) is one of the methods to solve a Multi-Criteria Decision Making (MCDM) problem. This method was developed by Hwang and Yoon and its further developments by Yoon (1987), and Hwang, Lai and Liu (1993). The main steps of TOPSIS methodology are:

**Step 1:** Construction of decision matrix.

**Step 2:** Construction of normalized decision matrix.

**Step 3:** Construction of weighted normalized decision making.

**Step 4:** Determining the Positive Ideal Solution (PIS) and Negative Ideal Solutions (NIS).

**Step 5:** Calculating the distances of each alternative to the positive and negative ideal solutions.

**Step 6:** Calculating the Closeness Coefficient (CC) aggregation function.

**Step 7:** Ranking the alternatives.

**The main advantages of TOPSIS method are**:
- ★ It will work with quantitative data with different units.
- ★ It process will be very simple.
- ★ It will need only a minimal number of inputs from the user.
- ★ It will be very simple to use and programmable and their output will be easy to understand.
- ★ The advantage of its simplicity and its ability to maintain the same amount of steps regardless of problem size or number of alternatives has allowed it to be utilized quickly as a suitable decision making tool.

**APPLICATION OF RANKING ORDER OF SOFT TOPSIS- MULTI CRITERIA DECISION MAKING**

**Mathematical modelling of MCDM problem**

Suppose there are m alternatives (working areas) U = { } and the decision makers have taken some selection criteria as X = { } for preference evaluation of the working area. The performance evaluation is expressed as fuzzy soft set, where F: X→P(U), for each decision makers. Suppose player is interested to select the suitable working area on the basis of the recent decision maker‘s information D, but player may have his own weightage to different selection criteria. For example preference weightage can be expressed as Best Non-Fuzzy performance Value (BNP) is obtained from defuzzifying fuzzy Using COA, obtain weightage of the alternatives and using these, player can decide the suitable working area among the working areas.

**New approach using Multi criteria decision making for selecting suitable working area**

Selim Eraslan used an algorithm to solve the decision method via TOPSIS on soft sets. studied about MODM for the selection of optimized edible fish and MCDM problem using fuzzy soft sets in sports. According to these algorithms and ideas, we reconstruct a new method. Define the problem and create a decision matrix for each decision maker. Find the max/min of the corresponding matrix entries.

If the objectives need not be maximized or minimized, find the average of the corresponding matrix entries, say D. Multiply the weight of the player's selection criteria by the corresponding items in each column to obtain a comprehensive decision matrix.The alternative weight is calculated by a normalization process. Defuzzify fuzzy numbers to determine the degree of importance of alternatives. Get the weight for each work area and work area The maximum weight is recommended as a suitable work surface. Now we will follow a new approach to solve the above problem.

Here, one player struggles with choosing a suitable desktop and consults his confusion with three members. Coimbatore, Tirunelveli and Cuddalore out of these three areas he wants to choose any area. Here, these areas are taken as alternatives. And according to the distance, department, environment / lifestyle he wants to decide and these three are the criteria. According to these multiple criteria, the decision-making bodies choose the best alternative.

A player has a set of all different types of working areas U= { } (For i=1, 2, 3 an alternatives stands for ―Coimbatore‖, ―Tirunelveli‖, ―Cuddalore‖)
which may be characterized by a set of all parameters (criterion) X={ }. For j=1, 2, 3 the parameters stands for ―Distance‖, ―Department‖, ―Environment / lifestyle‖ respectively.

Here, there are three decision-makers come to the person to select a suitable area. First, each decision-maker has to consider their set of parameters. Then, they can construct their soft sets.

## II. OVERVIEW OF THE DISEASE DYSLEXIA

In this section, we discussed the disease, dyslexia. With the help of Dr. A. Niranjan Kumar, Post Graduate in Anesthesiology, we analyze about it.

Disease is often constructed as a medical condition associated with specific symptoms and signs. Dyslexia is a developmental disorder that was not clear to researchers until the 20th century. It became categorized as a learning disability in 1896 and was debated for many years (Snowling et al, 2003). Dyslexia has been defined in many different forms and ways. According to the US National Institutes of Health, it is a learning disability that causes a child to have difficulty reading, writing, pronouncing and sometimes speaking. In the 1980s, the National Institute of Child Health and Human Development (NICHD) said that if a child struggles with reading, it cannot be explained by low intelligence, poor eyesight, insufficient educational opportunities, poor hearing, and then the child must be affected by dyslexia. Facts about life All children grow, develop and learn. Every day the children faced many new concepts and different challenges. We can't imagine a child who not only faces new challenges in life, but also faces such challenges while living with a learning disability. In this post, we have discussed one of the suitable games for treating dyslexia. Here we conducted a comparative study between fuzzy soft set, weighted sum model, fuzzy matrix in decision-making and a newly proposed method. Molodtsov (1999) proposed a fuzzy soft set and its properties were studied in Maji et al. (2001). It is useful for solving everyday problems in the simplest way and this method helps in making decisions in a critical situation. Shimura (1973) discussed the concept of Fuzzy sets in ordering objects. In decision theory, the weighted sum model is the simplest multi-criteria decision-making method for evaluating a number of alternatives in terms of a number of decision criteria.

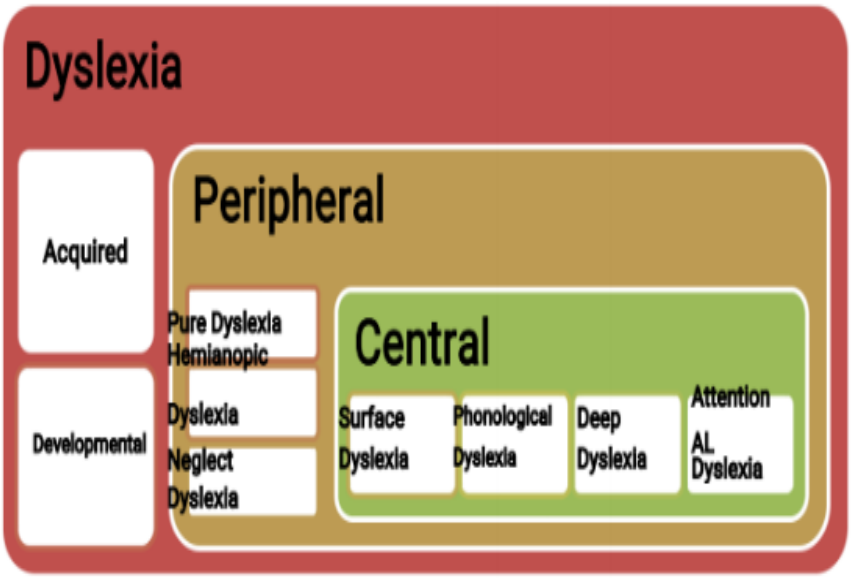


**Figure 1: Classification of Dyslexia**

Dyslexia is a specific learning disability in reading. People get dyslexia from trauma or stroke after birth. This causes brain cells to die. Someone who suffers from dyslexia will have difficulty reading accurately and fluently. They may have difficulty with reading comprehension, spelling and also writing. Compared to girls, it is more common in boys. It doesn't just affect learning. This disease can also affect daily activities and skills. These include social interaction, memory and stress management

**Central Dyslexia**

*Surface Dyslexia:* Regular pronunciations are read easily. Example: Ball, but those irregular pronunciations are difficult. Example: ISLAND.

*Phonological Dyslexia:* He/she can easily read familiar words, but they feel very difficult to read unfamiliar words.

*Deep Dyslexia:* It is combination of Semantic Dyslexia **(**he/she can‘t correlate the meaning of the world, which they spell or read) and Phonological Dyslexia (he/she can read the word, but says unrelated meaning instead of the actual meaning).

*Attention AL Dyslexia:* He/she can‘t read blended words, but can read the same word when split into halves.

**Peripheral Dyslexia**

*Pure Dyslexia:* He/she unable recognizes the written letters in a sequence.

*Hemianopic Dyslexia:* It will damage the visual cortex. Hence, visual field will loss and that he/she will be slow reader.

*Neglect Dyslexia:* He/she will leave some part of word or beginning of word is left or wrongly spelled.

Other features are Learning disability; No sex predilection, but frequently is in male; When diagnosed in childhood, then the prognosis outcome is good; He/she needs social support; Poor memory capacity; Depression. Signs of dyslexia will differ by age to age. Here are some examples of signs of dyslexia are given in figure 2

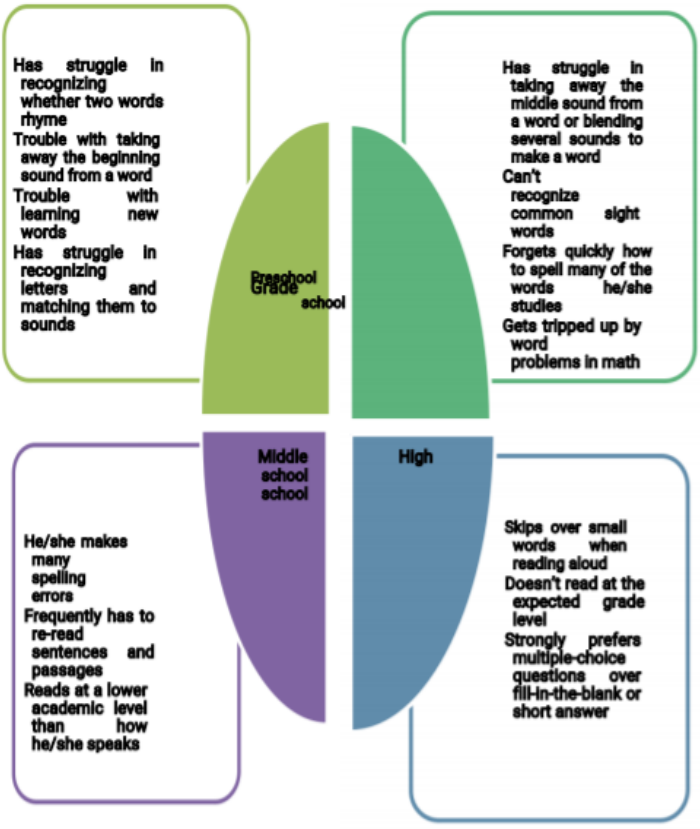


**Figure 2 : Signs of Dyslexia for different ages**

For dyslexia there is no curative treatment, but we can reduce the symptoms. One of the way is to reduce the symptoms of dyslexia is playing indoor games. Indoor games can be one of the best ways to keep mind healthy and active. It will creates happiness and reduce stress, an opportunity to spend time together, memory formation and cognitive skills, improves immune system, coordination and so on. Playing indoor games is one of an excellent treatment for dyslexia. Every indoor game has different rules and assists in different ways in the development of kid‘s mind. Indoor games will help to increase the mental power of the child and considered to be the best mind exercise. In this paper dealt with one of the suitable indoor game treatments for dyslexia. The criteria and alternatives to define one of the suitable indoor game treatments for dyslexia are created using a simple questionnaire.

## PROBLEM PROCEDURE FOR FUZZY SOFT SET, WEIGHTED SUM MODEL AND FUZZY MATRIX IN DECISION MAKING

### Problem procedure for fuzzy soft set

The concept of soft set theory was introduced by Molodtsov in 1999. Krishna Gogoi et al. (2014) has solved a day to day problem using fuzzy soft set theory. Here, we have used his procedure to select a suitable indoor game treatment for the disease dyslexia. Input the performance evaluation of the indoor games by experts as matrices. Find the average of the corresponding entries of all the matrices. Multiply the weightage of the selection criteria of the person to the corresponding entries of each row to get the comprehensive decision matrix (in this problem we have given the weightage for each criteria as 0.07, 0.09, 0.2, 0.1, 0.05, 0.18, 0.19, 0.12). Formulate the comparison table. Find the row-sum and column-sum of the comparison table. Obtain the score for each indoor games and the indoor game with maximum score is recommended as one of the suitable indoor game treatment for dyslexia.

### Problem procedure for Weighted Sum Model

WSM is the simplest method to solve Multi-criteria decision making problem. It is also said to be Weighted Linear Combination (WLC) or Simple Additive Weighting (SAW). Fishburn (1967) reviewed additive utility formulations for risky and non-risky multi factor decision situations. Input the performance evaluation of the indoor games by experts as matrices. Find the average of the corresponding entries of all the matrices. Assume that all the criteria are benefit criteria. Then, the total importance of alternative $G_i$, denoted as $G_i^{\text{WSM-score}}$, is defined as follows:

$G_i^{\text{WSM-score}} = \sum$, for I = 1, 2, 3, … , m.

where, $w_j$ is the relative weight of importance of the criterion $X_j$ and $a_{ij}$ is the performance value of alternative $G_i$ when it is evaluated in terms of criterion $X_j$. For the maximization case, the best alternative is the one that yields the maximum total performance value.

### Problem procedure for fuzzy matrix in decision making

Thomason (1977) defined fuzzy matrices and discuss about the convergence of powers of a fuzzy matrix. Find the average of the corresponding entries of all the matrices. Multiply the weightage of the selection criteria of the person to the corresponding entries of each row to get the comprehensive decision matrix. Then, formulate the pair wise function. Using relativity function we find the comparison matrix and here, the suitable indoor game treatment for dyslexia is the one that yields the minimum value.

## NEW APPROACH USING MULTI-CRITERIA DECISION MAKING METHOD FOR SELECTING SUITABLE INDOOR GAME TREATMENT FOR DYSLEXIA

the indoor game with maximum row-sum is i.e., Chess. Hence, Chess is recommended as one of the suitable indoor game treatment for dyslexia.

| | | | | | | | | | Row-Sum |
|---|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 1 | 4 |
| | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 6 |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 |
| | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 5 |
| | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 7 |

**COMPARISON BETWEEN DIFFERENT APPROACHES**

| Indoor games | Fuzzy soft set | | WSM | | Fuzzy matrix | | Proposed method | |
|---|---|---|---|---|---|---|---|---|
| | Final value | Rank | Final value | Rank | Final value | Rank | Final value | Rank |
| | -10 | 5 | 0.5158 | 5 | 1 | 5 | 4 | 5 |
| | -5 | 3 | 0.565 | 3 | 0.8 | 4 | 6 | 3 |
| | 20 | 1 | 0.7981 | 1 | 0.143 | 1 | 8 | 1 |
| | -7 | 4 | 0.5648 | 4 | 0.6 | 3 | 5 | 4 |
| | 2 | 2 | 0.6039 | 2 | 0.33 | 2 | 7 | 2 |

Table 2 : Comparative result

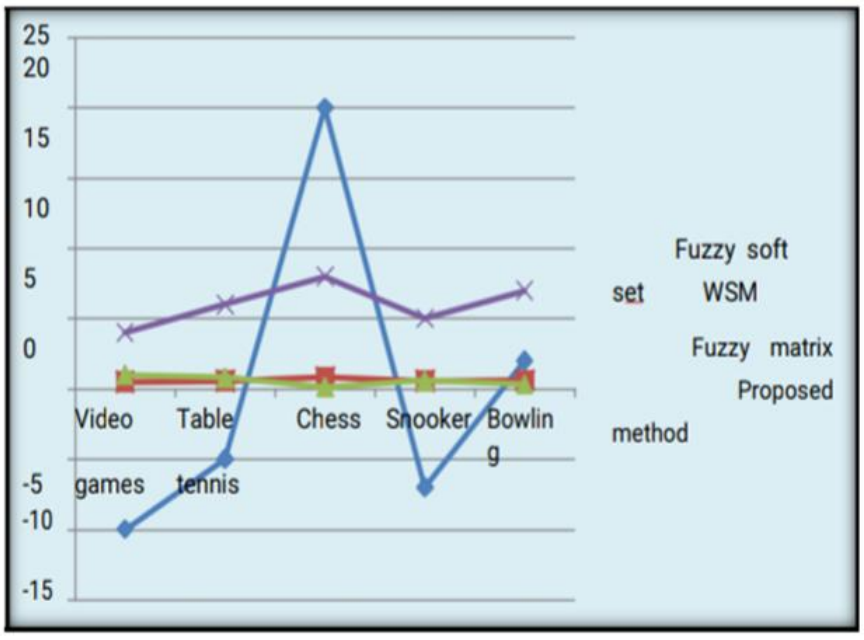


**Figure 3 Graphical representation of comparative result**

## III. RESULTS AND DISCUSSION

By table 2 and figure 3 we have seen that g (chess) is the best way to reduce symptoms of dyslexia followed by g (bowling). While comparing to fuzzy soft set, weighted sum model, fuzzy matrix, we can conclude that the concept of new approach in multi-criteria decision making problems using by soft set and fuzzy algebra method is very much interesting and has simple calculation for solving the day to day problems.

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