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Integrating fuzzy numbers in analyzing students' decisions on higher education and employment

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ABSTRACT

A prism fuzzy number is the integration of triangular and trapezoidal fuzzy numbers. In this artifact, the balancing point and the grading value of the prism fuzzy number is defined. By using prism fuzzy number, we were able to infer the Trapezoidal and Triangular fuzzy numbers. A comparative study with the current model is done to corroborate our findings. An enhanced grading technique for evaluating the prism fuzzy numbers is defined. Finally, the application of prism fuzzy numbers to assess student's interest in higher studies and employment is illustrated using the MATLAB simulation. A statistical analysis is demonstrated using the Python programme with real-life data.

Keywords: prism fuzzy number (PrFN), balancing point, grading value, decision making

1. Introduction

Zadeh [23] established the Fuzzy Set theory model to approach ambiguous or uncertain things. In 1975, Zadeh [24] pioneered fuzzy numbers. Further, the conjecture of fuzzy numbers was established by several authors like Dubois, R. Yager Mizomoto, and J. Buckley. Triangular fuzzy numbers and Trapezoidal fuzzy numbers play a very important role in fuzzy numbers. In the last decade, the fuzzy numbers were enriched with various numbers [5], [22] ,[13], [14],[6],[20] and [2] . fuzzy numbers

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have been functional in various areas, such as engineering, medication, business, decision-making, and so on. Several authors like Yager [21], Cheng's [7], Chu and Tsao's [9], Rao and Shankar [16], Abbasbandy [1] devised and discussed many ranking methods using the centroid points of different fuzzy numbers , with their strengths and shortcomings. Decision-making plays a significant role in human life. Several authors have applied the theoretical fuzzy number idea in social issues to find the optimal solution.

Neff [12] applied the fuzzy set theoretical concept to study the poverty level. Revathi et al. [17] identified the social problems of farmers using Fuzzy mathematics. Thakre et al. [19] employed a fuzzy logic multicriteria approach to evaluate the teacher's performance. Kumar and Pathinathan [11] applied the Pentagonal Fuzzy decision-making technique in "Sieving out the Poor". In Greece, during the COVID-19 epidemic, Chrysafiadi et al. [8] evaluated the E- learning acceptance and effectiveness of computer science students. Siva and RamKumar [18] applied Fuzzy cognitive concepts to study the poverty rate in a pandemic scenario in Tamil Nadu. Several authors applied Fuzzy Mathematical concepts and Fuzzy Logic evaluation methods to social problems [10], [15].

An emerging new type of fuzzy number called prism fuzzy number (PrFN) [2]. prism fuzzy number has its own membership value, properties, and operations. The combination of Trapezoidal fuzzy numbers and other fuzzy numbers enhances the prism fuzzy number (PrFN) in different ways of approaching crisp values for better results with precise descriptions.

The conjectural ideas are accomplished when they are implemented. Numerous mathematical ideas have been used in realistic condition. The main objective of the study is to apply its findings to society. Education is one of the essential things for the growth of country. Higher education fosters knowledge, ethics, and it improves the technology. The development of society depends on the growth of an individual person which depends on the higher education. Education was seen as a difficult endeavor in the past, and scholars were viewed as achievers by the community. Nowadays, enrollment in higher education and the level of placement for job reveals that student's interests are slowly decline towards education. In this study, we investigate the main factors influencing students' decisions regarding jobs and higher education. In general, society believes that financial status plays a significant role in shaping a student's future choices. We also examine whether economic status is the sole factor behind a student's decision to pursue a job. Whenever two extreme cases exist for a problem, the prism fuzzy number helps in determining the optimal solution based on the given circumstances. Choosing a job or pursuing higher education are both good decisions; one cannot be deemed the best while the other is the worst. Such cases can be effectively analyzed using the prism fuzzy number to determine the most suitable choice.

In this artifact, Section 2 gives the preliminaries to understand the types and operations in fuzzy numbers. Section 3 presents the centroid of prism fuzzy number and Section 4 provides the comparative analysis that supports our suggested outcome. The grading value with the alpha cuts and an improved prism fuzzy number technique are presented in Section 5. Section 6 employs the improved prism fuzzy number technique to investigate the student's interest in pursuing higher education and employment. Additionally, we investigate the main factors influencing students' decisions regarding their future. The statistical analysis using the Python programme is presented in section 8. Section 9 gives the discussion of the study. The conclusion and potential directions for further prism fuzzy number analysis are presented in Section 10.

2. Preliminaries

Definition 2.1 (Triangular fuzzy number [4]). A Triangular fuzzy number $T = (t_1, t_2, t_3)$ where t_1, t_2, t_3 are real numbers is a fuzzy set which is a subset of real line R. The membership function $\mu_T(x)$ satisfies the conditions as given below:

$$\mu_T(x) = \begin{cases} \frac{(x-t_1)}{t_2-t_1}, & \text{for } t_1 \leq x \leq t_3, \\ \frac{(t_3-x)}{t_3-t_2}, & \text{for } t_2 \leq x \leq t_3, \\ 0, & \text{otherwise.} \end{cases}$$

Definition 2.2 (Trapezoidal fuzzy number [5]). A Trapezoidal fuzzy number $Tr = (Tr_1, Tr_2, Tr_3, Tr_4)$, $(Tr_1 \leq Tr_2 \leq Tr_3 \leq Tr_4)$ is defined in R. Its membership function is represented as:

$$\mu_{Tr}(x) = \begin{cases} 0, & x < Tr_1, \\ \frac{x-Tr_1}{Tr_2-Tr_1}, & \text{for } Tr_1 \leq x \leq Tr_2, \\ 1, & \text{for } Tr_2 \leq x \leq Tr_3, \\ \frac{Tr_4-x}{Tr_4-Tr_3}, & \text{for } Tr_3 \leq x \leq Tr_4, \\ 0, & x > Tr_4. \end{cases}$$

Definition 2.3 (prism fuzzy number [2]). A prism fuzzy number $P = \{a_1, a_2, a_3, a_4, a_5; \beta\}$ is defined on the real line R, whose degree of membership is defined as follows:

$$\mu_P(x) = \begin{cases} \frac{(x-a_1)}{a_3-a_1}, & \text{for } a_1 \leq x \leq a_3, \\ \frac{(a_5-x)}{a_5-a_3}, & \text{for } a_3 \leq x \leq a_5, \\ \beta, & \text{base}, \\ \frac{(a_1-x)}{a_1-a_2}, & \text{for } a_1 \leq x \leq a_2, \\ 1, & \text{for } a_2 \leq x \leq a_4, \\ \frac{(x-a_5)}{a_4-a_5}, & \text{for } a_4 \leq x \leq a_5, \\ 0, & \text{otherwise.} \end{cases}$$

Definition 2.4 (Operations on prism fuzzy number [2]). Consider two prism fuzzy number $Px = \{Px_1, Px_2, Px_3, Px_4, Px_5\}$, $Py = \{Py_1, Py_2, Py_3, Py_4, Py_5\}$

1. Addition of two prism fuzzy number: $Px + Py = \{Px_1 + Py_1, Px_2 + Py_2, Px_3 + Py_3, Px_4 + Py_4, Px_5 + Py_5\}$
2. Subtraction of two prism fuzzy number: $Px - Py = \{Px_1 - Py_1, Px_2 - Py_2, Px_3 - Py_3, Px_4 - Py_4, Px_5 - Py_5\}$
3. A scalar multiplication of prism fuzzy number: $kPx = \{kPx_1, kPx_2, kPx_3, kPx_4, kPx_5\}$

3. Centroids of prism fuzzy number

Partition the prism fuzzy number into three triangles, with $(a_1, 0), (a_2, w)$ and (a_3, w) as the first triangle's vertex, $(a_2, w), (a_3, w)$ and (a_4, w) as the second triangle's vertex, and $(a_4, w), (a_3, w)$ and $(a_5, 0)$ as the third triangle's vertex and centroids GPr_1, GPr_2, GPr_3 respectively [2] which are depicted in Figure 1.

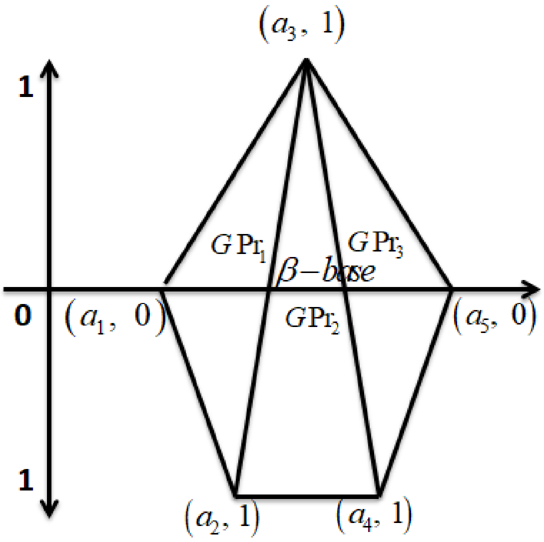


Fig. 1. Centroids of prism fuzzy number

The centroid of GPr_1, GPr_2, GPr_3 is

$$GPr^*(x_0, y_0) = \left(\frac{a_1 + 2a_2 + 3a_3 + 2a_4 + a_5}{9}, \frac{7w}{9}\right). \tag{1}$$

The three points on each triangle that balance each other are known as GPr_1, GPr_2, and GPr_3. So, let us use this as a starting point and identify the circumcenter of these balancing points. Consider the prism fuzzy number as $Pr= (a_1, a_2, a_3, a_4, a_5 : w)$. GPr_2 does not lie on the line connecting GPr_1 and GPr_3, and the equation of the line involving GPr_1 and GPr_3 is $y = 2w/3$. It indicates the points are not collinear. Thus, it creates a triangle. The circumcenters of these centroid points are distributed equally among each of their vertices.

The circumcenter of the prism fuzzy number is

$$GP_r(x_0, y_0) = \left(\frac{a_1 + a_2 + 2a_3 + a_4 + a_5}{6}, \frac{(a_1 - a_4)(a_5 - a_2) + 5w^2}{6w}\right). \tag{2}$$

It provides the appropriate balancing point for the plane and is uniformly spaced from every vertex. This is the best ranking strategy.

Transform the generalized prism fuzzy number into a Trapezoidal fuzzy number by assuming that $a_3 = 0$. Hence, $GPr\{Tr\}(x_0, y_0) = \left(\frac{a_1+a_2+a_4+a_5}{6}, \frac{(a_1-a_4)(a_5-a_2)+5w^2}{6w}\right)$.

Deduce the Triangular fuzzy number from the generalized prism fuzzy number by substituting $a_2 = a_4 = 0$. Hence we get, $GPr\{T\}(x_0, y_0) = \left(\frac{(a_1+2a_3+a_5)}{6}, \frac{(a_1-a_4)(a_5-a_2)+5w^2}{6w}\right)$.

For any decision maker $R(Pr) = (x_0, y_0)$ gives the ranking value of the generalized prism fuzzy number.

4. Comparative study

Many authors recommended different rating systems and made decisions. This section compares the deduced generalized Trapezoidal Fuzzy value to other existing models in order to validate our findings.

Consider the fuzzy numbers: $P_1 = (0.3, 0.4, 0.5, 0.6 : 1), P_2 = (0.1, 0.2, 0.4, 0.7 : 1)$.

Table 1. Comparative study

Method	GP_1Tr	GP_2Tr	$R(P_1)$	$R(P_1)$	Result
Yager's Method [21]	(0.45)	0.35	-	-	$P_2 < P_1$
Cheng's Method [7]	(0.45, 0.33)	(0.358,0.33)	0.5598	0.469	$P_2 < P_1$
Azman et al. Method [3]	(0.3916,0.416)	(0.245,0.416)	0.571	0.4837	$P_2 < P_1$
Proposed Method	(0.3,0.826)	(0.233,0.8083)	0.2478	0.1883	$P_2 < P_1$

Remark 4.1. From the centroid of prism fuzzy number Eq. (1), the inferred Trapezoidal formula yields

$$GPr^*\{Tr\} = \left(\frac{(a_1 + 2a_2 + 2a_4 + a_5)}{9}, \frac{7w}{9}\right).$$

With this formula, P_1 and P_2 have values of $(0.3, 0.777)$ and $(0.222, 0.777)$ respectively. Then $R(P_1) = 0.2331$, $R(P_2) = 0.1724$ which also results in $R(P_2) < R(P_1)$.

5. A novel grading value and its attributes

A grading value ρ is the function $\rho : F \times R$ which maps all the fuzzy number on the real set into the real quantity.

Definition 5.1 (Grading value)**.** i) The grade of Triangular fuzzy number is $\rho\{T\} = \frac{(a+2b+c)}{2}$.
ii) The grade of Trapezoidal fuzzy number is $\rho\{T_r\} = \frac{(a+b+c+d)}{2}$

5.1. Grading value of prism fuzzy number

The grading value of prism fuzzy number is the sum of integral of $L_1(\alpha), L_2(\alpha), R_1(\alpha)$ and $R_2(\alpha)$.

$$\rho(Pr) = \int_0^1 \Big(L_1(\alpha) + L_2(\alpha) + R_1(\alpha) + R_2(\alpha)\Big)d\alpha,$$

where $L_1(\alpha) = (a_3 - a_2)\alpha + a_1$, $L_2(\alpha) = a_5 + (a_5 - a_3)\alpha$, $R_1(\alpha) = a_1 - (a_1 - a_2)\alpha$, and $R_2(\alpha) = (a_4 - a_5)\alpha + a_5$.

$$\rho(Pr) = \frac{(2a_1 + a_2 + 2a_3 + a_4 + 2a_5)}{2}.$$

Let Pr_1 and Pr_2 be two prism fuzzy numbers. The grading of Pr_1 and Pr_2 can be assessed by the following principle:
i) If $\rho Pr_1 > \rho Pr_2$ then $Pr_1 > Pr_2$.
ii) If $\rho Pr_1 < \rho Pr_2$ then $Pr_1 < Pr_2$.
iii) If $\rho Pr_1 = \rho Pr_2$ then $Pr_1 = Pr_2$.

5.2. Unique attributes of the proposed grading system

fuzzy numbers help us find solutions where uncertainty exists. Triangular, Trapezoidal, and Pentagonal fuzzy numbers play a significant role in Fuzzy Set theory. For a problem, these fuzzy numbers assess the values on one side of possibility and do not take the other side into account. So, the comparison between two sides of an issue cannot be done with the existing method. For example, suppose the person wants to choose a job from three choices. fuzzy numbers help the person find the optimal solution with one way of assessing the data. The current imprecise data does not justify evaluating the situation in terms of two extremes.

However, the upgraded tool of prism fuzzy number makes it easy to justify the benefits of a certain job for a person. One-sided grading is insufficient to quantify a quantity and choose the best course of action. Every problem has its pros and cons, or the two extremes. The only method for evaluating a problem's two extreme levels with a common basis is the prism fuzzy number (PrFN). The suggested methodology based on grading technique depends on the common base.

Let us consider, $Pr_1 = \{1, 2, 3, 4, 5\}$ and $Pr_2 = \{3, 4, 5, 6, 7\}$ be two prism fuzzy numbers.

Table 2. Conjecture and outcomes of a prism fuzzy number

Assumptions	ρPr_1	ρPr_2
$a_2 = a_4 = 0$	9	15
$a_3 = 0$	9	15

Table 2 indicates that the upper and lower sections of the prism fuzzy number are given equal significance by the suggested grading value. This helps us to fix our two extremes of a problem in two sections of prism fuzzy number. Then the grading value facilitates the results with extreme yields being the most beneficial.

Case i. A person wants to travel from City A to City B. He has two options: either to travel by car or by bike. Let $Pr_1 = (0.3, 1, 0.6, 1, 0.4)$ stand for the individual's preference among a car and a bike.In this instance, the upper portion of the prism fuzzy number (a_3) indicates the desire to choose a car, and the lower part (a_2, a_4) indicates the interest in choosing a bike. The common traits of the bike and car are indicated by (a_1, a_5). As soon as we perceive the value, it is clear that the individual has a strong interest in bike (lower section).

Table 3. Conjecture and Outcomes of Pr_1

Assumptions	ρPr_1	Outcome
$a_2 = a_4 = 0$	1.3	$1.3 < 1.7$
$a_3 = 0$	1.7	To choose bike

Table 4. Conjecture and outcomes of Pr_2

Assumptions	ρPr_2	**Outcome**
$a_2 = a_4 = 0$	1.7	$1.7 > 1.3$
$a_3 = 0$	1.3	To choose car

The outcome is depicted in Table 3, which demonstrates that an individual's interests and circumstances make him to choose a bike.

Case ii. For $Pr_2 = (0.3, 0.6, 1, 0.6, 0.4)$ the outcome is illustrated in Table 4.

6. Application of the prism fuzzy number to assess students' interest in higher studies or employment

Education fosters personal growth, which is the driving force behind societal advancement. In recent years, there has been a marked decline in the desire to go to college. Students interest in pursuing higher education can be influenced by a variety of variables, including their financial situation, lack of motivation for learning, ignorance about opportunities for higher education, etc. There are a variety of reasons why students choose to work, including the need to provide financial support for their families, a lack of enthusiasm in their studies, an exaggerated perception of higher education, or parental pressure. The integrated prism fuzzy number tool allows us to quickly figure out whether a student is interested in pursuing further education or finding work. Figure 2 illustrates the flowchart for the data analysis process. In this segment, we look into the primary motivators behind the choices that students make regarding their future.

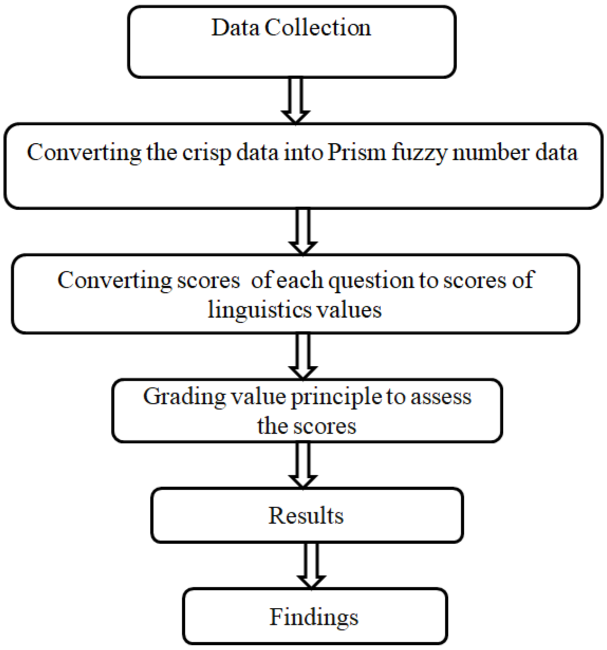


Fig. 2. Flowchart of data analysis

7. Algorithm

1. Data is collected through a Google Form questionnaire that focuses on information about the financial state of the family, the influence of the parents, the interest in education, the interest in a job, social networks, and background information about the family.
2. Converting crisp data into prism fuzzy number data.
3. Translating each questionnaire's scores into a linguistic value on a 5- point scale.
4. Use the grading value principle to evaluate the standard of scores.
5. Results
6. Findings

Step 1: Data collection

Data from the final year UG and PG students at the colleges in the Vellore and Ranipet district were collected using a questionnaire in order to determine the psychological reasons behind the students' decisions. The questionnaire includes information on the financial status of the student (FS), interest in studies (IS), interest in a job (IJ), parents' obligation to support higher education (PH), the influence of social networks on higher education (SN), fee structure (FES), interest in future studies (IF), and other reasons (ORH) for pursuing higher education, such as being forced to marry, not wanting to stay at home simply. Parents' compulsion to work (PW), students' financial need to support their families (SFF), misunderstandings about higher education (OHS), transportation options (TF), and additional factors that influence employment decisions (AFE).

Step 2: Adaptation of the crisp number into a prism fuzzy number

Scaling Value: Very Low(V_L)= (0,0.05,0.1,0.15,0.2)

Low(L)= (0.2,0.25,0.3,035,0.4)

Moderate(M)= (0.4,0.45,0.5,0.55,0.6)

High(H)=(0.6,0.65,0.7,0.75,0.8)

Very High(V_H)=(0.8,0.85,0.9,0.95,1.0)

Step 3: Adaptation scores

The adapatation scores of linguistic values for higher studies and employment are presented in Table 5 and Table 7.

Table 5. Adaptation scores of linguistic values for higher studies

	V_L	L	M	H	V_H
FS	(0,4.7,9.5,	(6.6,8.2,9.9,	(3.6,4.05,4.5,	(5.4,5.8,6.3,	(4.8,5.1,
	14.2,19)	11.5,13.2)	4.9,5.4)	6.7,7.2)	5.4,5.7,6)
PH	(0,3.7,7.4,	(5.4,6.7,8.1,	(6,6.7,7.5,	(12.6,13.6,14.7,	(12,12.7,
	11.1,14.8)	9.4,10.8)	8.2,9)	15.7,16.8)	13.5,14.2,15)
SN	(0,1.8,3.7,	(4.7,5.8,7.0,	(15.1,16.9,18.8,	(16.6,18,19.4,	(20.4,21.6,
	5.6,7.5)	8.2,9.4)	20.7,22.6)	20.8,22.2)	22.9,24.2,25.5)
FES	(0,0.9,1.9,	(3,3.7,4.5	(19.6,22.,24.5	(20.4,22.1,23.8,	(28,29.7,
	2.8,3.8)	5.25,6)	26.9,29.4)	25.5,27.2)	31.5,33.2,35)
IS	(0,0.3,0.6,	(2.1,2.6,3.1,	(7.4,8.3,9.2,	(14.7,15.9,17.1,	(73.6,78.2,
	0.9,1.3)	3.6,4.2)	10.1,11.1)	18.3,19.6)	82.8,87.4,92)
IF	(0,0.5,1,	(2.6,3.2,3.9,	(6.4,7.2,8,	(19.2,20.8,22.4,	(64.8,68.8,
	1.5, 2)	4.5,5.2)	8.8,9.6)	24,25.6)	72.9,76.9,81)
ORH	(0,2.8,5.6,	(3.5,4.3, 5.2	(11,12.3,13.7,	(8.1,8.7,9.4,	(29.6,31.4,
	8.47,11.3)	5.2,6.1,7)	15.1,16.5)	10.1,10.8)	33.3,35.1,37)

Table 6. Grading Value of Higher studies

Criteria	FS	PH	SN	FES	IS	IF	OR
V_L	38	29.6	15	7.6	2.6	4	22.6
L	39.6	32.4	28.2	18	12.6	15.6	21
M	18	30	75.49	98	37	32	55
H	25.2	58.8	77.69	95.2	68.6	89.6	37.8
V_H	21.6	54	91.8	126	331	291.6	133.2

Step 4: Grading value(ρPr**)**

The grading values for higher studies and employment are presented in Table 6 and Table 8.

Step 5: Results

MATLAB software is used to analyze the data, and the following are simulation results, which are represented in Figures 3 and 4.

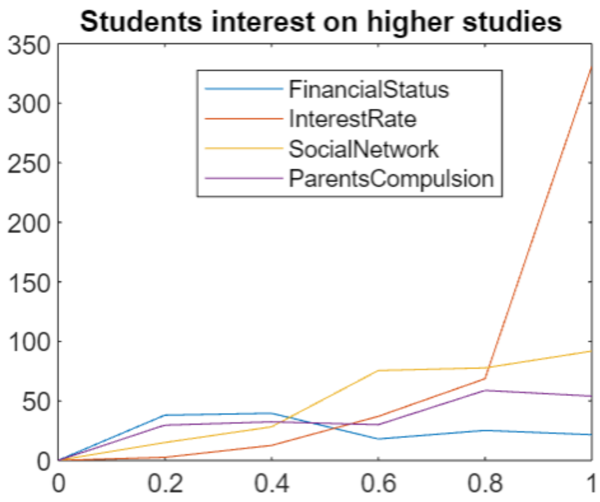


Fig. 3. Simulation results on students' interest in higher studies

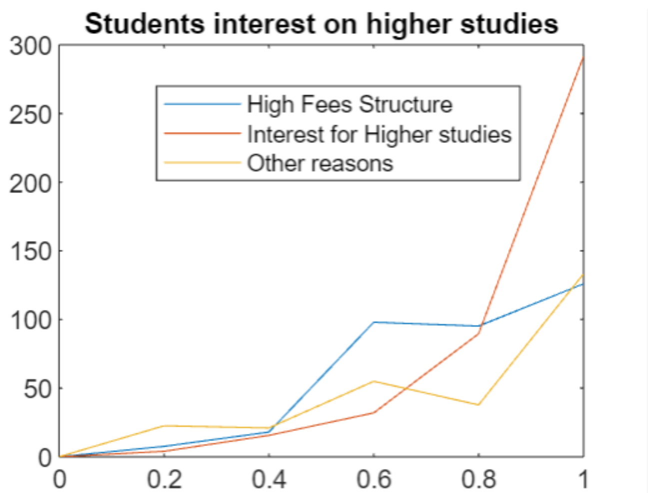


Fig. 4. Simulation results on students' interest in higher studies

1. The influence of social media, parental pressure, and financial situation do not significantly influence a student's decision to pursue further education.

2. The decision to pursue higher education is mostly influenced by the student's own interests in their courses, the cost, and other factors.

The figures 5 and 6 depicts the following results:

1. The primary factor influencing a student's decision to work is their level of interest in the job.

2. Financial support for the family is the secondary motivation for employment.

3. Other factors, such as parental pressure, social networks, rates of education dissatisfaction, misinterpretation of higher education job opportunities, financial situation, and transportation options, do not significantly influence employment decisions.

Table 7. Adaptation scores of linguistic values for employment

	V_L	L	M	H	V_H
PW	(0,4.4,8.8,	(3,3.7,4.5,	(10.8,12.1,13.5,	(5.4,5.8,6.3,	(10.4,11,
	13.2,17.6)	5.2,6)	14.8,16.2)	6.7,7.2)	11.7,12.3,13)
SFF	(0,0.6,1.3,	(2,2.5,3,	(11.6,13,14.5,	(17.4,18.8,20.3,	(56.8,60.3,
	1.95,2.6)	3.5,4)	15.9,17.4)	21.7,23.2)	63.9,67.4,71)
IJ	(0,0.1,0.2,	(0.6,0.7,0.9,	(6.8,7.6,8.5,	(12.6,13.6,14.7,	(87.2,92.6,
	0.3,0.4)	1.05,1.2)	9.3,10.2)	15.7,16.8)	98,103,109)
OHS	(0,3.6,7.2,	(3.8,4.7,5.7,	(13.4,15,16.7,	(10.5,11.4,12.2,	(7.6,8,
	10.8,14.5)	6.6,7.6)	18.4,20.1)	13.1,14)	8.5,9,9.5)
TF	(0,3.4,6.8,	(4.4,5.5,6.6,	(14.4,16.2,18,	(9,9.7,10.5,	(8.8,9.3,
	10.2,13.6)	7.7,8.8)	19.8,21.6)	11.25,12)	9.9,10.4,11)
AFE	(0,3.3,6.6,	(3.8,4.7,5.7,	(7.6,9.5,11.4,	(9.3,10,10.8,	(10.4,11.05,
	9.9,13.3)	6.6,7.6)	13.3,15.2)	11.6,12.4)	11.7,12.3,13)

Table 8. Grading Value of Employment

Criteria	PW	SFF	IJ	OHS	TF	AFE
V_L	35.2	5.2	0.8	29	27.2	26.6
L	18	12	3.6	22.8	26.4	22.8
M	54	58	34	67	72	45.6
H	25.2	81.2	58.8	49	42	43.4
V_H	46.8	255.6	392.37	34.2	39.6	46.8

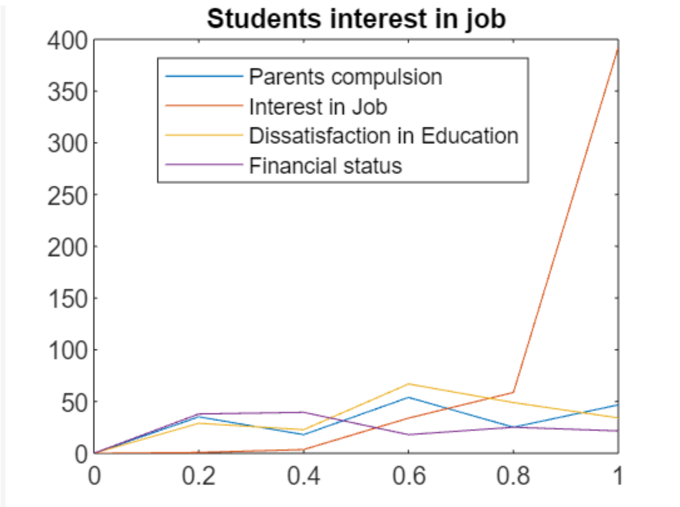


Fig. 5. Simulation results on students' interest in employment

Step 6: Findings

Based on the statistics, the simulation results, which are represented in Figure 6, illustrate that the students are more interested in finding a job than in going to college. In our modern era, smart work is what people do to enjoy their lives. Additionally, it influences students to select a career over continuing their education.

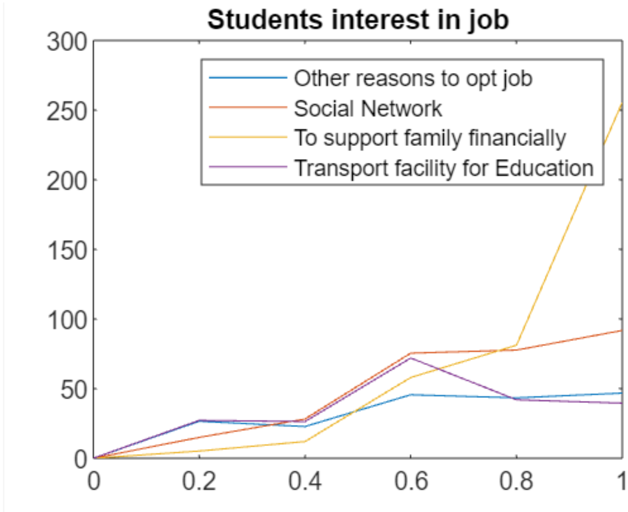


Fig. 6. Simulation results on students' interest in employment

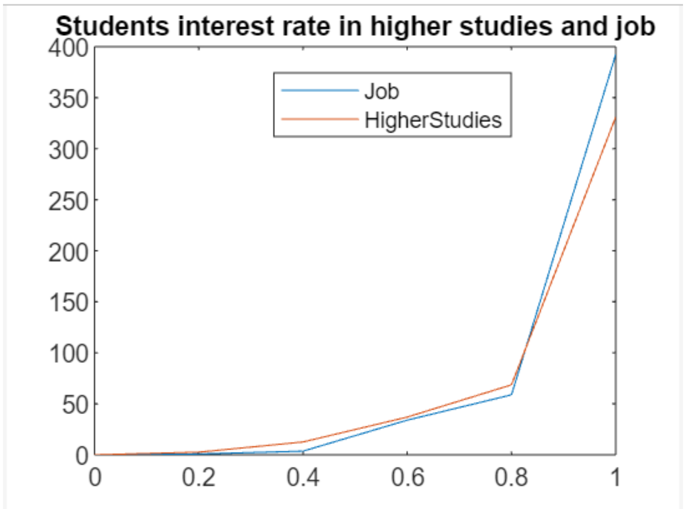


Fig. 7. Simulation results on the comparison of higher studies and employment

8. Statistical analysis between students' financial status and their decision to enroll in higher studies

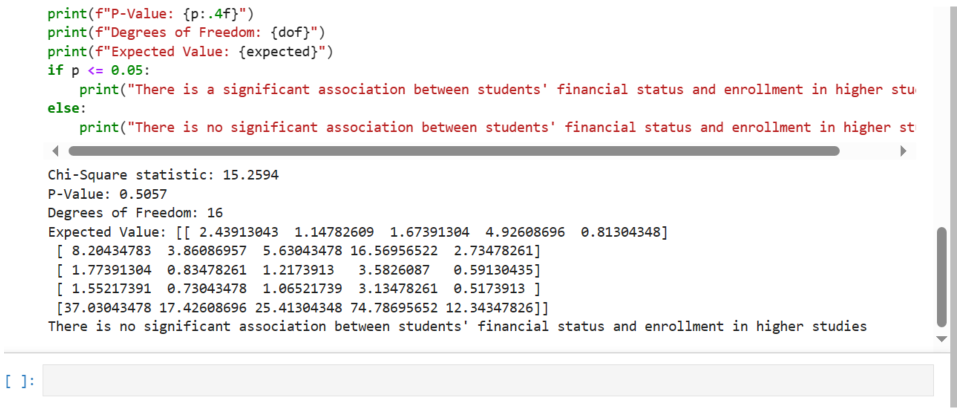
To ensure that financial status is not the major key to the decline in enrollment in higher studies. We examine the relationship between a student's financial situation and their decision to engage in higher education. Python 3.11.5 is used for statistical analysis of the data. The observed values are shown in Table 9, the Chi-square statistic value is 15.2594, and the P-value is 0.5057 are shown in Figure 8. Chi-square statistically tests the difference between the observed and expected frequencies. In this case, the p-value is greater than the significance level of 0.05. It witnesses that there is no statistically significant association between a student's financial status and their decision to enroll in higher education.

9. Discussion

The study indicates that interest levels play a crucial role in higher education, even for students from low-income families, regardless of their financial situation. To encourage students to enroll in higher education, it is suggested to emphasize the importance of education through schooling and social media, highlighting scholarships, free education, and loan availability. Interest in employment increases with employment rates, with passion for the profession being the primary driver. Social media platforms can effectively highlight the significance of loans, scholarships, and part-time work for higher education, especially for low-income students who may need to balance their studies and family finances. Also, the study found that there is no significant relation between students financial status and their decision to pursue higher education.

Table 9. Observed values

FS\ HS	**H**	**L**	**M**	V_H	V_L
H	4	0	3	4	0
L	7	3	5	21	1
M	0	0	1	6	1
V_H	1	0	2	3	1
V_L	39	21	24	69	14



```
print(f"P-Value: {p:.4f}")
print(f"Degrees of Freedom: {dof}")
print(f"Expected Value: {expected}")
if p <= 0.05:
    print("There is a significant association between students' financial status and enrollment in higher stu
else:
    print("There is no significant association between students' financial status and enrollment in higher st

Chi-Square statistic: 15.2594
P-Value: 0.5057
Degrees of Freedom: 16
Expected Value: [[ 2.43913043  1.14782609  1.67391304  4.92608696  0.81304348]
 [ 8.20434783  3.86086957  5.63043478 16.56956522  2.73478261]
 [ 1.77391304  0.83478261  1.2173913   3.5826087   0.59130435]
 [ 1.55217391  0.73043478  1.06521739  3.13478261  0.5173913 ]
 [37.03043478 17.42608696 25.41304348 74.78695652 12.34347826]]
There is no significant association between students' financial status and enrollment in higher studies
```

Fig. 8. Statistical analysis and outcome

10. Conclusion

In this artifact, the centroid of the prism fuzzy number is defined with inferred Triangular and Trapezoidal centroid values. We conducted a comparison analysis using the proposed centroid value to corroborate our findings. A grading value is defined with alpha cuts of a prism fuzzy number. As an application, we investigate the student's interest in job and higher studies. The MATLAB simulation results were established using the proposed grading tool. Discussions on the major factors that influenced the student's decision and recommendations were offered on the conclusions drawn about the student's future decision. Additionally, the Python programme was used to perform the statistical analysis. In the forthcoming work, the application of PrFN can be implemented in various fields such as operation research, medication, business statistics, and decision-making.

Conflict of interest

The authors declare that they have no conflicts of interest.

References

[1] S. Abbasbandy and B. Asady. Ranking of fuzzy numbers by sign distance. *Information Sciences*, 176(16):2405–2416, 2006. https://doi.org/10.1016/j.ins.2005.03.013.

[2] G. Aruna and J. J. Rosline. Prism fuzzy number and its applications. In *AIP Conference Proceedings*, volume 2852 of number 1. AIP Publishing, 2023.

[3] F. N. Azman and L. Abdullah. Ranking fuzzy numbers by centroid method. *Malaysian Journal of Fundamental and Applied Sciences*, 8(3):121–125, 2012. https://doi.org/10.11113/mjfas.v8n3.134.

[4] A. Bansal. Some non linear arithmetic operations on triangular fuzzy numbers (m, α, β). *Advances in Fuzzy Mathematics*, 5(2):147–156, 2010.

[5] A. Bansal. Trapezoidal fuzzy numbers (a, b, c, d): arithmetic behavior. *International Journal of Physical and Mathematical Sciences*, 2(1):39–44, 2011.

[6] S. Bekheet. Polygon fuzzy numbers. *ADRRI Journal (Multidisciplinary)*, 3(3):52–63, 2013.

[7] C.-H. Cheng. A new approach for ranking fuzzy numbers by distance method. *Fuzzy Sets and Systems*, 95(3):307–317, 1998. https://doi.org/10.1016/S0165-0114(96)00272-2.

[8] K. Chrysafiadi, M. Virvou, and G. A. Tsihrintzis. A fuzzy-based evaluation of e-learning acceptance and effectiveness by computer science students in greece in the period of covid-19. *Electronics*, 12(2):428, 2023. https://doi.org/10.3390/electronics12020428.

[9] T.-C. Chu and C.-T. Tsao. Ranking fuzzy numbers with an area between the centroid point and original point. *Computers & Mathematics with Applications*, 43(1-2):111–117, 2002. https://doi.org/10.1016/S0898-1221(01)00277-2.

[10] M. O. Hegazi, B. Almaslukh, and K. Siddig. A fuzzy model for reasoning and predicting student's academic performance. *Applied Sciences*, 13(8):5140, 2023. https://doi.org/10.3390/app13085140.

[11] R. Kumar and T. Pathinathan. Sieving out the poor using fuzzy decision making tools. *Indian Journal of Science and Technology*, 8(22):1–7, 2015. https://dx.doi.org/10.17485/ijst/2015/v8i22/79161.

[12] D. Neff. Fuzzy set theoretic applications in poverty research. *Policy and Society*, 32(4):319–331, 2013. https://doi.org/10.1016/j.polsoc.2013.10.004.

[13] T. Pathinathan and K. Ponnivalavan. Pentagonal fuzzy number. *International Journal of Computing Algorithm*, 3(2014):1003–1005, 2014.

[14] T. Pathinathan and K. Ponnivalavan. Reverse order triangular, trapezoidal and pentagonal fuzzy numbers. *Annals of Pure and Applied Mathematics*, 9(1):107–117, 2015.

[15] S. H. J. Petrudi, M. Pirouz, and B. Pirouz. Application of fuzzy logic for performance evaluation of academic students. In *2013 13th Iranian Conference on Fuzzy Systems (IFSC)*, pages 1–5. IEEE, 2013. https://doi.org/10.1109/IFSC.2013.6675615.

[16] P. P. B. Rao and N. R. Shankar. Ranking fuzzy numbers with an area method using circumcenter of centroids. *Fuzzy Information and Engineering*, 5(1):3–18, 2013. https://doi.org/10.1007/s12543-013-0129-1.

[17] G. Revathi, B. Amudhambigai, V. Narmadha, and T. Poornima. Identification of social problems of farmers using fuzzy mathematics. *International Journal of Engineering & Technology*, 7(4.10):624–628, 2018. http://dx.doi.org/10.14419/ijet.v7i4.10.21297.

[18] E. Siva and C. Ramkumar. A super fuzzy cognitive study of poverty in pandemic scenario in tamilnadu, india. *Journal of Survey in Fisheries Sciences*:337–343, 2023. https://doi.org/10.53555/sfs.v10i2.1070.

[19] T. Thakre, O. Chaudhari, and N. Dhawade. A fuzzy logic multi criteria approach for evaluation of teachers performance. *Advances in Fuzzy Mathematics*, 12(1):129–145, 2017.

[20] G. Wang, W. Chen, and X. Gao. Pyramid fuzzy numbers. In *2009 Sixth International Conference on Fuzzy Systems and Knowledge Discovery*, volume 7, pages 76–80. IEEE, 2009. https://doi.org/10.1109/FSKD.2009.172.

[21] R. R. Yager. A procedure for ordering fuzzy subsets of the unit interval. *Information Sciences*, 24(2):143–161, 1981. https://doi.org/10.1016/0020-0255(81)90017-7.

[22] Y. S. Yun, S. U. Ryu, and J. W. Park. The generalized triangular fuzzy sets. *Journal of the Chungcheong Mathematical Society*, 22(2):161–161, 2009.

[23] L. A. Zadeh. Fuzzy sets. *Information and Control*, 8(3):338–353, 1965.

[24] L. A. Zadeh, G. J. Klir, and B. Yuan. *Fuzzy Sets, Fuzzy Logic, and Fuzzy Systems: Selected Papers*, volume 6. World scientific, 1996.