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USING HIERARCHICAL PROCESS ANALYSIS TO ASSESS THE LEVEL OF IMPORTANCE OF MULTIPLE INTELLIGENCES IN UNDERGRADUATE STUDENTS

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ABSTRACT

Multiple Intelligences (MIs) are a set of eight individual skills that can be improved in the context of higher education. The possibility of identifying and classifying these abilities enables effective action to be taken to develop the most relevant MIs for the student according to their area of study. The aim of this article is to describe the use of the Hierarchical Process Analysis (HPA) method as a tool for classifying the level of attention to be given to each MI in a sample of higher education students. To do this, a questionnaire was used to survey the MIs of a sample of 500 students from a public higher education institution. The researchers then used the AHP to sort and classify the MIs in the sample. It was thus possible to conclude that the AHP can be used as a form of classification and evaluation for the theory of the MIs, helping to choose which MIs need a closer look and which do not need intervention. The limitations of the research were that it used only one multi-criteria analysis tool. Therefore, for future work, we intend to use the database obtained from the study and apply other multi-criteria analysis methodologies.

Keywords: Hierarchical Analysis Method; Multiple Intelligences; Education; Multicriteria Analysis.

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INTRODUCTION

The theory of Multiple Intelligences (MI) is made up of a set of eight intelligences and is a counterpoint to traditional IQ (Intelligence Quotient) tests, which only assess two skills: logical-mathematical and linguistic (Gardner, 1983). The concept of intelligence can change depending on the cultural context: what is valued in one culture may not be valued in another. If we only consider the eight intelligences proposed in Gardner's theory, even within evolution, some intelligence types have been more important than others have. Naturalistic intelligence, as an example, deals with understanding nature, plants, and animals. Little is known about skills and abilities not measured in tests, such as wisdom, creativity, practical knowledge, and social skills (Consenza and Guerra, 2011). However, this theory provides a broader view of individuals' intelligences. Within this context, the question arises as to whether, in addition to culture, the area of knowledge chosen by people is also influenced by MIs. This research seeks to answer this question using the analytic hierarchy process (AHP) method (Saaty, 1988) as an instrument for classifying the relevance level to be given to each of the multiple intelligences (MIs) (Gardner, 1983) identified in the responses to a study involving students from twenty courses at a Brazilian public higher education institution. The study sample consisted of five hundred students, and in a previous study with this data, we could analyze the combination between the students' academic background (chosen area of knowledge) and multiple intelligences (Quadros, Sampaio, and Adamatti, 2021) without defining their level of importance, which a multi-criteria method such as AHP allows us to do.

A previous survey on the relationship between the hierarchical analysis method and its application in the theory of multiple intelligences was carried out through the work of Quadros, Longaray, and Adamatti (2021). In the context of this meta-synthesis evaluation, without stipulating a defined period, this work conducted a search for the terms "analytic hierarchy process" and "multiple intelligences" from November to December 2020. After discarding the theses and dissertations, this collection left only seven articles that used the hierarchical analysis method in conjunction with the theory of multiple intelligences. Of the seven papers, three focused on health (Rezaie *et al*., 2012, 2013, 2014), and four were applied to education (Chin-Wen *et al.*, 2016; Oktavia and Madyatmadja, 2018; Ahsan *et al*., 2019; Peiyu, 2019). However, none of these studies presented any application of the AHP to the MI theory through the multi-criteria evaluation of MIs in individual profiles, considering how the profile identifies with each intelligence type. Therefore, we have identified this gap in the AHP method applied to MI theory.

The database of student profiles used for this research indicates how these clusters of students identify themselves according to the group of multiple intelligences. By applying the AHP, using each multiple intelligence type as an evaluation criterion, we can demonstrate that the method can be useful for evaluating the most and least relevant MIs for a possible intervention, which is the main objective of this research.

This work is organized as follows: Section 2 presents a brief introduction to the theory of multiple intelligences; Section 3 shows the hierarchical analysis method that will be used in this work; Section 4 details the methodological process of applying the AHP method to the MI theory; Section 5 deals with the results and discussions about the work presented; and Section 6 sets out the conclusions of the research.

THE THEORY OF MULTIPLE INTELLIGENCES

The theory of Multiple Intelligences was created in 1983 by researcher Howard Gardner and has been consolidated over the years. The fact that it is not a closed theory allows new intelligences, which must meet some requirements, to be added to the list of possible candidates to make up the set of MIs at a later stage (Gardner, 1995).

Currently, the theory comprises a group of eight intelligences, which are presented with a brief description in **Chart 1**. The set of intelligences proposed in the theory at the time was initially intended as a counterpoint to intelligence quotient (IQ) tests that only addressed linguistic and logical-mathematical skills. This proposed set of intelligences is directly linked to certain professions, and the idea is suggestive for educators to incorporate intelligences into their curriculum planning for practical use in the classroom (Nolen, 2003).

All individuals possess the eight intelligences in a unique way, as if it were an equalizer with a knob for each intelligence, which regulates between the minimum and maximum degrees (Armstrong, 2001). In this way, the MI theory is not a classification of just one particular type of intelligence but a group of abilities that all people possess, some with more than others, among the set of eight intelligences.

In 2023, the MI theory will be forty years old. During this period, a significant amount of work worldwide has been written to contribute to the theory's dissemination, the creation of applications that contribute to improving each individual's intelligence, and the formulation of tests to assess MI in different groups of individuals. This perspective on how the theory has advanced globally was presented in the book Multiple Intelligences Around the World by Gardner, Chen, and Moran (2010), which pointed to studies carried out in Asia and the Pacific regions, Europe, South America, and the United States (the country of origin of the MI theory).

Chart 1 shows some of the characteristics of each of the eight intelligences proposed in Howard Gardner's MI theory.

THE METHOD OF HYPERARCHICAL ANALYSIS (AHP, ANALYTIC HIERARCHY PROCESS)

Professor Thomas L. Saaty created the Hierarchical Process Analysis (HPA) method in the 1980s (Saaty, 1988). The AHP decision-making process allows for a precise assessment of the relevance of each criterion placed for analysis within hierarchical levels. From its inception to the present, the AHP, a simple and robust tool for making complex decisions, has been studied and improved over the years (Handfield *et al*., 2002). The method is hierarchical, as its basic model has a three-level structure: at the top, the objective, the criteria, and the alternatives.

The AHP method involves structuring the problem systematically, from constructing the general objective and choosing criteria and sub-criteria for choosing the most and least important factors through the assembly of scales to obtaining the result (Saaty, 1990). Thomas Saaty, to solve the problems of comparisons made using absolute scales, published a work that presents ideas on how to improve inconsistent judgments and obtain better results (Saaty, 2008). It should be noted that structuring the problem solved by the AHP method not only allows for the inclusion of quantitative but also qualitative criteria.

The AHP has been applied to decision-making in a wide variety of areas, such as: Economics, with a supplier evaluation study (Handfield *et al*., 2002), with project selection and evaluation (Palcic and Lalic, 2009), and with a case study of a public bidding process (Longaray, 2014); in Administration, with the analysis of the manager's decision for small and medium-sized IT companies (Jerônimo *et al*., 2016); in Production Engineering, with the identification of quality losses in production processes (Sousa, 2016); with the improvement of manufacturing processes in Total Productive Maintenance (TPM) in a port complex (Sousa, 2016); in Geosciences, with the development of a macro that allows the derivation of criteria weights for land use decisions (Marinoni, 2004); and in Tourism, with an application for convention site selection (Chen, 2006). Vaidya (2006), whose work presents an overview of applications using the multicriteria AHP method, categorizes the works according to the themes identified based on the areas of application, grouped by year and region.

Quadros, Longaray, and Adamatti (2021) carried out a previous survey on the relationship between the Analytic Hierarchy Process (AHP) and its application in the Theory of Multiple Intelligences (MI). In the context of this meta-synthesis evaluation, without stipulating a defined period, this work carried out a search for the terms "analytic hierarchy process" and "multiple intelligences" from November to December 2020. After discarding the theses and dissertations, this collection left only seven articles that used the

Chart 1. Characteristics of multiple intelligences

Bodily-kinesthetic	**Control of body movement is in the motor cortex, with each hemisphere dominating body movements on the contralateral side.**
Spatial	Just as the left hemisphere, during evolution, was chosen as the site of linguistic processing in right-handed people, the right hemisphere is proven crucial site of spatial processing.
Interpersonal	It is based on a core ability to perceive distinctions between others, in particular, contrasts in their moods, temperaments, motivations, and intentions.
Intrapersonal	It works on knowledge of the inner aspects of a person: access to the feeling of one's own life, the range of one's own emotions, and the ability to discriminate these emotions and eventually label them and use them as a way of understanding and guiding one's own behavior.
Linguistic	The so-called "Drill's Center" is responsible for producing grammatical sentences. A person with damage to this area can understand words and sentences quite well but has difficulty putting words together beyond the simplest sentences.
Logical-mathematical	It is the archetype of "pure intelligence," or the ability to solve problems, that significantly shortens the path between domains. Some areas of the brain are more relevant than others regarding mathematical calculation. There are individuals with Savant Syndrome (a mentally disabled individual with a highly specialized talent in some area) who perform exceptional feats of calculation.
Musical	Parts of the brain play a significant role in perceiving and producing music. These areas are characteristically located in the right hemisphere, although musical ability is not located distinctly in such a specific area as language.
Naturalistic	A naturalist is someone who can recognize and classify objects. Hunters, farmers, and gardeners would have naturalistic intelligence, as would artists, poets, and social scientists who are adept at recognizing patterns.

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Hierarchical Analysis Process (AHP) with the Theory of Multiple Intelligences (MI). Of the seven papers, three focused on health (Rezaie, 2012, 2013, 2014), and four had applications in education (Liao, 2016; Oktavia and Madyatmadja, 2018; Ahsan, 2019; Yan, 2019). In this way, we identified a gap in employing the AHP method in the MI theory.

METHODOLOGY

One of the aims of this study is to provide an understanding of how the AHP method can help classify the MIs in higher education student profiles. This research characterizes itself as descriptive concerning its objectives and ex-post facto regarding its nature, as it studies the relationships between two or more variables of a given phenomenon without manipulating them (Koche, 2016).

Regarding the data collection and analysis technique, this study is classified as qualitative and quantitative, in which the numerical results are complemented by qualitative results (Pereira, 2018). Therefore, from the database of student profiles, we move on to applying the method and analyzing the results in this qualitative-quantitative research.

The database used for this research was obtained through a questionnaire with eighty-one (81) questions for all eight MIs proposed by Armstrong (2001). The questions on this instrument are for adults only. Moreover, through it, we could assess the degree of importance of each intelligence for each individual surveyed. These individuals were organized into groups according to the courses they were registered.

In the organizational chart of this Brazilian public higher education institution, the courses are organized in clusters (called academic units 1) by areas that are close to each other, as follows: The Center for Computational Sciences (C3) comprises courses in Automation Engineering, Computer Engineering, and Information Systems; the Institute of Human and Information Sciences (ICHI) comprises courses in Archaeology, Archivology, Librarianship, Geography (Bachelor's and Degree), History (Bachelor's and Degree), Hospitality, Psychology, Technology in Events, and Tourism; and the Institute of Economic, Administrative, and Accounting Sciences (ICEAC) comprises courses in Administration (Santo Antônio da Patrulha campus), Accounting Sciences, Economic Sciences, Foreign Trade, and Technology in Cooperative Management.

Through this questionnaire, in previous work, we pinpointed the combination between the students' academic background (chosen area of knowledge) and multiple intelligences (Quadros *et al.*, 2021) using statistical methods. These students' responses to the questionnaire form a base of five hundred individuals (15.06% of the 3,313 students who received the questionnaire) and 20 undergraduate courses in Engineering, Humanities, and Applied Social Sciences. These questionnaires were sent by e-mail to regularly enrolled students and were available for responses for 15 days. Therefore, this database is used to apply the AHP method to this research. This study's main idea is to apply the AHP method to this database to classify which intelligences need more attention in a heterogeneous set of individuals from different areas of knowledge.

Organizing data for use in the AHP

The AHP method requires a series of steps described in this section. We begin with the subtitles for each of the eight intelligences that will be analyzed during the process, shown in Chart 2. These subtitles were created for use during the application phases of the AHP method and are the abbreviations for each of the intelligences in the MI theory.

Chart 2. IM Initials

BODILY-KINESTHETIC	COR
SPACE	ESP
INTERPERSONAL	TER
INTRAPERSONAL	TRA
LINGUISTIC	LIN
LOGICAL-MATHEMATICAL	LÓG
MUSICAL	MUS
NATURALISTIC	NAT

Source: The authors

Chart 3 shows the comparison levels of the hierarchical analysis method according to Saaty's fundamental scale (1988).

This scale includes the numbers 1 to 9 so we can see which criterion is more or less relevant in the evaluation. The odd numbers (1, 3, 5, 7, and 9) within the scale make up the fields of criteria differentiation, and the even numbers (2, 4, 6, and 8) are part of the intermediate values between the criteria.

Chart 3. Saaty fundamental scale (SFS)

1 - 1	Equal importance
1 - 1/3	Small importance of one over the other
1 - 1/5	Great or essential importance
1 - 1/7	Much greater or demonstrated importance
1 - 1/9	Absolute importance
2, 4, 6, and 8	Intermediate values

Source: Saaty (1988)

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Based on the values collected from the answers in the second column of **Table 2** (information based on the students' answers and the statistical analysis previously carried out), normalization was conducted to enable us to adapt these values to the Saaty Fundamental Scale (EFS). The process is defined in **Table 1**, and we adopted the strategy of placing only the values that influence importance (1, 3, 5, 7, and 9). After normalization, the results that had intermediate values (2, 4, 6, and 8) received the necessary adjustment. In other words, if, after normalization, the MI result was 0.12, the adjustment value becomes 0.13 and 5 in the EFS.

Table 1. Adaptation of standardization to the Saaty fundamental scale (EFS)

Standardization	Saaty (EFS)
0.09	1
0.11	3
0.13	5
0.15	7
0.18	9

Source: The authors

Table 2 shows the results for each MI in each cluster of Brazilian public higher education institutions (Engineering, Humanities, and Applied Social Sciences). The result shown in the table, in the second column, refers to the proportion of answers given compared to the number of respondents in each cluster to the MIs with which the students most identified, based on the results obtained by the study conducted by Quadros, Sampaio, and Adamatti (2021). Column 3 of the table shows normalization so that the answers could be adapted to the Saaty scale, which ranges from 1 to 9. Finally, in the last column, we have the results of the Saaty scale for applying the AHP method. In this way, each intelligence becomes a criterion for applying the method.

Table 2. Study results and suitability for the Saaty scale

	Engineering	Standardization	Saaty (EFS)
COR	4.48	0.13	1
ESP	3.82	0.11	3
TER	4.11	0.12	5
TRA	4.89	0.14	7
LIN	3.86	0.11	3
LÓG	6.37	0.18	9
MUS	4.42	0.13	5
NAT	3.22	0.09	1
SOMA	35.17	1	
	Humanities	**Standardization**	**Saaty (EFS)**
COR	3.68	0.11	1
ESP	3.96	0.12	5
TER	3.93	0.12	5
TRA	4.91	0.15	7
LIN	4.55	0.14	7
LÓG	3.79	0.12	5
MUS	4.08	0.12	5
NAT	3.98	0.12	5
SOMA	32.88	1	
	Applied Social Sciences	**Standardization**	**Saaty (EFS)**
COR	3.84	0.11	1
ESP	3.79	0.11	3
TER	4.22	0.12	5
TRA	5.01	0.15	7
LIN	4.03	0.12	5
LÓG	4.94	0.15	7
MUS	4.48	0.13	5
NAT	3.47	0.10	3
SOMA	33.78	1	

Source: The authors

RESULTS

By adapting the data to the Saaty scale (**Table 2**), it is possible to apply the AHP method to the Engineering, Humanities, and Applied Social Sciences clusters. **Tables 3**, **4**, and **5** show these results. Using the data extracted from the three clusters, we applied normalization to classify each MI compared to the others according to the Saaty fundamental scale (EFS). Therefore, through the inputs from the Saaty (EFS) column, we applied the AHP method to the MI theory.

After applying the AHP method, we have the result of the averages of each MI compared to the others in the set of eight intelligences. **Tables 6**, **7**, and **8** thus show the average results after applying the AHP method to the Engineering, Humanities, and Applied Social Sciences clusters, respectively.

Finally, in graphical form, we present the results of applying the AHP method to the MI theory in Figure 1, which illustrates the consolidated data of all the MIs and the three clusters used to apply the AHP method.

Table 2 shows, in simplified form, the results of the normalization process for the Saaty fundamental scale (EFS). After applying the normalization process, we can see from **Table 2** that the results have a discrepancy in the following sequence of results: 0.09, 0.10, 0.11, 0.12, 0.13, 0.14, 0.15, and 0.18. As a result, it was necessary to make an adjust-

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Table 3. Results of responses from courses in the Engineering cluster

	COR	ESP	TER	TRA	LIN	LÓG	MUS	NAT
COR	1	3	5	7	3	9	5	1
ESP	1 / 3	1	3	5	7	3	9	5
TER	1 / 5	1 / 3	1	3	5	7	3	9
TRA	1 / 7	1 / 5	1 / 3	1	3	5	7	3
LIN	1 / 3	1 / 7	1 / 5	1 / 3	1	3	5	7
LÓG	1 / 9	1 / 3	1 / 7	1 / 5	1 / 3	1	3	5
MUS	1 / 5	1 / 9	1 / 3	1 / 7	1 / 5	1 / 3	1	3
NAT	1 / 1	1 / 5	1 / 9	1 / 3	1 / 7	1 / 5	1 / 3	1

Source: The authors

Table 4. Results from the Humanities cluster courses

	COR	ESP	TER	TRA	LIN	LÓG	MUS	NAT
COR	1	5	5	7	7	5	5	5
ESP	1 / 5	1	5	5	7	7	5	5
TER	1 / 5	1 / 5	1	5	5	7	7	5
TRA	1 / 7	1 / 5	1 / 5	1	5	5	7	7
LIN	1 / 7	1 / 7	1 / 5	1 / 5	1	5	5	7
LÓG	1 / 5	1 / 7	1 / 7	1 / 5	1 / 5	1	5	5
MUS	1 / 5	1 / 5	1 / 7	1 / 7	1 / 5	1 / 5	1	5
NAT	1 / 5	1 / 5	1 / 5	1 / 7	1 / 7	1 / 5	1 / 5	1

Source: The authors

Table 5. Results of responses from courses in the Applied Social Sciences cluster

	COR	ESP	TER	TRA	LIN	LÓG	MUS	NAT
COR	1	3	5	7	5	7	5	3
ESP	1 / 3	1	3	5	7	5	7	5
TER	1 / 5	1 / 3	1	3	5	7	5	7
TRA	1 / 7	1 / 5	1 / 3	1	3	5	7	5
LIN	1 / 5	1 / 7	1 / 5	1 / 3	1	3	5	7
LÓG	1 / 7	1 / 5	1 / 7	1 / 5	1 / 3	1	3	5
MUS	1 / 5	1 / 7	1 / 5	1 / 7	1 / 5	1 / 3	1	3
NAT	1 / 3	1 / 5	1 / 7	1 / 5	1 / 7	1 / 5	1 / 3	1

Source: The authors

Table 6. The result of the Engineering cluster after applying the AHP method

	COR	ESP	TER	TRA	LIN	LÓG	MUS	NAT	AVERAGE
COR	0.029	0.010	0.007	0.007	0.020	0.011	0.038	0.301	0.053
ESP	0.088	0.030	0.012	0.010	0.008	0.033	0.021	0.060	0.033
TER	0.147	0.090	0.035	0.017	0.012	0.014	0.063	0.033	0.051
TRA	0.206	0.150	0.105	0.051	0.020	0.020	0.027	0.100	0.085
LIN	0.088	0.210	0.175	0.152	0.059	0.033	0.038	0.043	0.100
LÓG	0.265	0.090	0.245	0.254	0.176	0.099	0.063	0.060	0.157
MUS	0.147	0.270	0.105	0.356	0.294	0.296	0.188	0.100	0.220
NAT	0.029	0.150	0.315	0.152	0.412	0.494	0.564	0.301	0.302

Source: The authors

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ment for applying the AHP method, distributing the results obtained for the EFS from 1 to 9.

This adjustment takes the normalization values and distributes them among the EFS so that the intermediate values (even) are reallocated to a number above the scale, and the important values (odd) are distributed from the lowest to the highest EFS value. This value distribution for adequacy is shown in **Table 2**, which lists the eight MIs, the database collection results, the normalization calculation, and the EFS indices used to apply the method.

After adjusting the normalization results for the ESF, we placed each MI value in the matrix (**Tables 6**, **7**, and **8**) to apply the method that compares pair by pair how each intelligence is more or less relevant according to the answers given by the students for each cluster investigated in the research (Engineering, Humanities, and Applied Social Sciences).

As can be seen in **Tables 6** (Engineering), **7** (Humanities), and **8** (Applied Social Sciences), the results from using the

Table 7. Result of the Humanities cluster after applying the AHP method

	COR	ESP	TER	TRA	LIN	LÓG	MUS	NAT	MÉDIA
COR	0.025	0.006	0.007	0.006	0.008	0.017	0.028	0.088	0.023
ESP	0.125	0.028	0.007	0.008	0.008	0.012	0.028	0.088	0.038
TER	0.125	0.142	0.033	0.008	0.011	0.012	0.020	0.088	0.055
TRA	0.175	0.142	0.164	0.039	0.011	0.017	0.020	0.063	0.079
LIN	0.175	0.199	0.164	0.196	0.054	0.017	0.028	0.063	0.112
LÓG	0.125	0.199	0.230	0.196	0.268	0.084	0.028	0.088	0.152
MUS	0.125	0.142	0.230	0.274	0.268	0.421	0.141	0.088	0.211
NAT	0.125	0.142	0.164	0.274	0.375	0.421	0.706	0.438	0.331

Source: The authors

Table 8. Result of the Applied Social Sciences cluster after applying the AHP method

	COR	ESP	TER	TRA	LIN	LÓG	MUS	NAT	MÉDIA
COR	0.028	0.010	0.007	0.007	0.012	0.014	0.038	0.131	0.031
ESP	0.083	0.030	0.012	0.009	0.008	0.020	0.027	0.078	0.034
TER	0.139	0.090	0.035	0.015	0.012	0.014	0.038	0.056	0.050
TRA	0.194	0.150	0.105	0.046	0.020	0.020	0.027	0.078	0.080
LIN	0.139	0.210	0.175	0.138	0.059	0.033	0.038	0.056	0.106
LÓG	0.194	0.150	0.245	0.231	0.178	0.100	0.064	0.078	0.155
MUS	0.139	0.210	0.175	0.323	0.296	0.299	0.192	0.131	0.221
NAT	0.083	0.150	0.245	0.231	0.415	0.499	0.575	0.392	0.324

Source: The authors

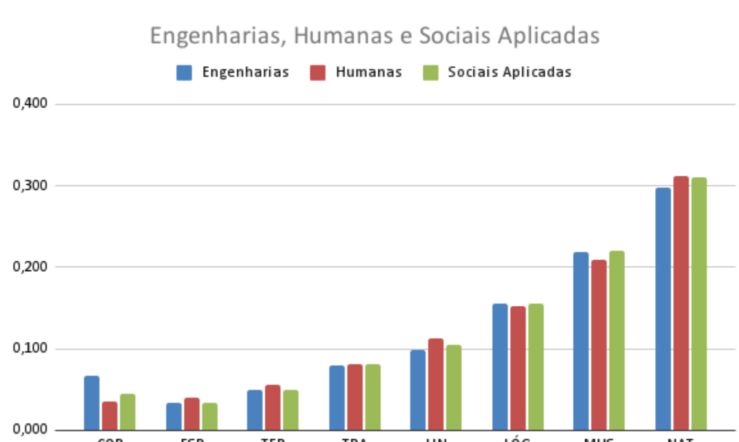

Figure 1. Summary of the results for the Engineering, Humanities, and Applied Social Sciences clusters.
Source: The authors

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AHP method return averages for each MI. These averages result from entering the EFS indices after adjusting them, transposing the matrix to evaluate the MIs that need more attention pair by pair, adding up the results, and normalizing them. These steps are at the heart of applying the AHP method. In the pure method, there is no need to transpose the original matrix, as this maneuver was only carried out to reorganize the MIs that need more attention.

These steps are at the heart of applying the AHP method. In other words, in the pure method, there is no need to transpose the original matrix, as this maneuver was only carried out to reorganize the MIs that need more attention.

Using the Humanities (or Applied Social Sciences) cluster as an example, we can see that the result of the averages shows the following decreasing sequence: NAT, MUS, LÓG, LIN, TRA, TER, ESP, and COR. Therefore, as the AHP makes a pair-by-pair evaluation, the result is different from the simple ordered evaluation, in which we have the sequence of the results of the MIs as follows: TRA, LIN, MUS, NAT, ESP, TER, LÓG, and COR (from smallest to largest). In other words, in the Human Sciences cluster, according to the answers sent in by the students for the previous survey, the MI with which they would have the greatest identification would be intrapersonal, and the one with the least identification would be kinesthetic body on an ordered scale and without considering any weighting. With the AHP method, the kinesthetic body MI would be the one that needs the least attention (within the composition of the eight MIs), while the naturalistic one should receive more attention than the others.

Using the AHP method, which assesses the importance of each criterion compared to the others or, in the case of this study, the importance of a MI compared to the others, we can see that the sequence is not the same as the simple ordering, as we have: NAT, MUS, LÓG, LIN, TRA, TER, ESP, and COR. This sequence is formed from the MI that would need the most attention to the one that could have less attention regarding the individuals interviewed.

In the Engineering cluster, this sequence of results does not remain the same and is as follows: NAT, MUS, LOG, LIN, TRA, COR, TER, and ESP. In other words, the last three MIs do not follow the same sequence as in the Humanities and Applied Social Sciences clusters.

For the purposes of organization and analysis, we have divided the intelligences into two groups, according to the results of applying the AHP method, because we can see that the naturalistic, musical, logical-mathematical, and linguistic intelligences have higher scores than the other four. Therefore, we could suggest that these intelligences should be better trained and encouraged. On the other hand, kinesthetic, spatial, interpersonal, and intrapersonal bodily intelligence could be maintained as they already are. With regard to the first group, the MIs that need more attention, new methodologies, and practices could be evaluated so that this group of interviewees has the opportunity to develop an interest in these MIs or even work on any difficulties or blockages that prevent them from taking an interest in them.

Figure 1 summarizes the method applied to the three clusters (Engineering, Humanities, and Applied Social Sciences). The graph reveals some differences in the comparative results of some clusters. When evaluating the highest indices after applying the method, Engineering has the highest values in the kinesthetic, intrapersonal, and logical-mathematical body MIs; Humanities has the highest values in the spatial, interpersonal, linguistic, and naturalistic MIs; and Applied Social Sciences has the highest index in the musical MI.

Furthermore, looking at the lowest scores in these results, Engineering has the lowest scores for spatial, linguistic, and naturalistic MIs; Humanities has the lowest scores for kinesthetic, intrapersonal, logical-mathematical, and musical MI; and Applied Social Sciences has the lowest score for interpersonal MI.

With the AHP applied to each multiple intelligence used as an evaluation criterion, the results show that the method was valuable for evaluating the most and least relevant MIs for a possible intervention. We all possess all the intelligences, and people differ because they have different levels of each intelligence. Therefore, this application, which carries out a peer-to-peer evaluation, has the clear ability to point to a better evaluation indicator when referring to the intervention that can be performed on the intelligences that showed the lowest results.

CONCLUSION

Multiple intelligences present a new way of understanding individuals' abilities that differs from the usual IQ test. MIs present a plural version of our expertise beyond the pencil-and-paper test that only assesses logical-mathematical and linguistic intelligence. The AHP multi-criteria decision-making method organizes the criteria into pairs so that we can compare the importance of one item over another and justify the choice by applying the method.

This study primarily aimed to use the results collected in a previous survey, which classified the profile of higher education students according to the intelligences with which they most identified, to subsequently apply the hierarchical analysis method and assess in a qualitative and quantitative way which intelligences need more attention and which do not require intervention.

With a view to achieving the proposed objective, this paper has presented a general overview of what multiple intelligences are, their initial proposal, and some of the specific features of each MI. It also presented the AHP multi-criteria method for decision-making, the central steps in structuring and applying the method, and lastly, some applications in different areas.

The main results achieved in this work can answer the following questions: 1) Which intelligence types need more attention within the MI group? 2) What is the quantitative index of each intelligence type in the group? 3) What is the difference between one type of intelligence and another after applying the method? 4) Which intelligences can be maintained in the teaching strategies? We believe that questions 1, 2, 3, and 4 have been answered in this research, which serves as a proposal for an instrument to evaluate the MIs using the AHP in groups of higher education student profiles.

In addition, this work may provoke the following questions related to MI in education: 5) What methodologies can improve the most deficient intelligences? 6) How can these results collaborate in the development of new curricula? 7) How can we classify the theory of MI to collaborate in special education? Based on this, we envision other future projects to be carried out.

Therefore, we can conclude that the AHP method can be a classification and evaluation method for the theory of MIs since the calculation of the method uses each MI as a criterion compared to the others, thus aiding strategic decision-making to choose which MIs require more attention and which can be improved and/or encouraged from childhood or even within higher education itself.

The results of this work can serve as a strategy method for developing new curricula, searching for new practices in the classroom, and assessing profiles in some groups (homogeneous or heterogeneous), among other actions.

The research's limitations were the use of only one multi-criteria analysis tool. Therefore, for future work, we intend to use the database obtained from the study and apply other multi-criteria analysis methodologies, such as Fuzzy Decision Approach (FDA) (Bellman, 1970), Measuring Attractiveness by a Categorical Based Evaluation Technique (MACBETH) (Carlos and Costa, 1997), or Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) (Hwang and Yoon, 1981).

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