Intercriteria analysis of the influence of the different sports activities on the physical and emotional status of university students

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Abstract. In this paper, we investigate the influence of the different academic sports activities on the university student's profile, particularly on their physical and emotional status, using the Intercriteria analysis approach. Nowadays universities are in the effort to contribute to student's academic life by providing variety of sports opportunities. These sports activities, which are a part of university education, should be seen as activities that aim at develop not only the student's physical condition, but also the emotional and intellectual condition. The purpose of the present study is to evaluate the influence of four different sports on the physical and emotional status of the university students

Keywords: Intercriteria analysis, University students, Sorts activities

1 Introduction

The health and well-being of the undergraduate university students is in great importance, not only due to their potential societal influence in the future, but because many lifestyles related attitudes and habits are formed at this stage and persist across the life span [7]. Physical and athletic activity is considered an essential factor in achieving psychological and emotional balance for students by controlling and directing some behaviors through a set of exercises devoted to that, whether individual or collective [8]. At present students' physical fitness is declining and their psychological quality is getting worse and worse. Therefore, it is urgent to improve their physical and

mental health level. To improve the overall health status of the students, most of the universities in Bulgaria, promote different sports, as a compulsory discipline during the first two years of education. Many of the university's sports departments are offering to students a wide range of sport disciplines for enhancing their physical and psychological health. The most popular sports in the department of "Physical Education and Sports" of the University of Mining and Geology "St. Ivan Rilski"-Sofia are: football, table tennis, fitness and basketball. In the present study, we propose the application of the approach of InterCriteria Analysis (ICrA) to data, obtained from university students practicing four different sports activities. The data was analyzed in search of correlations between the results from the method of testing for the level of several physical and personality qualities in order to investigate the influence of these sport activities on the overall status of the students and to find the best physical and psychological tests for the test battery.

2   Presentation of the input data

The investigation and the data collection process, has been carried out in the department of "Physical Education and Sports" of the University of Mining and Geology "St. Ivan Rilski"-Sofia. The contingent of the investigation are 70, 1st year students males, attending basketball (13 students, O1-O13), table tennis (21 students, O1-O21), fitness (18 students, O1-O18) and football (17 students, O1-O17) from "Physical Culture" subject. Following [9], we have chosen a set of several parameters defining the level of physical and personality status in a test battery of 17 control tests, divided into two major groups. In order to find differences and correlations among the criteria (C1-C17) and the influence of the specific sports on the students, the tests were performed in the beginning and at the end of the educational year. In the first group is the test determining the overall physical condition of the students: General physical fitness (C1), Strength (C2), Agility (C3), Flexibility (C4) and Finger dexterity (C5). In the second group are the tests related to the personality of the students: Control of attention (C6), Stability of attention (C7), Operational thinking (C8, C9, C10), Logical thinking (C11), Memory (C12), Personal activity (C13), Willpower (C14), Communication skills (C15), Organizational skills (C16) and Emotional stability (C17). The input data for the analysis of the four different sports is shown on tables 1-8.

Basketball	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17
O1	134.01	44	6.60	16.7	81.3	46.67	0.79	82	52.28	2.10	3	6	8	23	17	13	15
O2	191.23	12	10.30	25.0	71.0	32.31	0.63	64	96.71	1.57	4	9	7	24	17	14	6
O3	137.06	44	6.45	52.3	66.5	26.80	1.06	83	53.42	2.13	2	12	3	22	7	10	11
O4	148.45	33	9.60	44.0	68.8	27.16	0.97	68	41.78	1.73	5	10	9	20	14	14	15
O5	223.71	10	9.88	18.0	64.3	24.69	1.30	69	34.14	1.61	4	12	5	21	18	11	9
O6	221.08	15	10.02	53.0	72.5	25.47	0.63	81	56.95	2.16	3	8	4	19	4	13	12
O7	168.48	20	8.25	42.0	76.4	33.91	0.76	70	37.32	1.68	2	38	8	24	16	17	20
O8	157.57	26	8.24	51.7	99.3	57.52	1.00	73	58.01	2.05	2	8	11	20	11	14	10
O9	190.11	29	10.55	43.3	73.5	29.73	1.04	69	33.01	1.61	4	9	8	20	17	8	9
O10	242.26	12	10.48	24.7	82.8	50.76	0.88	72	41.84	1.78	3	8	8	20	11	12	16
O11	178.63	22	8.50	46.0	68.2	34.30	1.40	75	40.31	1.80	3	6	5	10	12	13	0
O12	123.56	47	7.86	41.0	55.0	74.82	1.03	73	42.86	1.81	3	12	13	23	7	12	18
O13	176.07	32	8.50	58.7	64.3	52.07	1.11	84	59.36	2.34	4	5	11	24	16	14	10

Table 1. The input data of the students practicing basketball in the beginning of the educational year

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Table 2. The input data of the students practicing basketball at the end of the educational year

Table 3. The input data of the students practicing table tennis in the beginning of the educational year

Table 4. The input data of the students practicing table tennis at the end of the educational year

Table 5. The input data of the students practicing fitness in the beginning of the educational year

Fitness	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17

Table 6. The input data of the students practicing fitness at the end of the educational year

Football	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17

Table 7. The input data of the students practicing football in the beginning of the educational year

Football	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	C14	C15	C16	C17

Table 8. The input data of the students practicing football at the end of the educational year.

3   Results and discussion

The method of InterCriteria Analysis (ICA) is based on intuitionistic fuzzy sets, thus rendering account of the effects of uncertainty. Originally, ICA was being proposed in [1], and various aspects of its application over different data an its theoretical investigation are given [2, 3, 5, 6]. Following [4] in order to categorize all the values of the resultant $n(n-1)/2$ pairs of criteria, we need to define two thresholds, α and β, for the positive and for the negative consonance, respectively. The threshold values α and β are values on the [0; 1]- scale, changing with a precision step of 0.1. In our case the respective values, connected with the consonance/dissonance scale are as follows: strong positive consonance (0.95; 1), positive consonance (0.85; 0.95), weak positive

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consonance (0.75; 0.85), dissonance (0.55; 0.75), strong negative consonance (0.05; 0.00), negative consonance (0.5; 0.15) and week negative consonance (0.15; 0.25). When interpreting the results, the values of $\mu_{C1, Ci}$ and $\nu_{C1, Ci}$, respectively $\pi_{Ck, Cl}$ should be considered. The ICA method is applied over the data in the above presented tables (1-8). As a result, eight tables for membership part and non-membership part of the intuitionistic fuzzy pairs, that represent an intuitionistic fuzzy evaluation of the relations between every pair of criteria in the beginning of the educational year and at the end of the educational year of the students practicing four different sports (C1-C17) were obtained (tables 1-8).

Table 9. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing basketball in the beginning of the educational year (**A**- the membership parts of the Intuitionistic fuzzy pairs, **B**- the non- membership parts of the Intuitionistic fuzzy pairs)

Table 10. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing basketball at the end of the educational year (**A**- the membership parts of the Intuitionistic fuzzy pairs, **B**- the non- membership parts of the Intuitionistic fuzzy pairs)

Table 11. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing table tennis in the beginning of the educational year (**A**- the membership parts of the intuitionistic fuzzy pairs, **B**- the non- membership parts of the intuitionistic fuzzy pairs)

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Table 12. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing table tennis at the end of the educational year (**A**- the membership parts of the intuitionistic fuzzy pairs, **B**- the non- membership parts of the intuitionistic fuzzy pairs)

Table 13. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing fitness in the beginning of the educational year (**A**- the membership parts of the intuitionistic fuzzy pairs, **B**- the non- membership parts of the intuitionistic fuzzy pairs)

Table 14. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing fitness at the end of the educational year (**A**- the membership parts of the intuitionistic fuzzy pairs, **B**- the non- membership parts of the intuitionistic fuzzy pairs)

Table 15. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing football in the beginning of the educational year (**A**- the membership parts of the intuitionistic fuzzy pairs, **B**- the non- membership parts of the intuitionistic fuzzy pairs)

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Table 16. Results of the application of the InterCriteria Analysis on the aggregated data of the of the students practicing football at the end of the educational year (**A**- the membership parts of the intuitionistic fuzzy pairs, **B**- the non- membership parts of the intuitionistic fuzzy pairs)

From the results of the application of the ICra, we see that the pairs with the strongest positive consonance, i.e. those with smallest distance from the intuitionistic fuzzy truth ⟨0,1⟩, in the beginning of the educational year are those detected between the:
-   C8 - C10 (basketball, table tennis and football)
-   C8-C9-C10 (basketball, table tennis)

The pairs with the strongest negative consonance, i.e. those with smallest distance from the intuitionistic fuzzy truth ⟨0,1⟩, in the beginning of the educational year are those detected between the:
-   C1 - C2 (basketball)
-   C2 - C13 (football)
-   C6 – C12 (fitness)

There is also a correlation between the criteria Logical thinking (C11) and Memory (C12) with the criteria General physical fitness (C1) (fitness) and the criteria Control of attention (C6) (table tennis). At the end of the educational year all of the pairs in all of the investigated sport activities are in dissonance, and some of the strong correlations between the above mentioned criteria are missing. One possible reason for this phenomenon is that students practicing sport activities on academic level regardless of the sport they practice, develop and improve all of the locomotor skills and mental condition.

4   Conclusions

Based on our findings, we can conclude that in general the relations among the investigated criteria describing the physical and personality status of the students are much stronger in the beginning of the educational year compared to the relations at the end of the educational year. Some of the criteria in the test battery formed between logically related indicators can be easily excluded from the test battery in order to achieve efficiency while keeping the precision of the evaluating process.

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References

1. Atanassov, K., Mavrov, D., & Atanassova, V. Intercriteria Decision Making: A New Approach for Multicriteria Decision Making, Based on Index Matrices and Intuitionistic Fuzzy Sets. Issues in Intuitionistic Fuzzy Sets and Generalized Nets, 11, 1–8 (2014)
2. Atanassov, K., Atanassova, V. & Gluhchev, G. (2015). InterCriteria Analysis: Ideas and problems, Notes on Intuitionistic Fuzzy Sets, 21 (1), 81–88.
3. Atanassov, K.:On Generalized Nets Theory. Prof. M. Drinov Academic Publishing House, Sofia (2007) Atanassov, K., Szmidt, E., Kacprzyk, J., & Atanassova, V. (2017). An approach to a constructive simplification of multiagent multicriteria decision making problems via intercriteria analysis. Comptes rendus de l'Academie bulgare des Sciences, 70 (8), 1147–1156.
4. Atanassova, V. (2015). Interpretation in the Intuitionistic Fuzzy Triangle of the Results, Systems Association (IFSA), 9th Conference of the European Society for Fuzzy Logic and Technology (EUSFLAT), 30.06 – 03.07, 2015, Gijon, Spain, 1369–1374 (2015)

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5. Bureva, V.; Michalíková, A.; Sotirova, E.; Popov, S.; Riečan, B.; Roeva, O. Appli-cation of the intercriteria analysis to the universities rankings system in the Slo-vak Republic. Notes Intuit. Fuzzy Sets, 23, 128–140 (2017)

6. Çuvalcıoğlu, G., Bureva, V., & Michalíková, A. Intercriteria analysis applied to university ranking system of Turkey. Notes on Intuitionistic Fuzzy Sets, 25(4), 90–97 (2019)

7. Hussain, R., Guppy, M., Robertson, S. et al. Physical and mental health perspec-tives of first year undergraduate rural university students. BMC Public Health 13, 848, https://doi.org/10.1186/1471-2458-13-848 (2013)

8. Obeidat L., Aljarrah, Fatima. The Impact of Practicing Sports Activities on the Emotional State of Jordanian University Students, Journal of Educational and Social Research, Vol 11 No 4, DOI: https://doi.org/10.36941/jesr-2021-0083 (2021)

9. Ribagin, S., Stavrev, S.. InterCriteria Analysis of data from intellectual and physi-cal evaluation testsof students practicing sports activities. Notes on Intuitionistic Fuzzy Sets, 25, 4, ISSN:1310- 4926, DOI:10.7546/nifs.2019.25.4.83-89, 83-89 H (2019)