Eurasia Journal of Mathematics, Science & Technology Education, 2016, **12**(11), 2771-2781
doi: 10.12973/eurasia.2016.02303a

OPEN ACCESS

Is the evaluation of the students' values possible? An integrated approach to determining the weights of students' personal goals using multiple-criteria methods

Stanislav Dadelo, Zenonas Turskis, Edmundas Kazimieras Zavadskas & Tomas Kačerauskas
Vilnius Gediminas Technical University, LITHUANIA
Rūta Dadelienė
Vilnius University, LITHUANIA

•*Received 12 December 2015*•*Revised 29 May 2016* •*Accepted 30 May 2016*

To maximize the effectiveness of a decision, it is necessary to support decision–making with integrated methods. It can be assumed that subjective evaluation (considering only absolute values) is only remotely connected with the evaluation of real processes. Therefore, relying solely on these values in process management decision–making would be a mistake because this might lead to the lack of agreement between the criteria of the process. The absolute values of criteria are required for decision making, while the integrated criteria evaluation is necessary for making consistent decisions, taking into account the relative values of the criteria as well.

Keywords: ranking, entropy, integrated method, aggregate weights

INTRODUCTION

Various strategies of higher education in Europe (Wende, 2011), the USA (Centre for Studies in Higher Education, 2007) and elsewhere (Task Force on Higher Education and Society, 2000) maintain that higher education also covers general education, including education of students' values. However, the evaluation of students' achievements is impossible, while the values of both the students and the examiners are ignored (Golding, Sharmini & Lazarovitch, 2014). The values have been formed in a certain social environment (Baltrėnas, Baltrėnaitė & Kačerauskas, 2015) including political one (Pruskus, 2015) and change together with cultural climate (Park, 2014). The discourse on the values and goals inevitably involves the ethical and

Correspondence: Stanislav Dadelo,
Faculty of Creative Industries, Vilnius Gediminas Technical University,
Vilnius, Lithuania
E-mail: stanislav.dadelo@vgtu.lt

ecological (Juzefovič, 2015) aspects of education, as wel l as the relationship between an individual and society. Therefore, a question about a possibility of evaluating the students' values and goals arises.

The main goal of university education is to satisfy the needs of different social groups (students, research staff, administrative staff and the employers of graduates). Harmonization of stakeholders' needs and interests can provide a basis for effective academic management. The evaluation process of university studies highlights the key stakeholders' groups, students and future employers. Given the quality requirements to the study process, the university must harmonize the needs of students (future employees) and the needs and interests of future employers. However, this task is closely connected with education of students' values. Employers need young employees who can be efficient team leaders or team members and implement projects in a cross – functional environment in accordance with specifications, meeting the performance targets in terms of time and budget, in order to fully satisfy stakeholders' needs. To bridge this gap, innovative integrated approaches that can help develop both technical depth and interpersonal agility are essential to successful leadership of teams (Pitts, Klosterman & McGonagle, 2013). The learning outcomes of a student (preparation for future profession) depend on many variables, making a part of the general structure of life goals (Michou et al., 2013). In order to get optimal results and study the process of effective management and training of future professionals, a university should assess the range of student's life goals and establish the most important criteria affecting the optimal human functioning during the academic years and later (Jones, You & Furlong, 2013). The process of learning depends upon the feedback, which serves to inform and guide students during their studies (Jenkins, 2010). The results of their studies can help universities assess the motives of students, manage the educational process according to them, and determine optimal direction for studies (Reisz, Boudreaux & Ozer, 2013; Dadelo, 2015) and different situations generated different circumstances form unalike challenges and their solutions require applying different methods (Dadelo et al., 2015).

State of the literature

- There are findings in the current literature reporting decision of making method for evaluation of life goals for students.
- There are different methods' and multiple criteria evaluation supplies in a powerful framework for the implementing the principles that has to be realized.
- Research studies mostly show that multiple criteria methods' combination wasn't used by students who are looking into the future and is seeking for better results in career.

Contribution of this paper to the literature

- We first used together two methods: the entropy method and the expert judgment method for determining the criteria weights.
- We created the formula for aggregate weight which calculated as the geometric mean of the weights determined by using different assessment methods.
- These aggregate multiple-criteria methods bring a new quality to determining the weights of students' personal goals.

The harmonization of different study objectives and interests of students requires decision–making based on the alternatives. Therefore, in order to maximize the effectiveness of a decision, it is necessary to support decision-making with integral methods, combining the current situation and future prospects. The evaluation of the weights of criteria, influencing the course of the process, will vary depending on the changing human life-cycle objectives. The determination of the weights of criteria for solving Multiple Criteria Decision Making (MCDM) problems is a very important procedure for obtaining accurate evaluation data. The advantage of traditional methods of bid evaluation is simple and easy to realize (Kendall, 1970). Planning, setting priorities and resource allocation in the framework of the Multiple Criteria Decision Making approach involves another method known as Analytic Hierarchy Process (AHP). The AHP is a simple, yet powerful decision-making tool for planning, structuring priorities, weighing alternatives, allocating resources, analysing policy impacts and resolving conflicts (Saaty, 1980). The analysis of the considered methods is extended to account for the conflicts among different interest groups who have different goals, values, etc. Group decision making under multiple criteria includes such diverse and interconnected fields as preference analysis, utility theory, social choice theory, committee decision theory, theory of voting, game theory, expert evaluation analysis, integration of qualitative criteria and economic equilibrium theory (Hwang & Lin 1987). Summing up, it can be mentioned that subjective weight determination methods also include the Delphi approach, expert judgment method, Analytic Hierarchy Process (AHP) (Saaty, 1980), stepwise weight assessment ratio analysis (SWARA) (Keršulienė, Zavadskas & Turskis, 2010), and Criteria Relationship (FARE) method (Ginevičius, 2011). A description of the phenomenon considered is based on the relationships between all the criteria. It allows for reducing the amount of expert work and increasing the accuracy of calculations considerably. As a result of the development of new methods for determining the weights of criteria, the KEMIRA method was proposed. The criteria for determining the preference order of the criteria were established by applying the Kemeny median method. There are various other methods for determining the priorities of the criteria (Krylovas et al., 2014), as well as widely used classic weight determination methods (Dadelo et al., 2014).

The determination of the criteria weights for solving MCDM problems is very important issue for the accuracy of the evaluation results and also widely used classic weight determination methods. Aim of the research is to use integrated method to form a student's life goals ranking with different methods.

MATERIAL AND METHODS

The participants of the experiment were eighty-seven randomly selected 21–23-year-old, 2nd–3rd year students (men) from different faculties of Vilnius Gediminas Technical University (VGTU).

Table 1. Evaluation of the life goals' criteria (case study)

Nr.	Life goals	Ranking (x)	Present rate (γ)	Future rate (ρ)
1.	Business / Career / Studies – Usually the key segment in our lives. Business is for entrepreneurs, career for employees and studies for students	3	6	9
2.	Finance / Wealth – How rich you are. The amount of wealth, assets, material possessions you have	2	5	8
3.	Health / Fitness – Your state of health as well as your lifestyle. Diet, sleep, exercise falls here	1	7	10
4.	Social / Friends – How you're faring in your social circle	7	6	7
5.	Family – Your parents, siblings, next of kin, relatives, or even your guardians	5	6	8
6.	Love – The amount of love you feel in your life. While it can represent the status of your relationship with your spouse / boyfriend / girlfriend, it doesn't have to be the case. Love here does not refer to romantic love – but about universal love	4	7	8
7.	Recreation / Fun – Your recreation and enjoyment in life	8	7	7
8.	Contribution – How you're giving back to the society. Social cause. Humanitarian activities.	9	6	6
9.	Personal growth – Your personal development as a whole	6	6	6
10.	Spiritual – Your connection with the universe. Some call it higher power / God / higher self	10	4	5
11.	Self-image – How you see yourself	11	6	7

The students evaluate the criteria (life goals) according to the following rules:
Ranking (x) Rank all the general life goal criteria in your life from 1 to 11 (1 - the least important; 11 – the most important).
Today (γ) Rate your satisfaction life goal criteria level today in each of the every "slices" of your life goals above, using the following scale: from *1=Totally Dissatisfied* to *10=Totally Satisfied*.
Future (ρ) Repeat rate the exercise in number, this time assigning percentages that you would desire to be true of how you allocate your time in a future.

Evaluation criteria

The selected students evaluated the weights of criteria describing eleven life goals (values) suggested by Chua (2012) (Table 1).

The integrated methods of determining the criteria weights (Table 2):

The dynamic method of determining the weights of criteria. Various methods are available for determining the weights of criteria (Zavadskas et al., 2010; Keršulienė, Zavadskas & Turskis, 2010). Shannon introduced the concept of entropy into the theory of information (Shannon, 1948). Entropy is considered to be a measure of an undetermined random value. The application of entropy to the selection of solutions

Table 2. Methods of determining the weights of criteria

Determining the criteria weights evaluating the present and the future goals by the dynamic entropy method (Zavadskas et al. 2010)

The initial decision-making matrix X can be described as follows: where $i=\overline{1,m}$ are the compared solution alternatives, $x_1, x_2, \ldots, x_n$ are multiple criteria and $x_{11}, x_{12}, \ldots, x_{mn}$ are multiple criteria values	$X = \begin{bmatrix} x_{11} & x_{12} & \ldots & x_{1n} \\ x_{21} & x_{22} & \ldots & x_{2n} \\ \ldots & \ldots & \ldots & \ldots \\ x_{n1} & x_{n2} & \ldots & x_{mn} \end{bmatrix}; \; i=\overline{1,m}, \; j=\overline{1,n};$
In the presence of both criteria with minimal and maximal preferable optimal values. the normalization of the matrix X into normalized decision-making matrix $\overline{X}$ according to the expressions (5) and (6) is required	$\overline{x}_{ij} = \dfrac{x_{ij}}{\max\limits_i x_{ij}}, \; if \; \max\limits_i \; x_{ij}$ value is preferable and $\overline{x}_{ij} = \dfrac{\min\limits_i x_{ij}}{x_{ij}}, \; if \; \min\limits_i \; x_{ij}$ a value is preferable
$\overline{x}_{ij}$ denotes dimensionless criteria values. All maximal normalized values of the criteria are preferable. If all maximal values or all minimal values of all criteria are preferable, the normalization is not required, i.e. $X = \overline{X}$ is assumed	
Subsequently. the level of entropy E_j of each criterion is determined as follows:	$E_j = -k\sum_{i=1}^{m} \overline{x}_{ij} \ln(\overline{x}_{ij}), \; (i=\overline{1,m}; \; j=\overline{1,n}), \; k = \dfrac{1}{\ln m}.$
It is known that the criterion weight determined by the entropy method varies in the interval [0; 1], therefore,	$0 \le E_j \le 1; \; j = 1, n.$
The variation degree of j-th criterion within the limits of the problem, in diving a set of alternatives, is determined by d_j	$d_j = 1 - E_j; \; j = 1, n.$
If all criteria are equally important, or in other words, there are no subjective or expert estimates of their weights, the weights of the criteria are determined according to the equation:	$w_j^{*} = \dfrac{d_j}{\sum_{j=1}^{n} d_j}.$

Determining the criteria weights by the static expert judgment method (standard ranking) (Kendall 1970)

r is the number of experts, n is the number of criteria.

$j=\overline{1,\,n}; \; k=\overline{1,\,r}; \; r \ge 7$

Interviewing the highly skilled experts	t_{jk} — j^{th} criterion rank assigned by k^{th} expert.
Sum of ranks for each criterion	$\bar{t}_j = \sum_{k=1}^{r} t_{jk}$
Average criterion rank	$\bar{t}_j = \dfrac{\sum_{k=1}^{r} t_{jk}}{r}$
Criterion weight	$w_j^{**} = \dfrac{\bar{t}_j}{\sum_{j=1}^{n} t_j}$
The variance of experts' ranking values	$\sigma^2 = \dfrac{1}{r-1}\sum_{k=1}^{r}\left(t_{jk} - \bar{t}_j\right)^2$
Variation	$\beta_j = \dfrac{\sigma}{\bar{t}_j}$
Ranking sum average	$V = \dfrac{1}{r}\sum_{j=1}^{n}\sum_{k=1}^{r} t_{jk}$
The total square ranking deviation	$S = \sum_{j=1}^{n}\left(\sum_{k=1}^{r} t_{jk} - V\right)^2$
The coefficient of concordance $(W \ge 0.5)$	$W = \dfrac{12S}{r^2\left(n^3 - n\right)}$
The significance of the concordance coefficient (no tied ranks) $\chi^2_{\alpha,v}$	$\chi^2_{\alpha,v} = \dfrac{12S}{rn(n+1) - \dfrac{1}{n-1}\sum_{k=1}^{r} T_k},$ where $\dfrac{1}{n-1}\sum_{k=1}^{r} T_k = 0$
The rank of the table concordance χ^2_{tbl}, when the level of significance is 1 %	The degree of freedom of the problem solved $v = n - 1$; χ^2_{tbl} = from Table 1
Consisting of expert judgements	If $\chi^2_{\alpha,v} \succ \chi^2_{tbl}$ - the hypothesis about the consistency of experts' rankings is accepted

The aggregated weight is calculated as the geometric mean of the weights determined by using different assessment methods	$w_j = \dfrac{\left(w_j^{*} w_j^{**}\right)^{0.5}}{\sum_{j=1}^{n}\left(w_j^{*} w_j^{**}\right)^{0.5}}$ "A"

has been presented in the works (Jeynes, 1957; Paelnik, 1978). In this case, entropy can be used for determining the weights of criteria (Ye, 2010; Ghorbani, Bahrami & Arabzad, 2012; Chen et al., 2014). However, the entropy method can be used in various fields (Zavadskas et al., 2013; Sliogeriene, Turskis & Streimikiene, 2013; Dėjus, Antuchevičienė, 2013; Li, Liu & Li, 2014). The determination of the weights of criteria begins with normalization of the initial decision-making matrix.

The static method of determining the weights of criteria. The expert judgement method proposed by Kendall (1970) was used for determining the weights of criteria. This is a well-known and widely used method. Zavadskas et al. (2010) discussed the application of this method in this field (Table 2).

The integrated method for determining the criteria weights. It is suggested to calculate the values of the aggregate criteria weights by Equation "A" (Table 2).

THE INVESTIGATION RESULTS

The values for statistical data processing were obtained by interviewing 87 VGTU students (Table 3, 4, 5, 6). Students ranked all general criteria of their life goals (values) from 1 to 11, and static criteria weights were determined.

The weights of the criteria and rankings of the alternatives determined in the work reflect both the subjective judgements of a decision maker and the objective information. A weak statistical relation ($r = -0.2066$) between the applied methods of weighting the criteria (static – subjective (x) and dynamic – objective (γ-ρ)) has been established. However, the methods of weighting the criteria allow for identifying different features of the same criteria (Table 7). By using the static (subjective) method of weighting, the analysed criteria are ranked in the order of preference. Thus, the weights are given to the criteria disregarding the possibilities of their realization in the present time and in the future. When this method is used, the rating actually reflects absolute expectations and aspirations at present, not evaluating their realization possibilities and circumstances. The information acquired by using the above method can be used for determining the instantaneous, absolute or ideal values of the criteria, i.e. the expectations of people, not taking into account the surrounding processes, as well as subjective and objective circumstances. Therefore, students indicated health, family and personal growth as their absolute life goals (determined by static (subjective) method). When the dynamic weighting method is used, the criteria analysed are ranked, taking into consideration the possibilities of goals' realization at present and the requirements and opportunities for their realization in the future. Weights determined by using this method reflect the values obtained by combining the information on the necessity, opportunities and circumstances of realizing the goals described by the criteria. Therefore, students indicated that they mostly make efforts to achieve welfare and wealth. It is clear that the considered different criteria weighting methods reflect different information, and, therefore, the advantages of these methods can hardly be assessed with respect to each other. Rather, the methods of weighting various criteria create new opportunities in decision-making processes, considering the final goal. To determine the absolute value of the criteria (describing goals evaluated by a person as absolutely most important), the static criteria weighting method should be chosen, while in order to determine the relative values of the criteria (reflecting the efforts for their realization), the dynamic criteria weighting method must be chosen. In order to highly objectively (considering both the absolute and the relative values) determine the weights of the criteria (accumulating the absolute values and efforts needed for their realization), the third weighting method can be chosen. This is an integrated method, presenting a combination of static and dynamic approaches. The integrated weighting method gives a new quality to the criteria. In fact, this method accumulates the subjective and objective information of the evaluated criteria. It has been established

Table 3. Ranking the criteria describing the effectiveness of study process management

		Ranks of criteria describing the effectiveness of study process management										
Alternative		x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}	x_{11}
Optimum direction		*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*
max (the highest values)		1	1	1	1	1	2	1	1	2	1	1
min (the lowest values)		11	11	11	11	11	11	11	11	11	11	9
1	A_1	3	4	11	8	10	9	6	7	2	1	5
2	A_2	9	6	10	8	11	7	4	2	3	1	5
3	A_3	10	4	5	7	6	3	8	11	9	1	2
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
85	A_{85}	10	5	9	7	8	4	2	3	11	1	6
86	A_{86}	5	3	8	6	10	9	7	2	11	1	4
87	A_{87}	9	7	11	4	10	6	2	3	8	1	5
$\sum$		569	393	815	579	797	583	398	324	653	284	347
$\bar{x}$		6.540	3.667	10.111	6.722	10.111	7.333	3.944	4.111	6.944	3.056	2.889
Criteria rank (x)		2	1	4	10	6	9	5	7	8	3	11
Criteria weight $w_j^{**}(x)$		0.099	0.068	0.142	0.101	0.139	0.102	0.069	0.056	0.114	0.049	0.060

Table 4. Rating the effectiveness criteria values for students' present life goals

Alternative		γ_1	γ_2	γ_3	γ_4	γ_5	γ_6	γ_7	γ_8	γ_9	γ_{10}	γ_{11}
Optimum direction		*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*
max (highest values)		10	10	10	10	10	10	10	10	10	10	10
min (lowest values)		0	0	1	3	2	0	0	0	5	0	5
1	A_1	8	4	8	6	6	6	4	4	8	4	4
2	A_2	9	5	8	8	10	7	6	5	10	2	9
3	A_3	1	6	6	7	8	6	3	8	4	1	3
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
85	A_{85}	6	5	8	5	5	6	7	5	6	2	7
86	A_{86}	3	3	9	5	8	8	8	2	10	1	6
87	A_{87}	10	8	10	8	10	10	7	9	10	6	9
$\gamma(\bar{x})$		61.908	51.184	71.552	75.517	78.851	68.862	63.931	47.828	69.897	37.379	58.092

Table 5. Rating the effectiveness criteria values for students' future life goals

Alternative		ρ_1	ρ_2	ρ_3	ρ_4	ρ_5	ρ_6	ρ_7	ρ_8	ρ_9	ρ_{10}	ρ_{11}
Optimum direction		*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*	*max*
max (highest values)		10	10	10	10	10	10	10	10	10	10	10
min (lowest values)		0	0	3	1	5	0	1	5	2	2	1
1	A_1	8	5	9	8	9	5	5	5	8	3	5
2	A_2	10	8	10	8	10	7	6	5	10	8	9
3	A_3	2	7	7	8	9	7	4	7	5	1	4
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
85	A_{85}	5	8	8	5	9	5	3	5	5	3	3
86	A_{86}	8	7	10	5	9	8	5	5	8	2	8
87	A_{87}	10	9	10	7	10	10	5	9	10	6	9
$\rho(\bar{x})$		77.184	71.839	84.126	73.299	90.345	73.966	55.402	54.770	77.471	45.080	57.759

that finance, welfare and wealth are the dominant goals (values) of students, while business, career, studies, and health only follow them. The static relations between the aggregate weights of objective and subjective criteria are of irregular nature. A strong link (r=0.8608) between the objective (γ-ρ) and aggregate (w) weights and a weak link (r=0.1884) between the subjective (x) and aggregate (w) weights have been determined.

Table 6. The criteria weights determined by students for the present time (γ) and for a certain time period in the future (ρ) by applying only the dynamic entropy method

Alternative	γ_1-ρ_1	γ_2-ρ_2	γ_3-ρ_3	γ_4-ρ_4	γ_5-ρ_5	γ_6-ρ_6	γ_7-ρ_7	γ_8-ρ_8	γ_9-ρ_9	γ_{10}-ρ_{10}	γ_{11}-ρ_{11}
$\gamma(\bar{x})$	61.908	51.184	71.552	75.517	78.851	68.862	63.931	47.828	69.897	37.379	58.092
$\rho(\bar{x})$	77.184	71.839	84.126	73.299	90.345	73.966	55.402	54.770	77.471	45.080	57.759
$\sum$	139.09	123.02	155.68	148.82	169.20	142.83	119.33	102.60	147.37	82.46	115.85
E[j]	0.991	0.980	0.995	1.000	0.997	0.999	0.996	0.997	0.998	0.994	1.000
d[j]	0.009	0.020	0.005	0.000	0.003	0.001	0.004	0.003	0.002	0.006	0.000
The dynamic rank of criteria (γ-ρ)	2	1	4	10	6	9	5	7	8	3	11
The dynamic weight of criteria w_j^*(γ-ρ)	0.163	0.382	0.088	0.003	0.0623	0.017	0.069	0.0618	0.036	0.118	0.000

Table 7. General (static and dynamic) students' life goals (criteria weight values and the determined ranks)

Life goals' criteria	1	2	3	4	5	6	7	8	9	10	11
Weight of criteria determined by the static method, w_j^{**} (x)	0.099094	0.068443	0.141937	0.100836	0.138802	0.101533	0.069314	0.056426	0.113723	0.04946	0.060432
Weight of criteria determined by the dynamic method, w_j^* (γ-ρ)	0.163017	0.382026	0.088097	0.002997	0.062297	0.017224	0.068955	0.061807	0.035651	0.117817	0.000112
Aggregate weight of criteria $w_j = \frac{(w_j^* w_j^{**})^{0.5}}{\sum_{j=1}^{n}(w_j^* w_j^{**})^{0.5}}$	0.15432	0.19633	0.13577	0.02111	0.11290	0.05077	0.08394	0.07170	0.07731	0.09268	0.00316

DISCUSSION

When two systems of the same size are used, they may both be uniquely solvable, when letters are intercepted, but differ considerably in the amount of labour required to obtain the solution. An analysis of the basic weakness of secrecy systems is made. Finally, a certain incompatibility of various desirable qualities of secrecy systems is discussed. It seems that if various criteria were given quantitative significance, some sort of exchange equation could be found, which would involve them and give the best physically compatible sets of values. The two issues most difficult to measure numerically are complexity of operations and complexity of the statistical structure of the language (Shannon, 1948). Methodology for estimating the weights or saliencies of sub–criteria (attributes) in a composite criterion measure was applied to this problem solution. The inputs to the estimation procedure consist of a set of stimuli or objects, while each stimulus is defined by its sub-criteria profile (set of attribute values) and the set of paired comparison dominance (e.g. preference) judgments on the stimuli made by a single judge (expert) in terms of the global criterion (Srinivasan & Shocker, 1973). The technique of order of preference by similarity to an ideal solution was presented by Hwang and Yoon (1981). According to the basic principle, the chosen alternative should be the closest to the ideal solution and farthest from the non-ideal solution. By applying these principles, the problem of the choice group is treated more extensively – both the results of problem analysis and "aggregation" preference information, including non–numeric information are considered (Mirkin, 1974). This model is found to be a good predictor of consumer preferences. This methodology can be applied to managerial implications for product positioning, new product design, and market segmentation (Pekelman & Sen, 1974), while a soft consensus based on group decision making approach is used for consensus forming among the partners of the supply chain, regarding the preference values of various criteria for different alternatives (Singh & Benyoucef, 2013). These weighting methods can be called "dynamic".

Most MCDM approaches consider only subjective weights of the decision maker. However, the end-user attitude can be a key criterion. A novel approach involves the end–user into the whole decision making process (Wang & Lee, 2009). A new weight structure of evaluation criteria is proposed to combine the subjective and objective weights. The Projection Pursuit algorithm is introduced to calculate the objective weight. It is shown that the combined weight can describe the subjective information and the objective variation of information of sample values, while the uncertainty of information can be handled by the improvement methods (Su, Qin & Qin, 2013).

The subjective and objective methods available to decision makers are different and give different information; therefore, by combining them we can make more subtle decisions. Different weight determination methods give different results, provided that you do not lose the information needed to combine these methods.

Therefore, one of the most important research topics centeres around the selection of criteria and decisions. The procedures of selecting the appropriate criteria are highly important for decision–making in the field of human resources management. In this area, the appropriate human resources become very important for creating specific tests, evaluating the students' life goals and their sets (Dadelo et al., 2013). To optimize the efficiency of the process of determining the significance of criteria, the search for the combinations of several methods is required. It is essential to compare the results of evaluation obtained by using different methods, when assessing the efficiency of the criterion weight determination method. The study aims to design an algorithm for rating students' life goals (values) based on the multiple-criteria decision making methods. The congruence of different stakeholders' goals among different participants in the educational process affects their behaviour, regarding a degree of engagement in programmes and curricular assessment and even effectiveness (Emilia & Cressb 2014). The specific task of the research is to use this method to perform the ranking of students' life goals by different methods. The style of writing the 'Results' section in the present paper differs from that of a standard original paper because of the specific objective of this work. In this paper, the 'Results' are comprised not only of a set of observations, respective tables and figures, but also contain assumptions and the required (in our opinion) detailed methods, comments and information usually found in the 'Discussion' section.

CONCLUSION

The suggested methodology helps to eliminate the shortcomings associated with the application of only a subjective or an objective approach to analysis. The present investigation may be particularly useful for process managers striving to assess the quality and effectiveness of the study process, taking into account the increasing demands of contemporary education. It can be assumed that subjective evaluation (based only on absolute values) is hardly comparable with the evaluation of real processes. Therefore, relying solely on the above values in process management decision–making would be a mistake, because the application of this approach could result in disagreement between the criteria describing the process. The determining of absolute values of criteria is required for decision making, while the integrated criteria evaluation is necessary for making consistent decisions, which take into account the relative values of criteria. The authors think that balancing the contribution of subjective and objective methods to the determination of the criteria weights is required for making decisions in various cases and various areas (including social development, environment protection, science, industry, etc.). Therefore, it is necessary to control this process and direct it in the right direction by calculating the aggregate weights of criteria. This problem is still open to debate and requires more thorough investigation for its solution. Limitations in the application of methods and data analysis are also discussed for future research.

Teaching that is based on the problem-solving can contribute to the greater thinking activity of the students, who in turn exhibit greater activity during the class, versatile approach to mathematical contents, rationality, creativity and criticism. Learning in which the students are faced with problem-based situation that needs to be solved, represents a natural context of learning during classes, which cannot be said for classes organized in classical manner. In addition to that, the differentiation of the content for students in accordance with their current level of knowledge and possibilities creates conditions for adjusting their manner of learning and gaining knowledge.

Methodical contribution of the research is visible from the analysis of the contemporary teaching practice in the field of problem-based learning in teaching mathematics, based on which the models for the application in classes are constructed. Students who follow previously memorized paths in a traditional approach do not have the opportunity to create their own approaches (Hines, 2008). This approach of organizing teaching classes can also be applied not just in Analytical geometry but also in other areas in the field of mathematics, such as algebraic or geometric content. The greatest contribution of this paper will be if its results and suggestions become a part of everyday teaching practice and stimulus for writing new papers in mathematics teaching methodology.

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