An Analysis of Field Preferences of an Educational System

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Keywords

Abstract

It is the labour market that decides about the popularity of a field of studies. The area where the highest number of job offers appears is reflected in the offers of universities. However, it is very often mentioned in many media that future students decide to choose social and humane studies whose market chances are evaluated on a relatively low level.

In the past 10 years, because of the decrease in the birth rate, the number of Polish students at various universities declined to about 700,000 people. In these years, it was observed that the number of studying men and women declined (to almost 30%). The lowest decrease in the number of students was observed at technical universities because of the fact that, at that time, the number of female students increased there. The group of female students constitutes the one that has increased in numbers in the past 10 years.

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The authors of this article, using a multidimensional comparative analysis method, conducted a research on studying field preferences of female students, which is a dominant group of people studying at Polish universities.

INTRODUCTION

In pursuit of liberating from different kinds of dependencies and prejudice, it was characteristic for different social groups, including women, to aim at getting full social and political rights. The most important thing from the activities of emancipational movement amongst women was to get the rights to educate at university level. Some more liberal factions in Europe were prone to give women the right to educate; however, there was strong opposition in case of allowing women to perform certain occupations connected with education.[1] Nevertheless, with time, in Europe, in the nineteenth century, this movement gained more followers and votes to change a social and political situation of women, which was a beginning of a new model of bringing up women.[2]

 In nineteenth century, a model of bringing up women and what follows their access to education was dependent on the origins. Positivists have demanded to equate women's rights in many areas of public life, including women's access to higher education.[3]

Although, in the past 30 years of nineteenth century, some of the European universities allowed women to study, full involvement of women in teaching at universities started after the First World War. In Poland, the issue of a possibility to start studies and to perform an occupation connected with education was discussed at the turn of nineteenth and twentieth centuries. The main reason for a discussion in this area was a necessity of many women, connected with the results of regressive measures of invaders who not only repossessed fortune of Polish landed classes but also banished people from those lands and forced men to emigrate. As a consequence women faced the need to start a job that would give them money.[4] There were few factors that were meaningful on Polish lands for an academic emancipational movement of women such as functioning of higher female courses, studies at foreign universities and a permission to study at Polish universities for women. A form of education that preceded regular higher education for women was courses of a university level. These courses, however,

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[1]   J Hulewicz, H Więckowska, *Z dziejów dopuszczenia kobiet do wyższych uczelni* (1937).

[2]   J Suchmiel, *Emancypacja naukowa kobiet w uniwersytetach w Krakowie i we Lwowie do roku 1939* (2004).

[3]   J Zawal, 'Edukacja kobiet wczoraj i dziś' (2006) 4 Edukacja Dorosłych 78-79.

[4]   ibid.

did not give any university diploma in spite of the level. By contrast, a university diploma could be gained at foreign universities that allowed for women's education. Many Polish women scientists at those times were educated at foreign universities. Their foreign education and professional successes were direct cause of an increase in educational needs and aspirations amongst Polish women. They also influenced movements and actions towards gaining women's rights to study at domestic universities, resulting mainly from the fact that foreign universities were impossible to afford.[5]

After the First World War, all faculties were accessible for women. Moreover, women could choose any levels of academic career together with a possibility to gain postdoctoral degree. Second decade of the past century showed a scope of performed transformations regarding a situation of women. Women's educational and professional activity became more common at that time. What's more, contemporary women fulfilled their needs at many new areas of human activity including political, social and economic area of life.[6]

Nowadays, it is nothing strange that academic rooms are full of women student and academic staff has women professors. [7]

These days education becomes a criterion for an evaluation of personal and professional development for a contemporary woman, and it becomes a form of social activity. A contemporary woman wants to pursue her aims in any sphere of life without restricting only to being a mother and a wife; consequently, she wants to upgrade her academic qualifications, and it is very important not only because of economic reasons but mainly to express herself and to manifest her passions.[8] In addition, educated women more easily overcome structural barriers that, in any other stations, may prevent from gaining equal professional positions with men and have better motivation to broaden professional perspectives.[9] At the same time, education provides possibilities to gain a new role and makes it easier for them to enter adult social life.[10]

The period of economic transformations and growth of social awareness created an image of a woman as an independent entity who possesses her own aspirations and aims. In addition, tendencies of women entering faculties of

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[5] ibid.

[6] E Mazurek, 'Kariera zawodowa i aktywność edukacyjna jako szansa samorozwoju' [2007] Rocznik Andragoniczny 155.

[7] S Armstrong, *Wojna kobiet*, translated by B. Kucharuk (2015).

[8] Zawal (n 3).

[9] P Abbott, 'Przebić szklany sufit: Promocja studiów kobiecych' in *Problematyka kobiet na świecie* (1996).

[10] B Merrill, 'Płeć, edukacja i uczenie się' (tr M Machniewski) (2003) 1 Teraźniejszość - Człowiek - Edukacja.

studies that have been dominated by men are visible. The aim of this article is to determine the number of women as students at 93 universities in Poland in the academic year 2016–2017, indicating their preferences according to the type of a university and an education group. For fulfilling the above-mentioned aim, an advanced tool of multi-dimensional comparative analysis (MCA) was used. This is the first research of this type in Poland.

I. Methodology of Research – A Tool of Multi-Dimensional Comparative Analysis

MCA is supposed to compare objects that are described with the usage of various characteristics. Very specific methods that are used for such analyses are the so-called taxonomic methods that are based on comparisons of objects with the usage of the so-called distance matrix.[11] Amongst these methods, we can distinguish

– grouping methods;
– linear sorting.

In the first one, we can distinguish discrimination and classifying methods. By discrimination, we should understand an allocation of objects to familiar classes described by certain group of characteristics (such as position measures) or representatives (learning trial). On the other hand, classification is a division of objects into previously unknown classes in such a way that they are the most similar (in respect of distance) and objects from different classes were the least similar.[12]

On the contrary, the aim of a linear sorting method is to sort objects from the best one to the worst one according to an accepted criterion of a compound phenomenon. During linear sorting, first, we need to determine objects, an aim of ranging and a set of characteristics that serve as a criterion for an evaluation. First stage of ranging is to choose statistical characteristics. In each analysis of this type, a proper choice of diagnostic characteristics that define described phenomenon is vital and has an influence on it. The choice of these characteristics should be based on the presumptions that both content-related and formal and properly chosen diagnostic variables should[13]

– play a major role in a description of an analysed phenomenon;
– be complete and accessible;

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[11]   W Pluta, *Wielowymiarowa analiza porównawcza w badaniach ekonometrycznych* (1977).

[12]   *Ekonometria. Metody, przykłady, zadania,* editor J. Dziechciarz (2003).

[13]   P Gibas, K. Heffner, *Analiza ekonomiczno przestrzenna* (2007).

–   be captured in scales: interval or quotient;
–   be poorly correlated with each other to avoid information duplication;
–   be characterised by high level of changeability.

After considering content-related criteria, variables may undergo further reduction because in this set there should not be, simultaneously, characteristics that duplicate the information.

Consequently, similarities of characteristics are defined based on the matrix of Pearson's correlation coefficient.

According to the subject literature, diagnostic characteristics that a ranking will be based on should be characterized by[14]

–   a weak correlation with each other,
–   a strong correlation with other characteristics that were not chosen to a final set of diagnostic variables.

A terminal value that serves to separate characteristics that are weakly or strongly correlated with each other and used in a procedure of variable choice is a critical value of correlation coefficient that defines vitality of correlation:[15]

$$r^* = \sqrt{\frac{t_\alpha^2}{t_\alpha^2 + n - 2}}, \qquad\qquad (2)$$

where t is the value of statistics that is taken from test charts of t- student for a given significance level α and for $(n - 2)$ of level degrees of freedom; n is the number of defining variables.

On the basis of such reduction, we receive the so-called optimal set of diagnostic characteristics.

Another step of ranging is defining a character of particular variables. Amongst these, we can distinguish[16]

–   stimulant: an increase of which causes an increase in analysed phenomenon;
–   destimulants: an increase of which causes a decrease in the level of compound phenomenon;
–   nominants, their defined value (N) indicates that there is the highest level of compound phenomenon;
–   neutral, an increase or decrease of which has no influence on the level of compound phenomenon.

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[14]   *Zastosowanie metod ekonometryczno- statystycznych w zarządzaniu finansami zakładów ubezpieczeń*, editor W. Ronka Chmielowiec (2004).

[15]   ibid.

[16]   Dziechciarz (n 12).

One of the elementary steps of taxonomic research is to make sure that there are only characteristics of a simulative kind in a set of diagnostic variables. Owing to this, a change of characters of all variables into simulative is required. This procedure is broadly described in a text by Dziechciarz.[17]

Another very essential step in conducted ranging is normalisation of variables. The aim of this is to deprive all variables of their label and to standardise their size. A process of normalisation of variables uses standardisation formulas and unification for variables measured in an interval scale and quotient transformations for variables measured on a quotient scale. The most often used technique of normalisation is standardisation, which is defined as[18]

$$Z_{ij} = \frac{X_{ij} - \bar{X}_j}{S_j} \tag{3}$$

where Z_{ij} is the standardised value of j variable for i object, $\bar{X}_j$ is the arithmetic mean of j variable, S_j is the standard deviation of j variable.

In a method of a model development, variables are standardised and are of stimulant character.

After such standardisation, variables become uniform because of the variability with standard deviation 1 and mean 0.

The next step of a research is to determine a pattern and anti-pattern for abstract objects. [19]A pattern is a vector of the highest values of coordinates and an anti-pattern is a vector whose coordinates are the lowest values of each variable. In the next step, a similarity of objects with the best abstract object is analysed through measuring a distance (e.g. Euclidean) for each pattern of development: [20]

$$d_{i0} = \sqrt{\sum_{j=1}^{k}(Z_{ij} - Z_{0j})^2} \quad i = 1,2,\dots,n \tag{4}$$

where d_{i0} is the Euclidean distance of i object from a development pattern Z_0.

The smaller the distance of the object from a pattern, the higher is the level of a complex phenomenon.

The last step of ranging is to determine the so-called development measure for each object:

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[17] ibid.

[18] *Zastosowanie metod ekonometryczno- statystycznych w zarządzaniu finansami zakładów ubezpieczeń*, editor W. Ronka Chmielowiec (2004).

[19] K Nermend, *Metody analizy wilokryterialnej i wielowymiarowej we wspomaganiu decyzji*, (2017) 151-152.

[20] Dziechciarz (n 12) 70-80.

$$m_i = 1 - \frac{d_{io}}{d0}, (i = 1, 2, \ldots n), \tag{5}$$

where m_i is the measure of development for i object, d_0 is the distance between a development pattern and an anti-pattern.

This measure is composed in such a way that its values are from [0,1] interval, and the higher is the value, the higher the level of a complex phenomenon.

Owing to the fact that taxonomic measures of a development replace a description of an analysed object with the help of many characteristics due to one aggregated value, a classification of socio-economic objects may be reduced to a division of objects based on the only one variable. A starting point for this simple method of classification is a set of objects segregated according to non-decreasing measure of a development value. On the basis of location parameters and dispersion data, an average value and a standard deviation of development measure, we can divide a set of objects into four subsets that include objects that belong to the following range [Nowak 1990, p. 92-93][21]:

- group I: $z_i \geq \bar{z} + s_z$,
- group II: $\bar{z} + s_z > z_i \geq \bar{z}$,
- group III: $\bar{z} > z_i \geq \bar{z} - s_z$,
- group IV: $z_i < \bar{z} - s_z$.

II. Description of Data And Results of Conducted Researches

A situation of working women at public universities was analysed based on 93 universities in Poland according to their profile: universities, universities of technology, universities of economics, universities of environmental and life sciences, university schools of physical education, medical universities, university schools of music, academies of art and design and military universities (Table 1).

Data used in this research refer to women on intramural and extra-mural studies and at bachelor's and master's studies in 2016–2017. The data were collected from the Central Statistical Office webpage.[22]

In most of the cases, the percentage of women was higher than that of men both on intramural and extra-mural studies (Table 2 and Figure 1). The most feminist universities in 2016–2017 were medical universities because there were more than 85% of women students on intramural and extra-mural studies. A very

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[21] E Nowak, *Metody taksonomiczne w klasyfikacji obiektów społeczno-gospodarczych* (1990) 25-27.

[22] https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/5488/8/4/1/ szkolnictwo_wyzsze_dane_wstepne_stan_w_dniu_30_11_2016.xlsx.

Table 1: A list of public universities in academic year 2016–2017 used in the analysis

Symbol	Universities
U1	UNIVERSITY OF WROCŁAW
U2	KAZIMIERZ WIELKI UNIVERSITY IN BYDGOSZCZ
U3	NICOLAUS COPERNICUS UNIVERSITY OF TORUŃ
U4	MARIA CURIE-SKŁODOWSKA UNIVERSITY IN LUBLIN
U5	**THE JOHN PAUL II CATHOLIC UNIVERSITY OF LUBLIN**
U6	UNIVERSITY OF ZIELONA GÓRA
U7	UNIVERSITY OF ŁÓDŹ
U8	JAGIELLONIAN UNIVERSITY IN KRAKÓW
U9	UNIVERSITY OF WARSAW
U10	CARDINAL WYSZYŃSKI UNIVERSITY IN WARSAW
U11	UNIVERSITY OF OPOLE
U12	UNIVERSITY OF RZESZÓW
U13	UNIVERSITY OF BIAŁYSTOK
U14	UNIVERSITY OF GDAŃSK
U15	UNIWERSYTET ŚLĄSKI W KATOWICACH
U16	THE JAN DŁUGOSZ UNIVERSITY IN CZĘSTOCHOWA
U17	THE JAN KOCHANOWSKI UNIVERSITY IN KIELCE
U18	UNIVERSITY OF WARMIA I MAZURY IN OLSZTYN
U19	ADAM MICKIEWICZ UNIVERSITY IN POZNAŃ
U20	UNIVERSITY OF SZCZECIN
U21	WEST POMERANIAN UNIVERSITY OF TECHNOLOGY IN SZCZECIN
T1	WROCŁAW UNIVERSITY OF TECHNOLOGY
T2	LUBLIN UNIVERSITY OF TECHNOLOGY
T3	LODZ UNIVERSITY OF TECHNOLOGY
T4	AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY
T5	TADEUSZ KOŚCIUSZKO CRACOW UNIVERSITY OF TECHNOLOGY
T6	WARSAW UNIVERSITY OF TECHNOLOGY
T7	OPOLE UNIVERSITY OF TECHNOLOGY
T8	RZESZÓW UNIVERSITY OF TECHNOLOGY
T9	BIAŁYSTOK UNIVERSITY OF TECHNOLOGY
T10	GDAŃSK UNIVERSITY OF TECHNOLOGY
T11	CZĘSTOCHOWA UNIVERSITY OF TECHNOLOGY
T12	SILESIAN UNIVERSITY OF TECHNOLOGY
T13	UNIVERSITY OF BIELSKO-BIALA
T14	KIELCE UNIVERSITY OF TECHNOLOGY
T15	POZNAŃ UNIVERSITY OF TECHNOLOGY
T16	KOSZALIN UNIVERSITY OF TECHNOLOGY
T17	MARITIME UNIVERSITY OF SZCZECIN

^{Continued} Table 1: A list of public universities in academic year 2016–2017 used in the analysis

Symbol	Universities
P1	WROCŁAW UNIVERSITY OF ENVIRONMENTAL AND LIFE SCIENCES
P2	UTP UNIVERSITY OF SCIENCE AND TECHNOLOGY IN BYDOSZCZ
P3	UNIVERSITY OF LIFE SCIENCES IN LUBLIN
P4	UNIVERSITY OF AGRICULTURE IN KRAKOW
P5	WARSAW UNIVERSITY OF LIFE SCIENCES
P6	POZNAŃ UNIVERSITY OF LIFE SCIENCES
P7	SZCZECIN UNIVERSITY OF LIFE SCIENCES
E1	WROCŁAW UNIVERSITY OF ECONOMICS
E2	CRACOW UNIVERSITY ECONOMICS
E3	WARSAW SCHOOL OF ECONOMICS
E4	STATE HIGHER SCHOOL OF TECHNOLOGY AND ECONOMICS IN JAROSŁAW
E5	UNIVERSITY OF ECONOMICS IN KATOWICE
E6	POZNAŃ UNIVERSITY OF ECONOMICS
S1	UNIVERSITY OF PHYSICAL EDUCATION IN WROCŁAW
S2	UNIVERSITY OF PHYSICAL EDUCATION IN KRAKOW
S3	JÓZEF PIŁSUDSKI UNIVERSITY OF PHYSICAL EDUCATION IN WARSAW
S4	GDANSK UNIVERSITY OF PHYSICAL EDUCATION AND SPORT
S5	THE JERZY KUKUCZKA UNIVERSITY OF PHYSICAL EDUCATION IN KATOWICE
S6	THE EUGENIUSZ PIASECKI UNIVERSITY OF PHYSICAL EDUCATION IN POZNAN
M1	WROCŁAW MEDICAL UNIVERSITY
M2	MEDICAL UNIVERSITY OF LUBLIN
M3	MEDICAL UNIVERSITY OF ŁÓDŹ
M4	MEDICAL UNIVERSITY OF WARSAW
M5	OPOLE MEDICAL SCHOOL
M6	MEDICAL UNIVERSITY OF BIAŁYSTOK
M7	MEDICAL UNIVERSITY OF GDAŃSK
M8	POZNAŃ UNIVERSITY OF MEDICAL SCIENCES
M9	POMERENIAN MEDICAL UNIVERSITY IN SZCZECIN
MU1	THE KAROL LIPIŃSKI ACADEMY OF MUSIC IN WROCŁAW
MU2	THE FELIKS NOWOWIEJSKI ACADEMY OF MUSIC IN BYDGOSZCZ
MU3	ACADEMY OF MUSIC IN ŁÓDŹ
MU4	ACADEMY OF MUSIC IN KRAKÓW
MU5	THE FRYDERYK CHOPIN UNIVERSITY OF MUSIC G GDAŃSKG
MU6	ACADEMY OF MUSIC IN GDAŃSK
MU7	THE KAROL SZYMANOWSKI ACADEMY OF MUSIC IN KATOWICE

_{Continued}Table 1: A list of public universities in academic year 2016–2017 used in the analysis

Symbol	Universities
MU8	ACADEMY OF MUSIC IN POZNAŃ
A1	EUGENIUSZ GEPPERT ACADEMY OF ART AND DESIGN IN WROCLAW
A2	THE STRZEMIŃSKI ACADEMY OF ART
A3	ŁÓDŹ FILM SCHOOL
A4	THE ACADEMY OF FINE ARTS IN KRAKOW
A5	**THE ACADEMY OF FINE ARTS IN WARSAW**
A6	THE ALEKSANDER ZELWEROWICZ NATIONAL ACADEMY OF DRAMATIC ART IN WARSAW
A7	THE ACADEMY OF FINE ARTS IN GDAŃSK
A8	THE KATOWICE ACADEMY OF FINE ARTS
A9	**UNIVERSITY OF THE ARTS IN POZNAN**
PE1	PEDAGOGICAL UNIVERSITY OF CRACOW
PE2	THE ACADEMY OF PEDAGOGY IN WARSAW
PE3	POMERANIAN UNIVERSITY IN SŁUPSK
W1	POLISH NAVAL ACADEMY OF THE HEROS OF WESTERPLATTE IN GDYNIA
W2	WAR STUDIES UNIVERSITY IN WARSAW
W3	MILITARY ACADEMY OF TECHNOLOGY IN WARSAW
W4	POLISH AIR FORCE ACADEMY
W5	MILITARY UNIVERSITY OF LAND FORCES IN WROCŁAW
W6	THE STATE FIRE SERVICE COLLEGE IN WARSAW
W7	POLICE ACADEMY IN SZCZYTNO

Source: self-study.

Table 2: Involvement of women in higher education in the academic year 2016–2017 according to the type of a university

Type of a university	Intramural studies (%)	Extra-mural studies (%)
Universities	65.20	51.42
Universities of technology	48.00	29.72
Universities of environmental and life sciences	62.26	36.91
Universities of economics	61.55	50.63
University schools of physical education	56.27	42.08
Medical universities	84.62	84.51
University schools of music	57.48	63.18
Academy of art and design	81.34	71.67
School of education	79.32	73.61
Military universities	39.17	31.95

Source: self-study.

similar result was observed at academies of art and design and schools of education.

The universities that were rarely chosen by women were technical universities and military universities. At technical universities, there were about 48% and 40% at military universities on intramural studies. There were even fewer students on extra-mural studies of these types. As for technical universities, it amounted to about 30% of all students, and for military extra-mural studies, it was 31%.

It was also noticed that the biggest disproportion between intramural studies and extra-mural studies, regarding women, was at universities of environmental and life sciences. The difference between women studying on intramural and extra-mural studies amounted to 25 percentage points. Difference of more than 10 percentage points was noticed at technical universities, university schools of physical education and universities of economics. It is worth mentioning that only in case of university schools of music, the number of women studying on intramural studies was lower than in case of extra-mural studies.
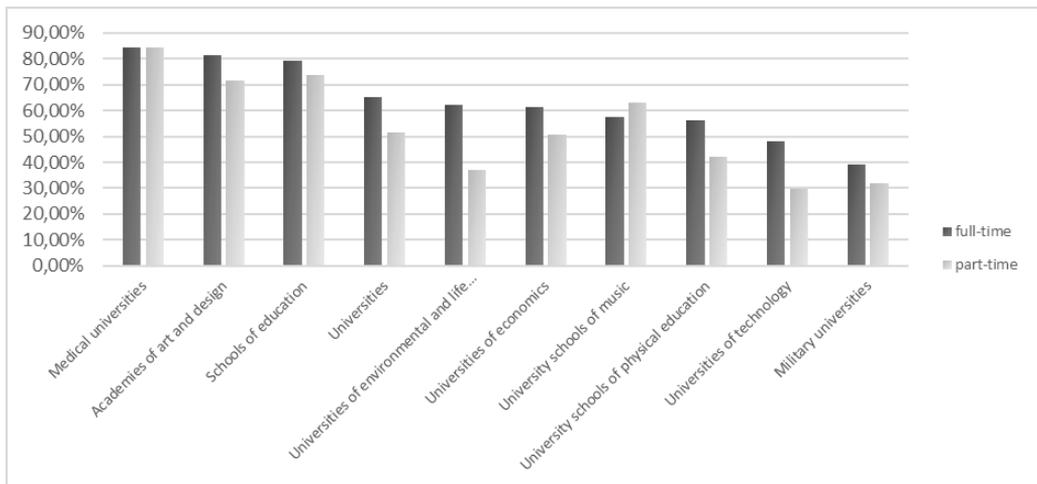
Figure 1: Involvement of women in higher-level education in the academic year 2016–2017 according to different types of universities
Source: self-study.

In another step, using taxonomic measure of development, preferences of women according to a group of education were analysed. According to the CSO, each of university faculty can be assigned to one of the 10 categories, which is presented in Table 3.

For each university, a percentage of involvement of studying women at both levels and in each group of education was measured (diagnostic variables: X1, X2, X3, X4). Descriptive statistics of these variables are presented in Table 4.

Owing to the fact that all variables influenced the situation of women in a simulative way at each university, the data were standardised in the first step and

Table 3: Groups of teaching faculties

Group	Name
1	AGRICULTURE
2	TECHNOLOGY, INDUSTRY, BUILDING
3	BUSINESS, ADMINISTRATION AND LAW
4	EDUCATION
5	UMANISTIC SCIENCES AND ART
6	NATURAL SCIENCES, MATHEMATICS AND STATISTICS
7	SOCIAL SCIENCES, JOURNALISM AND INFORMATION
8	TELEINFORMATION TECHNOLOGIES
9	SERVICES
10	HEALTH AND SOCIAL CARE

Source: CSO data.

Table 4: Descriptive statistics of diagnostic variables

	X1	X2	X3	X4
Mean	0.5972	0.6234	0.4151	0.4537
Standard deviation	0.2223	0.2453	0.3172	0.3470
Variability coefficient	37%	39%	76%	76%

Source: self-study.

Table 5: Pattern and anti-pattern of diagnostic variables

	X1	X2	X3	X4
Pattern	1.8120	1.5350	1.8438	1.5746
Anti-pattern	−2.3895	−2.5412	−1.3085	−1.3077

Source: self-study.

then the values of development measure for each university were distinguished according to the faculty groups (values of the pattern and anti-pattern form Table 5 were used).

Dispersion of development measure together with basic descriptive measures is presented in Table 6 and Figure 2. The results are presented in Table 7.

What is visible is a left-side asymmetry of development measure dispersion which means that such groups exist for which an involvement of women students in studying groups is lower than average expressed with a median of a development measure value. Another thing that states about an asymmetry is a discrepancy in the value of a median and average value equal to 0.59. Values of analysed measure can be characterised by a high variability (at a level of 39%), which means that there is a high differentiation between education groups chosen by women.

Table 6: Descriptive statistics of development measure

Descriptive statistics	Values
Mean	0.5891
Standard deviation	0.2325
Variability coefficient	39.47%
Median	0.6400
Q1	0.4637
Q3	0.7386
Skewness	−0.6556
Kurtosis	−0.2714
Max	1.0000
Min	0.0062

Source: self-study.
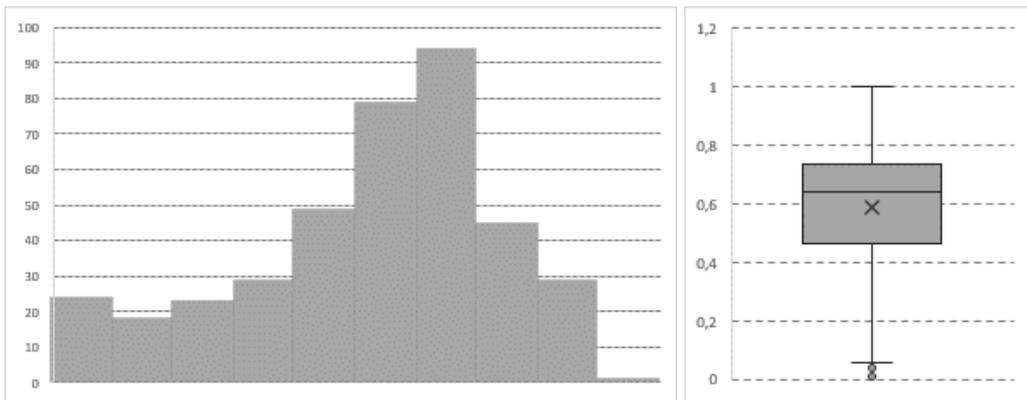
Figure 2: Bar chart and boxplot for a development measure
Source: self-study.

On the basis of the obtained data, it is visible that the most feministic education groups are those concerning health and social care. In these groups, high values of development measure were visible, which is explained by an average value of a measure and also by median. In a group with faculties connected with health and social care, there are people who want to become a therapist, a rehabilitator and a social worker as well as a speech therapist and a nurse. It is not surprising because these are usually women who work on this kind of positions. Similarly, high values of development measure in a group of faculties referring to staff education raise no doubt. In case of this group, regardless of the type of university, women are also dominant.

Despite of little dispersion of data (15%), a group with humanistic and art faculties were dominated by women. The lower value of development measure for this group was almost equal to 0.5, which is the best result amongst the rest of

Table 7: Ranking of universities in Poland in terms of women's involvement according to types of universities and education groups in the academic year 2016–2017

Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure
1	M6_9	1.00000	99	U3_5	0.73852	197	U3_7	0.63989	295	U15_9	0.46245
2	M2_9	0.99232	100	U6_6	0.73757	198	P5_2	0.63911	296	U8_9	0.45451
3	M3_9	0.98664	101	M8_6	0.73685	199	U14_3	0.63818	297	W3_7	0.45308
4	U13_4	0.96683	102	U3_6	0.73678	200	U12_3	0.63769	298	P2_2	0.44546
5	U14_4	0.95816	103	U4_2	0.73671	201	P3_1	0.63743	299	U4_6	0.44471
6	E4_4	0.95303	104	U3_5	0.73643	202	E5_7	0.63686	300	S4_10	0.43861
7	U13_10	0.94616	105	U5_10	0.73523	203	U2_6	0.63509	301	W1_9	0.43716
8	M8_2	0.94534	106	U9_3	0.73452	204	P1_1	0.63480	302	T3_2	0.43638
9	U3_4	0.94398	107	U2_3	0.73243	205	Pe3_5	0.63435	303	S1_4	0.42516
10	Pe1_10	0.94389	108	U13_5	0.73242	206	T3_6	0.63411	304	W3_3	0.42456
11	T13_4	0.94259	109	U7_5	0.73039	207	U13_7	0.63138	305	T13_2	0.42409
12	U7_4	0.93738	110	U19_4	0.72793	208	E1_2	0.63092	306	T15_9	0.42346
13	P5_4	0.93541	111	U9_6	0.72747	209	U13_6	0.63059	307	U20_2	0.42260
14	Pe2_4	0.93322	112	U10_6	0.72710	210	P5_3	0.63019	308	T9_2	0.41998
15	U3_4	0.93293	113	U6_9	0.72580	211	U18_6	0.62648	309	U5_2	0.40917
16	U6_10	0.93180	114	U15_6	0.72362	212	U6_7	0.62520	310	T6_9	0.39818
17	U1_4	0.93038	115	Pe3_6	0.72355	213	U6_3	0.62113	311	W2_7	0.39230
18	U9_4	0.93004	116	U8_5	0.72266	214	T12_3	0.61805	312	T14_2	0.38815
19	U10_4	0.92817	117	U14_5	0.72070	215	T11_3	0.61695	313	T10_2	0.37987
20	U3_10	0.92400	118	S1_10	0.71908	216	U12_9	0.61674	314	E6_8	0.37413
21	U12_4	0.92332	119	T8_6	0.71882	217	E6_3	0.61347	315	U11_1	0.36205
22	U4_4	0.91150	120	U3_3	0.71881	218	P2_3	0.61278	316	T16_2	0.36009
23	U8_10	0.91115	121	T11_6	0.71828	219	E4_3	0.61258	317	S5_4	0.35937
24	U18_4	0.91012	122	U18_5	0.71822	220	U8_3	0.61199	318	T17_9	0.35755
25	Pe1_4	0.90933	123	P6_7	0.71579	221	MU8_4	0.61157	319	T17_3	0.35203

Continued Table 7: Ranking of universities in Poland in terms of women's involvement according to types of universities and education groups in the academic year 2016–2017

Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure
26	T3_5	0.90718	124	Pe1_9	0.71558	222	T10_7	0.60865	320	T8_2	0.35186
27	P5_10	0.90521	125	S2_9	0.71426	223	U10_2	0.60816	321	S4_4	0.34922
28	U7_10	0.90029	126	U11_5	0.71181	224	U5_6	0.60595	322	T12_2	0.34904
29	P6_10	0.89214	127	U7_3	0.71069	225	U18_2	0.60363	323	S2_4	0.34826
30	U1_10	0.88997	128	U12_5	0.70953	226	U10_9	0.60358	324	T15_2	0.34480
31	U12_10	0.88312	129	T4_5	0.70905	227	T10_3	0.60309	325	U3_2	0.34365
32	U17_4	0.88310	130	U11_7	0.70891	228	MU3_5	0.60219	326	T8_9	0.33906
33	U14_10	0.88251	131	U16_5	0.70820	229	T4_6	0.59756	327	T4_2	0.33489
34	U8_4	0.88179	132	E2_3	0.70704	230	S5_9	0.59541	328	T1_2	0.33346
35	P4_10	0.88049	133	U17_6	0.70617	231	U3_7	0.59414	329	T6_2	0.33035
36	Pe1_3	0.87746	134	U5_4	0.70616	232	T2_3	0.59404	330	T2_2	0.32399
37	T15_5	0.87338	135	M3_2	0.70385	233	U5_3	0.59389	331	P5_8	0.32222
38	M5_10	0.87207	136	U20_1	0.70376	234	U11_2	0.59360	332	W7_9	0.31659
39	M1_10	0.87194	137	P7_1	0.70376	235	T16_7	0.59080	333	T12_9	0.30743
40	P3_10	0.87184	138	U1_3	0.70290	236	U3_9	0.58769	334	M8_9	0.30361
41	T16_4	0.86977	139	U19_6	0.70027	237	U18_9	0.58709	335	U2_10	0.30312
42	Pe3_4	0.86873	140	U19_5	0.70022	238	U5_7	0.58548	336	U19_8	0.29661
43	M4_10	0.86820	141	U12_7	0.69978	239	E2_7	0.58541	337	P1_3	0.29430
44	T12_5	0.86616	142	U4_5	0.69920	240	U3_9	0.58473	338	E1_8	0.29254
45	A1_2	0.86317	143	S2_10	0.69815	241	E1_7	0.58225	339	T11_2	0.28840
46	A6_5	0.85570	144	P5_6	0.69746	242	E6_7	0.57937	340	P2_9	0.28014
47	M8_10	0.84907	145	U2_5	0.69678	243	U17_7	0.57617	341	T2_9	0.26776
48	P2_5	0.84651	146	P5_9	0.69671	244	U8_2	0.57102	342	U13_8	0.25397
49	M7_10	0.84027	147	T6_3	0.69578	245	T4_3	0.56884	343	E5_8	0.23941
50	U3_10	0.83471	148	T6_7	0.69567	246	S4_9	0.56684	344	T7_4	0.23351

Continued Table 7: Ranking of universities in Poland in terms of women's involvement according to types of universities and education groups in the academic year 2016–2017

Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure
51	U4_10	0.83469	149	U3_6	0.69539	247	T3_3	0.56606	345	P4_3	0.23227
52	U18_10	0.83286	150	U17_3	0.69509	248	T15_3	0.56560	346	P3_7	0.23059
53	U6_4	0.83184	151	U5_5	0.69186	249	W3_6	0.55541	347	T3_9	0.22784
54	A2_5	0.82963	152	U10_3	0.69038	250	P4_1	0.55413	348	U2_8	0.22704
55	A7_5	0.82743	153	U20_7	0.68990	251	P5_7	0.55352	349	W3_2	0.22643
56	M6_10	0.82739	154	P7_7	0.68990	252	S6_4	0.55063	350	U8_8	0.22290
57	A4_5	0.82459	155	T1_6	0.68819	253	MU6_5	0.54920	351	U9_9	0.21790
58	A1_5	0.82367	156	U11_4	0.68711	254	U19_9	0.54779	352	T3_7	0.21760
59	U16_10	0.82041	157	E5_3	0.68710	255	MU3_4	0.54594	353	T4_4	0.21724
60	M2_10	0.82006	158	U16_3	0.68585	256	U16_9	0.54412	354	U5_9	0.21701
61	U16_4	0.81788	159	P1_2	0.68482	257	MU5_5	0.54237	355	W6_9	0.21248
62	E1_9	0.81623	160	P2_1	0.68219	258	U8_6	0.54168	356	T7_2	0.21150
63	T13_10	0.81489	161	P4_7	0.67823	259	MU1_5	0.53989	357	P1_9	0.20909
64	M9_10	0.81076	162	U8_7	0.67380	260	MU5_4	0.53869	358	U6_8	0.20281
65	Pe1_5	0.80448	163	T8_3	0.67261	261	U17_9	0.53553	359	T4_8	0.19577
66	A8_5	0.80186	164	P3_2	0.67128	262	T9_3	0.53530	360	U2_2	0.18769
67	MU6_4	0.80061	165	U3_3	0.67049	263	MU4_4	0.53239	361	W5_6	0.17474
68	M3_10	0.79961	166	U13_3	0.67002	264	S5_3	0.52803	362	U3_2	0.16983
69	U6_5	0.79787	167	P1_7	0.66895	265	P5_1	0.52449	363	U18_8	0.16872
70	A9_5	0.79263	168	U14_7	0.66874	266	T1_3	0.52431	364	U3_8	0.16302
71	P2_6	0.78265	169	U7_7	0.66818	267	S1_9	0.52409	365	U9_8	0.16299
72	Pe1_6	0.78072	170	U4_7	0.66599	268	W4_9	0.51830	366	T10_8	0.12593
73	T5_6	0.77978	171	S6_10	0.66416	269	U15_7	0.51772	367	T3_8	0.11880
74	P4_6	0.77975	172	U9_5	0.66293	270	T11_9	0.51680	368	W3_8	0.11487
75	A5_5	0.77692	173	U11_9	0.66171	271	MU8_5	0.51654	369	U10_8	0.11429

Continued Table 7: Ranking of universities in Poland in terms of women's involvement according to types of universities and education groups in the academic year 2016–2017

Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure	Place	Object	Development measure
76	T16_5	0.77149	174	E2_2	0.66069	272	W5_9	0.51646	370	T1_8	0.11177
77	T13_5	0.77037	175	T7_10	0.65947	273	U4_9	0.51642	371	U12_8	0.11086
78	P1_6	0.76706	176	P4_2	0.65929	274	S6_9	0.51604	372	T2_8	0.10586
79	P6_6	0.76458	177	S5_10	0.65910	275	U7_2	0.51440	373	T9_8	0.10583
80	T9_5	0.76441	178	A3_5	0.65831	276	MU7_5	0.51180	374	T6_8	0.09700
81	T7_7	0.76351	179	U16_7	0.65816	277	MU2_4	0.51052	375	U20_8	0.09444
82	Pe2_7	0.75918	180	U18_3	0.65653	278	W1_7	0.50407	376	P7_8	0.09444
83	U15_3	0.75890	181	U19_3	0.65651	279	U17_1	0.50282	377	U1_8	0.09377
84	T14_7	0.75743	182	U1_6	0.65579	280	MU2_5	0.50244	378	U3_8	0.09089
85	U2_4	0.75590	183	U7_6	0.65562	281	P6_1	0.50048	379	T12_8	0.09014
86	U1_5	0.75420	184	U17_5	0.65462	282	MU4_5	0.49992	380	T11_8	0.08855
87	U16_6	0.75412	185	T13_3	0.65419	283	S3_9	0.49852	381	T14_8	0.08754
88	U15_4	0.75364	186	U2_7	0.65338	284	E3_3	0.49815	382	T5_8	0.08248
89	U12_6	0.75336	187	T16_3	0.65256	285	T6_6	0.48760	383	T15_8	0.07126
90	E2_9	0.75264	188	U4_3	0.64845	286	U17_2	0.47721	384	U4_8	0.06961
91	P7_6	0.74777	189	U14_6	0.64654	287	T5_2	0.47559	385	U11_8	0.06133
92	P3_6	0.74621	190	E1_3	0.64543	288	S3_4	0.46922	386	T17_2	0.05473
93	Pe1_7	0.74431	191	U1_7	0.64490	289	Pe3_7	0.46782	387	T7_8	0.04429
94	U11_3	0.74406	192	S3_10	0.64377	290	W2_9	0.46640	388	T8_8	0.03898
95	U11_10	0.74379	193	P6_2	0.64276	291	E3_7	0.46573	389	T16_8	0.02980
96	T9_6	0.74198	194	U10_7	0.64131	292	P3_9	0.46468	390	W1_2	0.02734
97	U11_6	0.74068	195	U18_7	0.64054	293	P7_2	0.46408	391	P2_8	0.00622
98	U10_5	0.73875	196	U9_7	0.64003	294	W2_2	0.46335			

Source: self-study

Table 8: Descriptive statistics of a development measure in particular education groups

Measures	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10
Mean	0.5806	0.4585	0.6205	0.7371	0.7180	0.6767	0.6085	0.1398	0.5174	0.8034
Standard deviation	0.1110	0.1978	0.1157	0.2282	0.1061	0.1145	0.1201	0.0874	0.2022	0.1352
Variability coefficient	19.12%	43.15%	18.65%	30.96%	14.77%	16.92%	19.74%	62.54%	39.08%	16.84%
Median	0.5945	0.4302	0.6382	0.8318	0.7265	0.7186	0.6400	0.1109	0.5166	0.8347
Q1	0.5082	0.3415	0.5940	0.5459	0.6702	0.6348	0.5808	0.0885	0.3677	0.7438
Q3	0.6710	0.6138	0.6887	0.9300	0.7966	0.7430	0.6760	0.1958	0.6015	0.8831
Skewness	-0.6588	0.1420	-1.3933	-0.8745	-0.5759	-2.5503	-1.6686	0.9932	0.5436	-2.0373
Kurtosis	-0.0921	0.0599	3.2724	-0.5254	-0.2700	8.7803	3.3708	0.3715	0.2357	5.0072
Max	0.7038	0.9453	0.8775	0.9668	0.9072	0.7826	0.7635	0.3741	1.0000	0.9462
Min	0.3621	0.0273	0.2323	0.2172	0.4999	0.1747	0.2176	0.0062	0.2091	0.3031

Source: self-study.
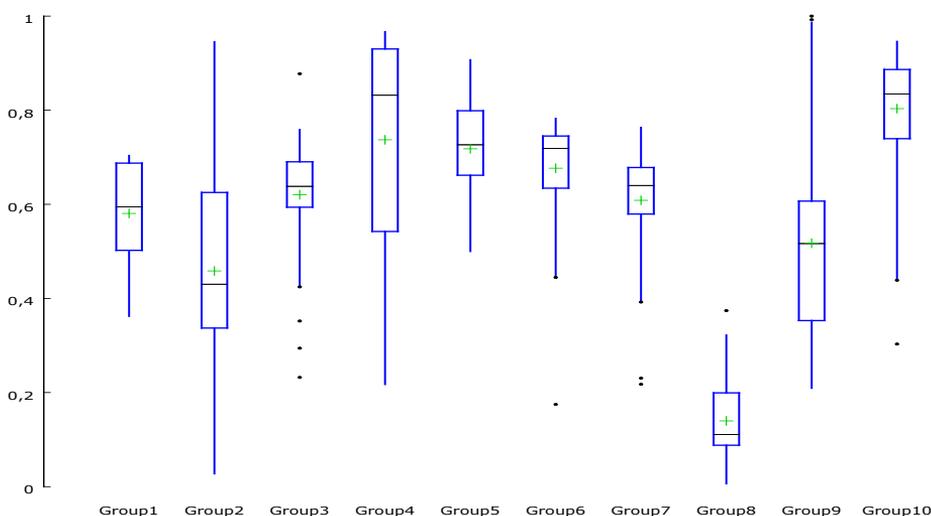
Figure 3: Boxplot for a development measure in particular education group
Source: self-study.

subsets faculty groups. In this group, the most common are universities, academies of art and design and university schools of music.

Figure 3 and Table 8 show a layout of development measure in particular education groups.

It is worth noticing that there was a huge dispersion of data in education groups with faculties of technology, industry and building. Nevertheless, we need to highlight that women chose studies on faculties in this group between general universities and universities of environmental and life sciences (a development

measure for most of these universities was 0.45) than amongst universities of technology and military universities (for these kind of universities, a calculated factor gained low values, and these universities were at the end places of the ranking). It is usually said that universities of technology or science faculties are not a domain of women, which was confirmed in this case.

It is also noticeable that the least attractive amongst women students are faculties connected with teleinformation technology. These are information technology, information science, creating and analyses of programming and application or education of information and technology. An average value of a development measure in this group was much lower than that in the remaining groups, and a maximal value of calculated development measure in this group was over 0.4.

It is interesting that a group of services was characterised by a huge dispersion of results. Medical universities that offer education in the sphere of services have majority of women students (at the Medical University in Bialystok, only women students were studying, not far from that was the Medical University in Lublin with a result of 0.99%). This disproportion in not surprising because medical universities offer, in their scope of services, cosmetology and hair care, which are very popular nowadays. At the remaining universities, in most of the cases, these are tourism, security and property protection. Owing to the fact that a scope of faculties with services is huge, the result is not surprising.

A final result of the aforementioned analysis is a ranking list in terms of women's involvement according to education group at universities listed in Table 5.

CONCLUSION

The equality of chances in a sector of higher education is one of the existing elements of the union policy. Statistic data from conducted analysis show that higher education became more accessible for women and these women dominated the people studying at this level of education.

As long as the number of women and men educating at higher level is rather equal (at some areas with dominance of women), the data on education profiles show significant differentiation amongst gender. Women still represent minority at profiles generally considered as 'male' (technology, industry, building, agriculture and science). They represent majority on 'soft' faculties (education, health and care, humanistic and art).

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