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VIII Congrés Català Internacional de Sociologia

Grup de Treball 1. Sociolingüística

Alfabetizaciones y Ocupación en la era digital (ALODIGI/LITERATOS)

Amado Alarcón.

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(Gràcies a J. Ubalde, N. Sorolla, M. Angeles Serrano, M.J Muiños entre d'altres com a pioners en
receques prèvies)

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1. Presentation & Background
2. Theory and Main Hypothesis. Deductive process
3. Inductive Process of investigation:
 - 3.1 Wages according skills
 - 3.2. Taxonomy analysis: Factors and Clusters
4. Brief Conclusion
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1. Presentation & Background

From Literacy to Literacies (STEM)

Given the widespread of alphabetization, literacy is today taken for granted as a condition sine qua non for entering labour markets, instead of a stratifier across occupations and social structure. What is true beyond this statement?

Empirically, the Jacquard machine of the beginning of the 19th century, based on perforated cards used in industry to run textile machines, can be defined as one of the key initial steps on digitalization process, automation, and differentiation among skilled and unskilled occupations within an incipient informational work.

At the end of the 19th century and the beginning of the 20th, artisanal systems were replaced as the main organizational work systems by Taylorist-Fordist models, dividing the workforce, according to literacy levels, into white-collar and bluecollar workers. Then, literacy became a hegemonic stratification system. In an extreme, blue-collar workers talking on assembly lines was considered counterproductive.

During the first third of the 20th century in the United States, “workers should not be expected to know how to read, or write, or to speak English, only to refrain from drinking on the job. The assembly-line was conceived for an illiterate population, many members of which were recent immigrants to the United States who didn’t speak English [...] These unions never dreamed of unionizing these illiterate workers who were arriving from Sicily and or Poland – workers they mistrusted but Fordism welcomed.”

S. XVII-S.XVIII

In the first State of the Union Address, **George Washington** (1790) promoted scientific knowledge for the wellbeing of the nation by pronouncing,

“Nor am I less persuaded that you will agree with me in opinion that there is nothing which can better deserve your patronage than the **promotion of science and literature**. Knowledge is in every country the surest basis of public happiness. (p. 1)

(Cited in Stevenson, 2014:13)

S. XXI

ODCE: ODCE (Schleicher et al. 2009) Directives and Strategic Plans in Literaciones to en alfabetizaciones to promote prosperity in a changing world

Heidi J. Stevenson (2014:133) indicates Barack Obamas Policies:

*Reaffirming and strengthening America's role as the **world's engine of scientific discovery and technological innovation** is essential to meeting the challenges of this century. That's why I (President B. Obama) am committed to making the improvement of STEM education over the next decade a national priority. (White House, 2009, para. 4)*

Obama supports initiatives as evidenced by his 2013 State of the Union Address, which calls for the training of 100,000 STEM teachers (The White House, 2013). In addition, Obama recognizes the importance of training STEM workers by stating,

*We'll reward schools that develop new **partnerships with colleges and employers**, and create classes that **focus on science, technology, engineering, and math—the skills** today's employers are looking for to fill jobs right now and in the future. (para. 42)*

Nevertheless and in spite of the political discourse...

(Impressively similar in official statements of Presidents Bush, Obama and Trump)

- *High controversies about what means STEM and who has an STEM Profession (Charette, 2013 Rothwell, 2013, NAP, 2005; 2010)*
- *Another important controversia in literature is that there is not a shortage of STEM workers. **There is a surplus.** Salzman, Lowell, and Kuehn (2013), Salzman et al. (2013)*
- *Moreover... H-1B Visas pressures to decrease wages in technological sectors (Costa, 2012; Eisenbrey, 2013; Matloff in Harkinson, 2013; Salzman, et al., 2013)*
- *What about Liberal Arts in all this discourse? Read the documents above. Minor role.*
- *The **core of our Study** is to understand all literacies and their interactions, including STEM and Liberal Arts skills, **competences or literacies including civic literacies, consumer literacies, health literacies, enterpreuneral literacies...***
- ***Sociologically, what about the relevance of language-literacies in division of labor?***

Sociologically, **in late capitalism** these new bunch of literacies, **undetermined** in official documents, should be considered in relation to *division of labor*, a central concept in sociology as new mediating variables in social stratification.

(see an analysis of language and division of labor in classics Smith, Marx, Weber, Durkheim, Simmel, Bourdieu, Elias in Alarcón 2021,2022)

These literacies have many **intersectionalities** with multilingualism gendered language, racialized language as well, more important here, relations with social class in classical terms of white/blue collar's type of work (Gonçalves, 2020).

My topic: language and division of labor; a broad topic.

A Simplified Conceptual Framework

Skills. Concept related to the field of work-labor. Survive at work

Competences. Concept related to the field of education. Survive at school system

Literacy(ies). Old and new concept related to the integration of Skills and Competences under a broader perspective. Survival at quickly changing society; uncertainness; mobility; social exclusion.

Literacy historically implies social status (Coulmas, 1992).

Today literacies are related to a adaptability to a changing society

Language: System of representation, interaction, calculating, communicating (Humans), also design and execution of algorithms (computers) and Person-Computer interaction (Protocoles-Scripts).

Results of this background:

Specific relations between different literacies at work has raised from our analysis at the Language & Occupations Project:

- B1. Literacy use organize workers across occupational classifications better than numeracy use (Ubalde & Alarcón, 2019)
- B2. Digital-informational literacy use explains wages better than literacy, numeracy and soft skills (Ubalde & Alarcon 2020)
- B3. There are strong gaps on literacy and numeracy among men and women (Corbella et al. 2021)
- B4. Bilingualism as, generally, not valuable asset in the labor market (at USA) due to ethnification and discrimination of immigrant or relative poor countries (Ubalde & Heyman 2021, Alarcón et al. 2014)
- **Analysis in depth by using both qualitative and quantitative data (PIIACC, SOC, ISCO, ACS-PUMS...). Interdisciplinary and international group of 28 reserchers**

2. Theory and Main Hypothesis

- Across History, written **language** has created **social differentiation** (Coulmas 1992:36).
- Development of industrialization created high differences between those with administration tasks implying literacy and those with manual tasks (Ayuso and Arata 2009 for an historical review).
- Today it's observable an **institutionalization** of a wide set of literacies (digital literacies, intercultural literacies, numeracy, professional and STEM literacies, **among others – Humanities? Obviously language, L1 & L2...**) as intrinsic elements of key competences for lifelong learning oriented to achieve both **individual and collective prosperity** (European Commission [EC] 2018).
- **The main hypothesis is that language part of literacies (speaking, writing, reasoning, discussing...) has better explanatory power of social stratification in occupation than some micro-skills (STEM), as numeracy or engineering**
- In spite of the relevance of these new STEM literacies, our thesis is that literacy understood as **writing, reading and verbal skills** in, at least, mother tongue, **remains as the main stratifying factor of occupations in developed societies.**

3.1. Inductive: Quantitative and taxonomy analysis

(Thanks to Josep Ubalde and Natxo Sorolla)

3.1. Regressions and PCA rotated factor loadings

Cognitive demands with PCA (Principal Components Analysis) rotated factor loadings ($r > 0.5$).
Based on O'NET (Department of Labor), US Sample **964 occupations 333 variables (skills)**

Item	Loading	Item	Loading	Item	Loading
S&E knowledge		Problem solving (LV)	0.51	Technology design (IM)	0.63
Engineering (IM)	0.84	Deductive reasoning (IM)	0.54	Technology design (LV)	0.65
Engineering (LV)	0.85	Deductive reasoning (LV)	0.54	Computer skills and knowledge	
Technical design (IM)	0.72	Inductive reasoning (IM)	0.60	Programming (IM)	0.70
Technical design (LV)	0.70	Inductive reasoning (LV)	0.60	Programming (LV)	0.65
Mechanical (IM)	0.81	Critical thinking (IM)	0.57	Computers & electronics (IM)	0.81
Mechanical (LV)	0.85	Communicative abilities		Computers & electronics (LV)	0.76
Physics (IM)	0.90	Oral Comprehension (IM)	0.62	Computers interaction (IM)	0.75
Physics (LV)	0.91	Oral Expression (IM)	0.66	Computers interaction (LV)	0.78
Chemistry (IM)	0.76	Speech clarity (IM)	0.63	Managerial skills	
Chemistry (LV)	0.80	Speech clarity (LV)	0.55	Financial Resources (IM)	0.69
Numerical Skills		Active listening (IM)	0.62	Financial Resources (LV)	0.68
Numerical reasoning (IM)	0.82	Speaking (IM)	0.64	Personnel Resources (IM)	0.70
Numerical reasoning (LV)	0.74	Communicate (IM)	0.62	Personnel Resources (LV)	0.65
Number facility (IN)	0.86	Communicate (LV)	0.55	Management (IM)	0.83
Number facility (LV)	0.80	Creative abilities		Management (LV)	0.75
Mathematics (IM)	0.85	Originality (IM)	0.64	Nurturing skills	
Mathematics (LV)	0.80	Originality (LV)	0.61	Service orientation (IM)	0.68
Verbal-reasoning skills		Thinking creatively (IM)	0.77	Service orientation (LV)	0.60
Written comprehension (LV)	0.52	Thinking creatively (LV)	0.71	Assisting and caring (IM)	0.91
Written expression (LV)	0.51	Innovation (IM)	0.62	Assisting and caring (LV)	0.92
Oral comprehension (LV)	0.51	Fluency of ideas (IM)	0.60	Foreign language knowledge	
Problem sensitivity (IM)	0.52	Fluency of ideas (LV)	0.57	Foreign Language (IM)	0.94
Problem sensitivity (LV)	0.60	Operations analysis (IM)	0.58	Foreign Language (LV)	0.95
Problem solving (IM)	0.51	Operations analysis (LV)	0.56		

Notes: Data are from O*NET (N=470 SOC occupations). For ease of exposition, Table 1 shows which items primarily loaded on each factor. The complete factor loading matrix could be requested to authors. IM= Importance and LV= Level.

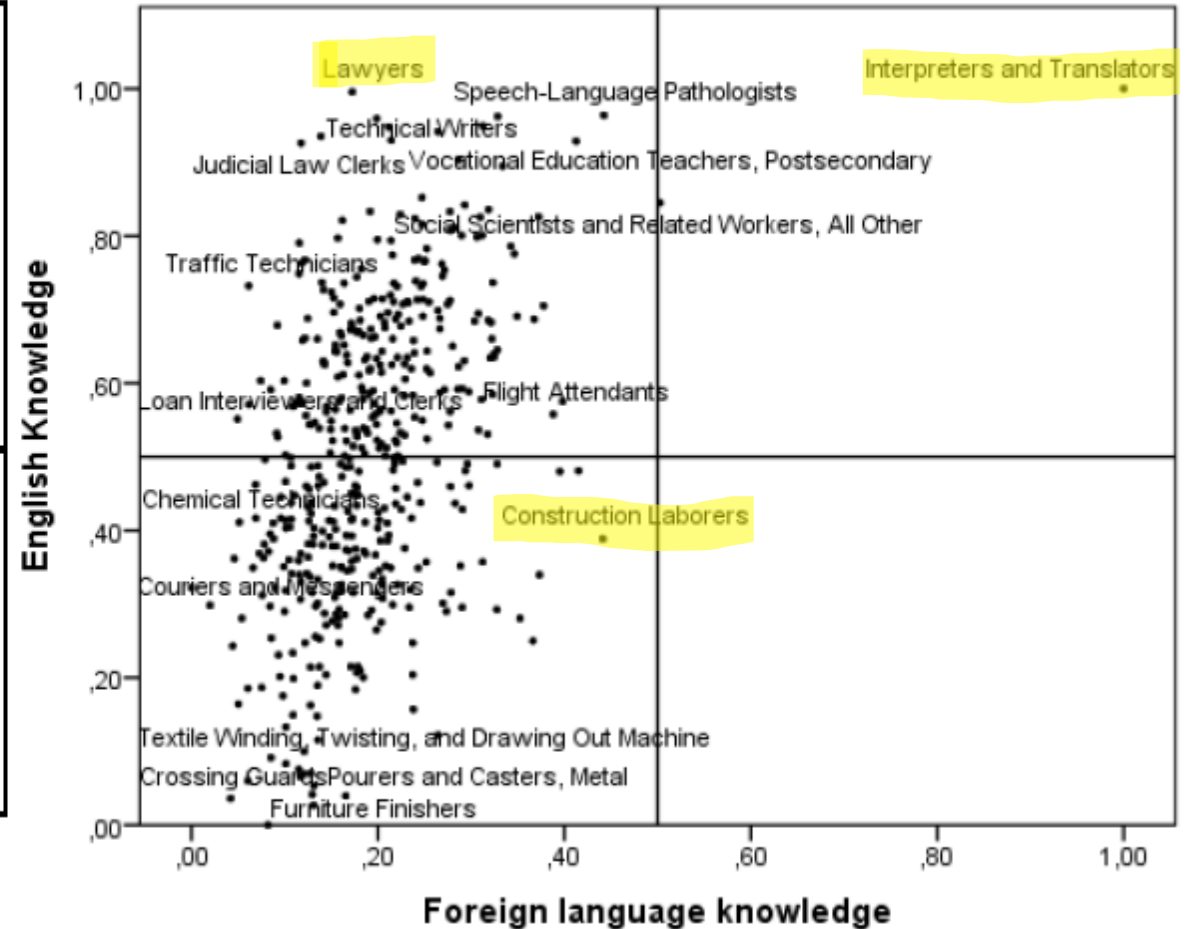
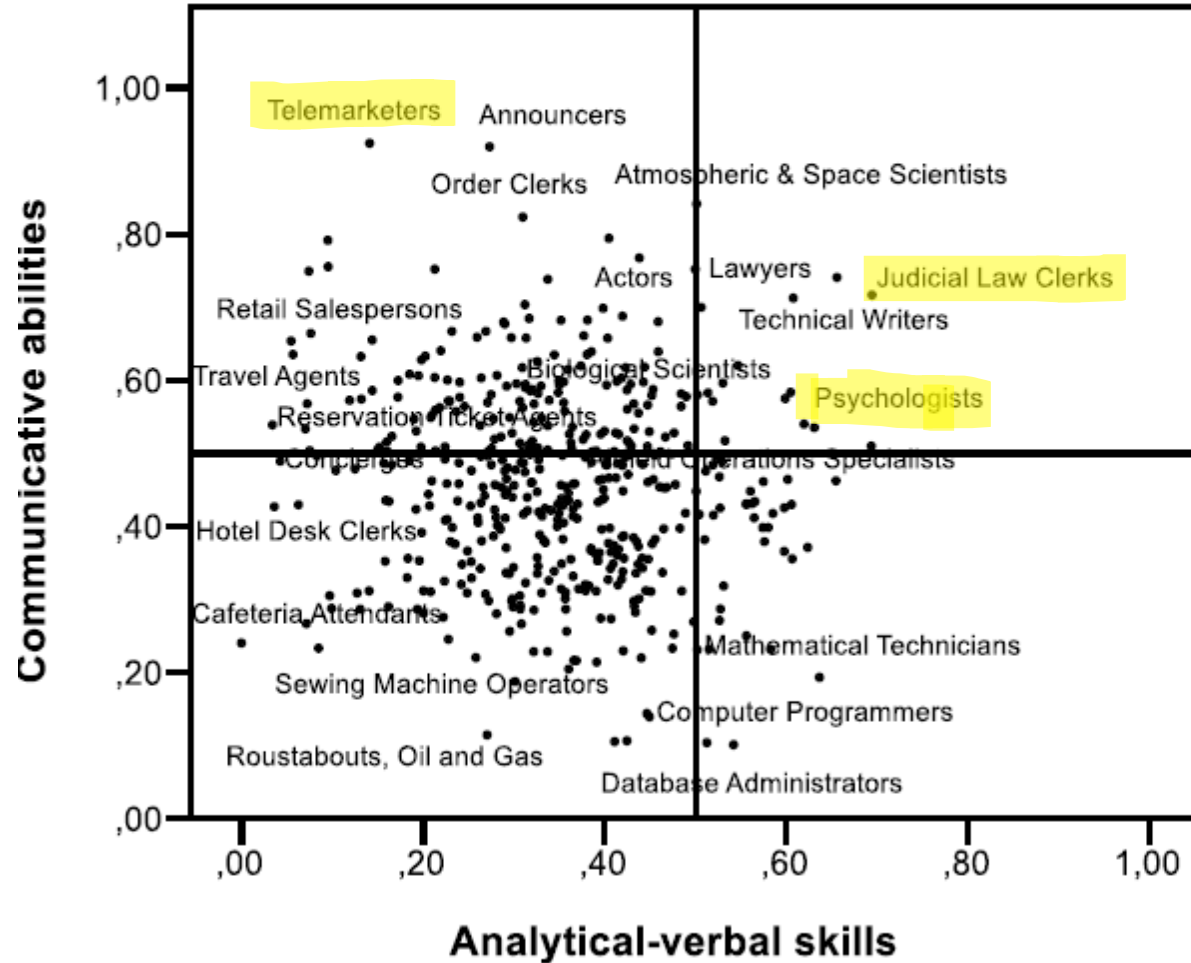
Estimated occupational-level effects on logged wages (J. Ubalde)

Variables	Model 1	Model 2	Model 3
Intercept	2,791*** (0.022)	0.179(0.135)	1,001*** (0.185)
Verbal-reasoning		1.334*** (0.091)	0.395*** (0.084)
Communicative		0.338** (0.11)	-0.142* (0.086)
Foreign languages		0.475** (0.203)	-0.229(0.164)
Science & engineer.		0.472*** (0.068)	0.299*** (0.067)
Numerical		1.021*** (0.109)	0.366*** (0.092)
Creative		0.517*** (0.08)	0.123* (0.069)
Informatics		1.342*** (0.114)	0.556*** (0.091)
Managerial		0.722*** (0.082)	0.306*** (0.068)
Nurturing		-0.062(0.07)	-0.116* (0.061)
English		0.083(0.129)	-0.023(0.095)
Autonomy			0.015(0.027)
Proportion female			0.048(0.047)
Prop. non white			-0.092(0.123)
Prop. Qualified			0.172*** (0.062)
Unionization			-0.07(0.066)
Unemployment			-0.008** (0.003)
Individual-level variables	No	No	Yes
Individual variance	0.954*** (0.006)	0.954*** (0.006)	0.895*** (0.006)
Occupational variance	0.177*** (0.014)	0.037*** (0.004)	0.037*** (0.002)

Notes: O*NET and CPS. N=50,667 workers nested in 464 occupations. Dependent variable: Log adjusted hourly wages. Individual-level variables in model 3 are: gender, race, place of birth, age and age squared, marital status, region, area of residence, educational level, industry, sector, type of contract, membership of trade unions and survey participation year. In bold there are the linguistic variables and their coefficients.

* p<0.1; ** p<0.05; *** p<0.01

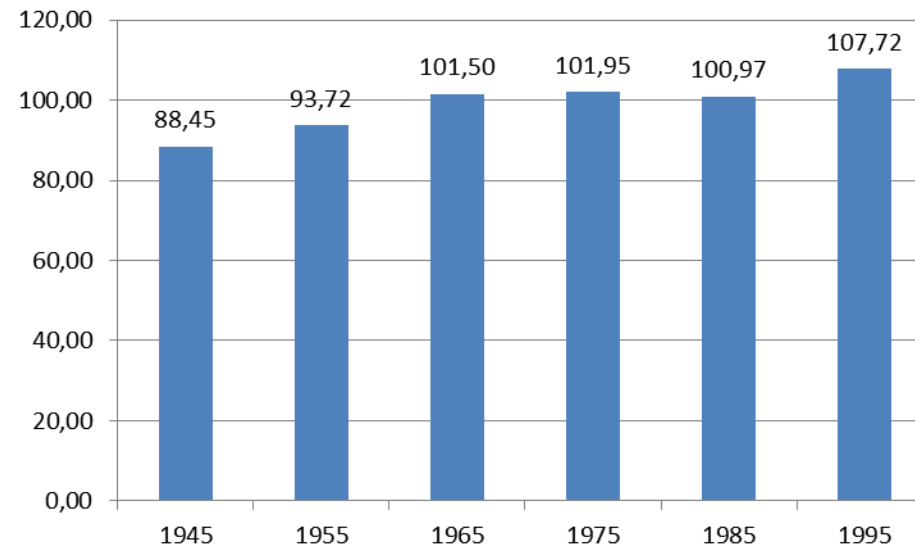
Illustrative occupations



Some controversies... literacy (classic term) is not an scarce resource? (M. J Muiños)

Salary of Skilled blue collar vs Non-Skilled White collar

Salary of the highest ranked blue collars, regarding the non skilled white collars (%)



Source: Alarcon et al. (2022) Collective Agreements in Spain

3.2. Inductive. Taxonomy: Results from factorial and clustering analysis

(N. Sorolla)

Inductive methodology

977 occupations and 333 variables (Knowledge, skills, abilities) analysed
(O'NET)

Factor analysis. Variability of clusters of occupations in relation to prestige of occupations.

(<https://www.occupationalprestige.com/data/>).

1st Factor Literacy vs Manual: (34,6% of explanation/variance)

2nd Factor STEM (Perception competence?) vs Others (12,16%)

3rd Factor Face-to-face vs computer-human interaction (7,1%)

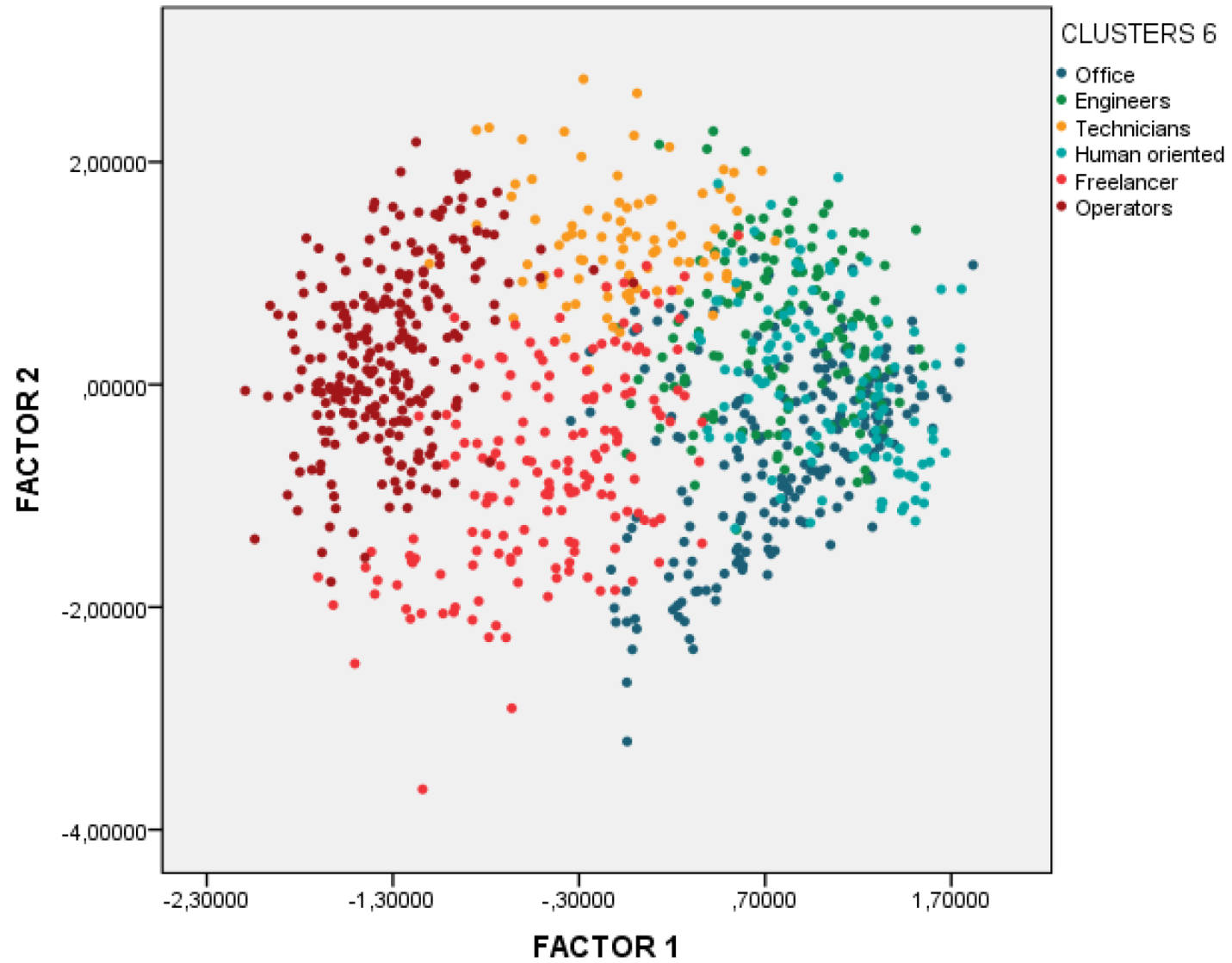
*Table 1 – Eigenvalues of 20 main variables of three first factors (or components) in factor analysis of occupation requirements of abilities, skills, knowledge, etc. Origin of data: O*Net.*

Component					
1		2		3	
1Ab_1.A.1.a.4_Written_Expression	,854	3Kn_2.C.4.b._Physics._LV	,703	7WS_1.C.3.b_Concern_for_Others	,760
2Sk_2.A.1.d_Speaking._LV	,851	1Ab_1.A.1.f.2_Visualization._LV	,672	7WS_1.C.4.a_Self_Control	,732
2Sk_2.A.1.c_Writing._LV	,845	3Kn_2.C.4.b._Physics._IM	,663	7WS_1.C.3.c_Social_Orientation	,732
8WC_4.C.1.a.2.h_Electronic_Mail	,835	3Kn_2.C.3.b._Engineering_and_T	,658	8WC_4.C.1.d.3_Deal_With_Physic	,694
2Sk_2.A.1.b_Active_Listening._LV	,826	3Kn_2.C.3.e._Mechanical._LV	,654	3Kn_2.C.5.b._Therapy_and_Coun	,651
2Sk_2.A.1.a_Reading_Comprehe	,823	2Sk_2.B.3.m_Quality_Control_Ana	,652	3Kn_2.C.5.b._Therapy_and_Coun	,651
6WV_1.B.2.c_Recognition	,823	2Sk_2.B.3.g_Operation_Monitoring	,648	8WC_4.C.1.d.2_Deal_With_Unple	,647
6WV_1.B.2.a_Achievement	,823	3Kn_2.C.3.b._Engineering_and_T	,620	3Kn_2.C.4.e._Psychology._IM	,631
1Ab_1.A.1.a.2_Written_Comprehe	,817	3Kn_2.C.4.c._Chemistry._LV	,619	6WV_1.B.2.d_Relationships	,620
1Ab_1.A.1.a.2_Written_Comprehe	,814	1Ab_1.A.1.e.3_Perceptual_Speed	,613	5In_1.B.1.d_Social	,619
1Ab_1.A.3.a.1_Static_Strength._IM	-,787	8WC_4.C.1.d.2_Deal_With_Unple	-,113	2Sk_2.B.3.b_Technology_Design	-,421
5In_1.B.1.a_Realistic	-,788	5In_1.B.1.e_Enterprising	-,126	3Kn_2.C.4.a._Mathematics._IM	-,424
1Ab_1.A.2.b.2_Multilimb_Coordina	-,790	7WS_1.C.3.c_Social_Orientation	-,131	2Sk_2.A.1.e_Mathematics._IM	-,428
8WC_4.C.2.d.1.g_Spend_Time_U	-,791	3Kn_2.C.7.c._Fine_Arts._LV	-,140	2Sk_2.A.1.e_Mathematics._LV	-,432
1Ab_1.A.3.c.1_Extent_Flexibility._IM	-,794	3Kn_2.C.7.c._Fine_Arts._IM	-,154	3Kn_2.C.4.a._Mathematics._LV	-,468
1Ab_1.A.3.a.1_Static_Strength._LV	-,797	5In_1.B.1.h_Second_Interest_Hig	-,170	3Kn_2.C.3.c._Design._IM	-,479
1Ab_1.A.2.b.2_Multilimb_Coordina	-,797	5In_1.B.1.d_Social	-,201	3Kn_2.C.3.c._Design._LV	-,498
1Ab_1.A.2.a.2_Manual_Dexterity._	-,801	5In_1.B.1.f_Conventional	-,228	3Kn_2.C.3.b._Engineering_and_T	-,502
8WC_4.C.2.d.1.h_Spend_Time_B	-,818	8WC_4.C.2.d.1.i_Spend_Time_Ma	-,272	3Kn_2.C.3.b._Engineering_and_T	-,528
1Ab_1.A.3.c.1_Extent_Flexibility._L	-,823	5In_1.B.1.g_First_Interest_High-P	-,350	2Sk_2.B.3.e_Programming._LV	-,536

Table 2 – Punctuations of 20 main occupations of three first components in factors analysis of occupation requirements of abilities, skills, knowledge, etc. Origin of data: O*Net.

Occupations in component...					
1		2		3	
Chief Executives	1,82	Airline Pilots, Copilots, and	2,74	Police Patrol Officers	2,91
Preventive Medicine Physicians	1,75	Municipal Fire Fighting and	2,62	Sheriffs and Deputy Sheriffs	2,69
Neuropsychologists and Clinical Psychologists	1,75	Municipal Firefighters	2,31	Correctional Officers and Jailers	2,48
Industrial-Organizational Psychologists	1,74	Forest Firefighters	2,29	Flight Attendants	2,48
Clergy	1,68	Robotics Engineers	2,28	Emergency Medical Technicians	2,43
Counseling Psychologists	1,67	Ship and Boat Captains	2,27	Transit and Railroad Police	2,42
Education Administrators, Postsecondary	1,65	Forest Fire Fighting and Prevention	2,24	Municipal Firefighters	2,40
Neurologists	1,65	Pilots, Ship	2,20	First-Line Supervisors of Production Occupations	2,35
Psychiatrists	1,62	Millwrights	2,18	Recreational Therapists	2,26
Business Teachers, Postsecondary	1,60	Marine Engineers	2,16	Forest Firefighters	2,24
Tire Builders	-1,83	Shampooers	-2,27	Physicists	-2,24
Pile-Driver Operators	-1,84	Manicurists and Pedicurists	-2,27	Chemical Engineers	-2,26
Mine Cutting and Channeling Machine Operators	-1,84	Credit Checkers	-2,29	Statisticians	-2,35
Agricultural Equipment Operators	-1,86	Door-To-Door Sales Workers	-2,38	Fuel Cell Engineers	-2,39
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	-1,87	Telephone Operators	-2,38	Astronomers	-2,40
Rail Car Repairers	-1,92	Graders and Sorters, Agricultural	-2,51	Mathematicians	-2,56
Roof Bolters, Mining	-1,96	Proofreaders and Copy Markers	-2,68	Computer Hardware Engineers	-2,61
Helpers--Brickmasons, Blocklayers, and Stonemasons	-1,97	Locker Room, Coatroom, and Dressing Room Attendants	-2,91	Software Developers, Applications	-2,62
Mine Shuttle Car Operators	-2,04	Telemarketers	-3,21	Photonics Engineers	-2,80
Fallers	-2,09	Models	-3,64	Mathematical Technicians	-2,96

Figure 3 – Position of occupations depending their score in the first and second factors; and colored with cluster membership. Origin of data: O*Net.



4. Brief Conclusion

- Skills are able to map all the labor market system in an a well defined new system of work in XXI Century
- But, we find obvious differences in the use of language and linguistic competences by occupations: white collar = language competences
- Language and linguistic competences (literacy) are the most important factors to both explain occupational prestige as well as to classify occupations
- Verbal-Analytical Skills, Perception competence , new concepts created in the research, very demanded in the labor market
- We must keep working to fully understand the role of language skills in occupations

Some questions for the debate

- *White collar is “only” linguistic competence?*
- *What is the role of numeracy and/or STEM?*
- *And what about entrepreneurship? Or leadership?*