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PSYCHOLOGICAL ATTRIBUTES NEEDED IN THE IT DOMAIN

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Abstract

The present study aimed to identify psychological traits that can be integrated in a profile of the student in the field of I.T. For this it was selected a sample of students from the technical field (N = 175) that was assessed with the following questionnaires: *Big Five Questionnaire (BFQ-2)*, *Holland Self-Directed Search (SDS)* and *Questionnaire of professional guidance for career in the informatics systems field (COPSI)*. Methodological design used correlational and exploratory factorial analysis. The results suggests the considerable interaction between the model of vocational interests and the Five Factor model and their close relationship to characterize the personality. The group analysed is, generally, characterized by high investigative interests, generally, and toward IT, especially. Based on the fact that interests are important predictors of performance in academics we can state that there is a match between the structure of personality of students who have chosen to study the scientific and technical field and the environment in which they operate (one aspect of the broader person – environment fit theory). Determinants factors of group analyzed, as reflected in the factor analysis, advancing the folowings definition' s attributes of this: nonconformity orientation directed to the social sphere, creativity and social responsibility, entrepreneurial and managerial orientation and interests for technique and computer science.

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1. Introduction

The complexity of IT and Computer Science tasks call for the need to identify the characteristics of the individuals who choose to study this domain. This is useful both for the students' and the future graduates' selection as well as for the forecast of the students' performance and consistence in educational programs and, subsequently, at the workplace.



In research, there is general consensus on the fact that the personality type is a predictor for performance (Barrick, Mount & Judge, 2001), a result which is valid for the IT domain as well (Cegielski & Hall, 2006 *apud* Kanij, Merkel & Grundy, 2013; Southworth & Morningstar, 1970). There are a small number of studies on the characteristics of the subjects involved in the IT domain. Most of the studies involve software testing engineers. For example, Kanij *et al.* (2013) use the NEO-PI test in their analysis of IT students and show that the latter are characterized by openness to high experience, emotional stability, and extroversion. They found that the personality type is a predictor for the performance in IT. The investigations which used the Myers-Briggs indicator underline the preeminence of the extroverted type in the Computer Science domain (Capretz & Faheem, 2010; Cecil, 2009; Teague, 1998). Another piece of research on a sample of 354 engineering students shows that the latter have skills such as self-organization, conscientiousness, orientation towards complex activity for students with persistence in the domain (persisting students) and self-organization and individualistic orientation for those engineering students who are high achievers (Duncan, 1997).

In the present paper we focused on the analysis of primary, structural characteristics, as well as on the secondary, factorial ones meant to describe the personality type of IT students.

2. Methodology

2.1 The objectives of the study

- The identification of the complex key factors which characterize IT students;
- The validation of the association of some psychological proofs necessary for the understanding of the students' profile.

2.2 Subjects

175 of students of the same technical university with the average age $M = 21,99$ ($S.D. = 1,15$) out of which 109 males and 67 females with no significant difference when it comes to the age average. All the participants were part of the vocational counseling project 161/2.1/G/135813.

2.3 Instruments

1. *Questionnaire of professional orientation for a career in the IT domain (COPSI)* built for evaluating professional interests which contains 65 items anchored on a scale from 0 – *I don't agree* to 3 – *I totally agree*. Seven of the items are calculated in reverse order. The questionnaire contains 3 scales for the identification of the professional inclination specific to 3 domains with technical applicability:

- *executive-industrial* (8 items; example of items: *I usually strictly observe standard methods and processes; When I start to work I first aim at being as efficient and as practical as possible* - $\alpha = .65$);
- *research and development* (10 items; example of items: *It is important for me to use statistical data to generate various forecasts; When I start to work I first aim at being as efficient and as practical as possible* - $\alpha = .89$).
- *IT* (13 items out of which the following: *I feel more fulfilled when I work with computers than when I work with people; I consider that I could easily manage the organization's computer network* - $\alpha = .54$).

2. *Vocational preferences inventory – Holland Self-Directed Search (SDS)* made by Holland, Fritzsche & Powell (1994). The test contains 228 items evaluated on a dichotomous True/False scale and it organizes the vocational interests in six types forming a hexagonal structure called the RIASEC model. The latter reflects the preferences of the person for behaviors, contexts, situations, and activities. The types are the following: 1. *Realistic (R)*, characterizing individuals interested in working outdoors. 2. *Investigative (I)* characterizing individuals interested in science (mathematics, physics, social or medical sciences etc.) 3. *Artistic (A)* characterizing those who prefer creative expression, especially in literature, visual and dramatic arts; 4. *Social (S)* characterizing individuals who want to help other fellow-beings. 5. *Entrepreneurial (E)* characterizing those who prefer to work in leadership or to have persuasive roles directed towards economic accomplishments; 6. *Conventional (C)* characterizing those interested in working in well-structured environments, especially in business. In Romania the test was adapted normatively to a sample of 1519 subjects by Pitariu, Iliescu & Vercellino (2010).

3. *The Big Five personality Questionnaire (BFQ-2)* drawn up by Caprara, Barbaranelli & Borgogni (1993). The test has 156 items on a Lickert-type scale with 5 levels and it offers scores for five main scales, each having two dimensions: *Extraversion* (Dynamism and Dominance), *Amicability* (Cooperation and Cordiality), *Conscientiousness* (Thoroughness and Perseverance), *Mental Openness* (Openness to culture and experience) and *Emotional Stability* (Control of impulses and emotions). The BFQ questionnaire was devised in accordance with theoretical arguments which suggest that the five factors model has a privileged status, in comparison with other models. We used the combined Romanian reference points devised by Pitariu, Iliescu & Vercellino (2009). The alpha quotients for the 5 factors range between .79 and .86, and they are similar to the original values of the test.

2.4 Procedure

All the 175 students completed the SDS and BFQ tests online, in groups of maximum 20 people, and the results were communicated from the system TestCentral. The time for the completion of the set of tests was approximately 50 minutes. The test COPSI was a test of a pen and paper type and it was solved in a separate meeting of maximum 15 minutes.

3. Results and Discussions

3.1. Descriptive analysis

The COPSI questionnaire (table no.1) shows the inclination of subjects to the IT domain ($M = 20,56$; $S.D. = 6,41$) and to research ($M = 22,77$; $S.D. = 3,99$), which suggests the permanent preoccupation during their study years and post-graduation years, the fact that most of the students will work in the domain they have trained for. Gender differences highlight that male subjects are more oriented towards the IT domain than the female ones in the group ($t = 2,31$; $p = .022$).

In the case of the SDS inventory, one can notice the high level of investigative preferences ($M = 53,20$; $S.D. = 23,74$), followed by entrepreneurial interests from a distance ($M = 47,50$; $S.D. = 26,20$). The result is the expected one for the scientific-technical domain in which people perform activities that correspond to the interests related to the exploit and to the understanding of complexities and of reflexive

knowledge. Artistic interests are the least favoured ($M = 29,32$; $S.D. = 22,32$) in the case of the studied group. The high scores obtained for investigative interests (within the SDS inventory) and for the IT domain (the COPSI questionnaire) corroborate those pieces of research which demonstrate that the latter represent the most important preferential dimension in the case of the subjects interested in the scientific domain (Lubinski, Benbow-Persson, Shea *et al*, 2001; Holland, 1997; Dawis, 1991; Allport, Vernon & Lindzey, 1970;).

Table 01. Averages and the significance of differences

Variables		M	S.D.	Male	Female	t	p
COPSI	Executive-industrial	13,92	2,58	14,16	13,73	–	–
	Research	22,77	3,99	23,10	22,25	–	–
	I.T.	20,56	6,41	21,45	19,16	2,31	.022
SDS	Realistic	41,67	26,07	39,57	44,98	–	–
	Investigative	53,20	23,74	51,71	55,56	–	–
	Artistic	29,32	22,32	29,32	29,34	–	–
	Social	31,95	23,45	34,64	27,71	1,96	.058
	Entrepreneurial	47,50	26,20	43,35	54,25	-2,70	.007
	Conventional	44,12	24,74	44,74	43,14	–	–
BFQ	Extraversion	58,90	27,55	55,71	63,79	-1,88	.062
	Amicability	81,44	19,88	78,61	85,92	-2,38	.018
	Conscientiousness	71,00	28,10	65,63	79,41	-3,20	.002
	Mental openness	66,12	27,09	66,98	64,77	–	–
	Emotional stability	55,60	29,20	60,45	47,94	2,79	.006

The effects of the gender highlight entrepreneurial interests ($t = -2,70$; $p = .007$), mostly for female students, while male students are more oriented towards activities with human implications (social interests) in comparison with the female students within the group ($t = 1,96$; $p = .058$). The result contradicts our expectations and prior research which found the gender effect associated with traditional occupational types: male subjects with scientific and investigative interests, female subjects with artistic, social, and conventional interests (Paessler, 2015; Su, Rounds & Armstrong, 2009). However, the quoted studies were carried out on large samples of subjects belonging to the general population and not on specific groups. On the other hand, we keep in mind the malleable nature of interests, the fact that the latter are sensitive to small and subtle environmental stimuli, and, therefore, modifiable at a certain point in time. As Cheryan, Siy, Vichayapai *et al*, (2011) show, males' and females' interests measured by vocational tests can be stable, but when measured by vocational choices they can change in time.

We must remember that this vocational profile is manifest in a group that evinces high amicability, high tendency for cordiality and cooperation ($M = 81,44$; $S.D. = 19,88$), and extraverted structure of the females in the group ($t = -1,88$; $p = .062$); these factors justify their high interest in the entrepreneurial domain. In addition, we noticed two other traits with high values and supra-averages in the characterization of the group, namely mental openness ($M = 66,12$; $S.D. = 27,01$), and conscientiousness ($M = 71,00$; $S.D. = 28,10$).

3.2. Intercorrelation of variables

The correlational analysis (table no.2) shows consistent correlations obtained between the variables analyzed by the 3 questionnaires. Between the BFQ and SDS questionnaires there are 20 significant correlations out of 30 (r between .15 and .55), which demonstrates the considerable overlap of the two models represented by the latter (RIASEC and Big Five) and the relatively strong relationship of the latter in the characterization of personality.

The investigative type is the one which correlates with all the factors in the BFQ questionnaire, and in terms of personality questionnaire dimensions, most correlations are made by extraversion, amicability, and openness to experience.

The most powerful relationships were obtained between the variables of the questionnaires COPSI and SDS (7 significant variables out of a total of 18), between the variables of the COPSI and BFQ questionnaires (9/15) and between SDS and BFQ (20/30). The most powerful relationships were those between the entrepreneurial type and extraversion (r = .50; p < 0,01), between the investigative type and mental openness (r = .42; p < 0,01), as well as between mental openness and inclination towards the domain of research. Thus, it is suggested that energetic, active individuals are most probably compatible with activities or occupations which require using verbal abilities to persuade and lead others, while students who are open to experience will mainly prefer occupations which involve intellectual activities with the purpose of generating or using knowledge.

Table.02 Intercorrelation of variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Executiv-industrial	–													
2. Research	.37**	–												
3. IT.	.47**	.48**	–											
4. Realistic	.01	.04	-.00	–										
5. Investigative	.06	.26**	.11	.40**	–									
6. Artistic	-.05	.16*	-.06	.30**	.49**	–								
7. Social	.02	.15*	.03	.31**	.53**	.65**	–							
8. Entrepreneurial	-.07	.17*	-.06	.27**	.33**	.53**	.55**	–						
9. Conventional	.13	.23**	.11	.24**	.32**	.39**	.48**	.63**	–					
10. Extraversion	-.02	.32**	.05	.11	.17**	.15*	.27**	.50**	.32**	–				
11. Amicability	-.02	.21**	.00	.11	.24**	.22**	.28**	.24**	.12*	.41**	–			
12. Conscientiousness	-.18*	.41**	.16**	.05	.21**	.01	.02	.20**	.20**	.54**	.33**	–		
13. Mental openness	-.07	.48**	.14	.11	.42**	.24**	.27**	.19**	.11	.46**	.46	.44**	–	
14. Emotional stability	-.20**	.35**	.26**	-.03	.15*	.04	.19**	.02	.12*	.29**	.35**	.26**	.38**	–

*Correlation is significant at the 0.05 level

**Correlation is significant at the 0.01 level

A special mention must be made of the realistic type which does not make correlations with any of the five personality factors and any of the variables in the COPSI questionnaire. The results corroborate research based on the analysis of the relationship between RIASEC and Big Five typologies, according to which realistic interests are not related to any of the personality dimensions (Barrick, Mount, & Gupta 2003; DeFruyt & Mervielde, 1997; Gottfredson, Jones & Holland, 1993; Costa, McCrae & Holland, 1984). In fact, some studies argue that the subscale of realistic interests is not coherent, homogenous, or correctly named, as it includes interests for external activities (outdoor) and for mechanical activities, while, in fact, the two types of activities have very little in common (Valian, 2014).

3.3. The perspective of the factorial analysis

Under the sign of the prefigured interactionist model we resorted to the factorial analysis in the main components (Hotelling) and the Varimax rotation method (table no. 3).

Table 03. The result of the factorial analysis

Variables	Factors			
	1	2	3	4
Executiv-industrial	-.007	-.027	.808	.009
Research	.102	.418	.654	.189
I.T.	-.001	.087	.830	-.025
Realistic	.584	-.037	.017	.022
Investigative	.749	.320	.119	.043
Artistic	.798	.089	-.080	.230
Social	.823	.145	.018	.208
Entrepreneurial	.505	.073	-.098	.779
Conventional	.453	-.056	.194	.724
Extraversion	-.025	.600	-.028	.659
Amicability	.225	.735	-.140	.081
Conscientiousness	-.201	.615	.185	.495
Mental openness	.234	.822	.133	.035
Emotional stability	.039	.643	.309	-.030
Variance %	31,72	16,85	11,24	7,95

According to some older statistics (Guadagnoli & Velnicer, 1988), in order to be able to name the factors we took into consideration the variables with saturations over 60%, which demonstrates that the factorial solution is stable for a sample larger than 150 people. We obtained 4 factors with proportions of variance that are reasonable from a statistic point of view (31,72%, 16,25%, 11, 24%, and 7,69%, respectively). If we examine the composition of the variables within the three factors we will notice that for factor F1 we obtained high saturations in the case of the interest scales: investigative (thinkers), artistic (creators), and social (altruists).

The terms between the brackets reflect the types of personality usually associated with each of the three scales. We can name the factor as one related to *nonconformist orientation towards the social environment*. This factor has the highest variance and characterizes individuals to the highest extent. For factor F2, we observe high saturations in the case of the three factors of personality, amicability, conscientiousness, and mental openness. Thus, we identify a factor of *creativity and social responsibility*. Within F3, inclinations of subjects towards IT, the executive-technical domain, and towards research are related to high saturations. The factor was named *technical and IT interests*. In the case of factor F4, the entrepreneurial and the conventional types are connected with extraversion. Thus, the interest in leadership and the types with organizational skills belong to the extroverted personality in particular. We consider this is a factor related to the *managerial entrepreneurial orientation*.

4. Conclusions

The present investigation focused on the analysis and on the profiling of a group of IT students. Keeping in mind the 3 statistical methods used, we can state that there is an agreement between the technical students' personality structure and the environment where they function.

Gender differences show that female students show preferences for the action domain, while male students are interested in the social environment. This may be due to the malleability of interests throughout time, to the responsiveness of interests to environment differences (Valian, 2014; Cheryan *et al.*, 2011).

The obtained factorial solution highlighted the specificity of the sample. Thus, the group is characterized by nonconformist orientation towards the social environment, creativity, and social responsibility, technical and IT interests, and managerial entrepreneurial orientation. Upon synthesizing the factors obtained we consider that two important dimensions of the group stand out: creativity and independent spirit, which will be directed towards the social environment, and, secondly, the interest in the development of the abilities specific to the domain. Therefore, we found that the analyzed subjects evince the configuration of some factors starting from two distinct psychological areas which, at least theoretically, can be correlated with the specificity of the IT domain.

Finally, we conclude that the three questionnaires should be used *in corpore*, as they can lead to comprehensive pictures of the analyzed students' group.

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