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PREDICTIVE VALIDITY OF A PERSONALITY QUESTIONNAIRE BASED ON THE FIVE FACTORS MODEL: SUBJACENT MEDIATIONS?

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ABSTRACT

In this study we are interested in the predictive incremental validity of a Q-sort on self image at work; the items are derived from the five factor model (FFM) used in addition to a test of general mental ability, Domino70. The grades obtained by a sample of 120 students were the criterion. The results confirm that the dimension of Conscientiousness shows good predictive position, as well as, more specifically the dimension of Agreeableness. We also show that the personological trait does not intervene directly on the level of academic success. It is mediated by a causal chain extending from the normative proximity or distance of self image to a prototype model created by professors, while the second mediating variable is the coherence of choices as compared to the FFM dimensions.

KEYWORDS: *predictive validity, personality questionnaire, five factor model, implicative statistic analysis.*

THEORETICAL BACKGROUND

Personality questionnaires are largely used in clinical examination, skill evaluation or even in recruitment (Bruchon-Schweitzer & Ferrieux, 1991). Among them, those that are based on the five factors model FFM (McCrae & Costa, 2006) are

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frequently used. When a practitioner confines to a goal of describing a personality profile he will be able to support his interpretation on the grounds of validity studies of traits construction and of their disposition, as well as of concurrent criterion predictive validity studies. On the contrary, if the practitioner wants to establish a successful prediction at work, or training, he will have to take into account the criterion predictive validity studies made for the questionnaire that is used[1].

First, we took into account results of the studies related to the predictive validity of the FFM based questionnaires. The outcome is that the interest in this type of sample is situated at the incremental validity level. The goal of this paper is to make a replication of this type of result, starting from an original personality questionnaire constructed in a *Q*-sort format, the self image questionnaire at work - Q-ISAT - (Pasquier, 2007) and of D70 (Pichot, 1970) as factor g test. The study was conducted on a sample of 120 students from the Polytechnic University of Timisoara. As academic success criterion we used the overall grades students received from their professors. In addition to the ordinary correlation analyses, we employed a comprehensive approach of the subjacent process with predictive value, using the implicative statistical analysis – I.S.A. (Gras, Kuntz, & Briand, 2001).

The first predictive validity studies of the questionnaires coming from FFM supported mostly pessimistic conclusions related to the possibility of performance levels predictions by means of personality inventories (Ellis & Conrad, 1948; Guion & Gottier, 1965; Schmitt, Gooding, Noe, & Kirsch, 1984). Ghiselli and Barthol (1953) calculate predicting/criteria correlations from 0.14 to 0.36 with a central tendancy of 0.22. Guion and Gottier (1965) conclude that a predictive validity of personality inventories very seldom exceeded a correlation of 0.30. Schmitt et *al*. (1984) give middle values of 0.21.

Starting with 1990, several studies provide their results in a clearly more optimistic manner, emphasizing the stronger guarantees offered by the use of FFM, which insure a better basis for analyses, as compared to the concern for making the professional success evaluation criteria reliable and homogeneous and as compared to the analysis techniques used, better adjusted to the issue to be discussed. Tett and Jackson (1991) show that by means of confirmatory studies and after the adjustment of the criterion values and of the predictor, the following validities are obtained: -0.22 for neuroticism; 0.15 for extraversion; 0.27 for openness to experience; 0.32 for agreeableness and 0.17 for conscientiousness. The same year,

[1] Some questionnaires or personality inventories do not present predictive validity studies; in this case, the use of questionnaires in a predictive purpose is unfounded and reflects a risky approach

Barrick and Mount (1991) propose 0.08 for emotional stability; 0.13 for extraversion; 0.04 for openness to experience*;* 0.07 for agreeableness and 0.22 for conscientiousness. In their opinion extraversion would be essentially related to the success of shop assistants (0.15) and of managers (0.18), while openness would be a better predictor of the success in training (0.25). Taking again the set of the meta analyses of the relations between performance and personality, made during the last twelve years, Kanfer and Kantrowitz (2002) show low to moderate correlations for conscientiousness (0.12 to 0.31), for extraversion (0.09 to 0.16) and for emotional stability (0.08 to 0.22). Globally considered, these data show us that persons with high levels on the dimensions conscientiousness and extraversion and low levels on the dimension emotional stability would reach, on the average, high performance at work. Finally, in professional situations saturated with social relationships, Salgado (1997) show correlations of same size (0.14 to 0.28 for seven samples).

The predictive value of FFM, as compared to the level of performance at work, remain low to moderate. As compared to the other seventeen predictive methods (Schmidt & Hunter, 1998)[2], the dimension conscientiousness (0.31) is ranked thirteen, the most reliable methods being professional trials (0.54), intellectual ability tests and structured job interviews (0.51). The integrity questionnaires would be more reliable (0.41) than this sole dimension of FFM.

Generally, in addition to their predictive value, which is in fact less convincing, the main purpose of using personality tests in the recruitment process, especially those derived from FFM, relies in their contribution in terms of incremental validity[3] among the multi–methods and multi–tests procedures. These procedures consist in elaborating different tests or methods, each of them with good predictive validity, remaining independent from the others. In this way the redundancy related to the general factor is reduced and consequently the specificity of predictors allows their effects to increase the reliability of the predictive value.

A consensus is outlined in order to consider that the basis of prediction should be a test of intellectual ability, both for employment (0.51) and for training (0.56): "…of all the procedures that can be used, either for getting employed or for a higher position, it has the most validity and the lowest cost of application " (Schmidt & Hunter, 1998, p.264).

In complementary procedures and in terms of validity increase (Schmidt and Hunter, 1998), the dimension conscientiousness ($R_{multiple} = 0.60$) is ranked fourth after the integrity test ($R_{multiple} = 0.65$), professional tests and structured interviews ($R_{multiple} = 0.63$). The practical interest of FFM would be set,

[2] The values produced by the above mentioned authors are all adjusted values.
[3] In this direction as associated to a test of general mental ability, they increase the predictive validity of the latter.

essentially, as complementary test, to the general intelligence tests, and, more specifically, this interest would rather confine to the conscientiousness dimension.

The first goal of this study is to retort this type of conclusion by determining the quantum in which the data provided by Q-ISAT are of interest, as far as the incremental validity is concerned when applied as complementary to D70, taken as general mental ability test.

METHOD

Participants

At the beginning of the academic year, 120 first year students from different faculties within the Polytechnic University from Timisoara have taken the D70 test, as a test of general mental ability and the Q-ISAT as personality describer. The overall academic year grades were collected and are considered as a criterion of the success level to be predicted. Before going further with this study we find it proper to make a short presentation of Q-ISAT.

Procedure

The Q-ISAT is a *Q*-sort format questionnaire (Stepheson, 1935), which consists in classifying the items in three subsequent types, according to a forced distribution. In the original model the items were written on cards. Q-ISAT is entirely computerized on Excel, which avoids any material interference. There are 100 items, personological describers, at the rate of 20 by FFM dimension, 10 by positive pole and 10 by negative pole. In this type of a format the items are not considered separately; the answers as a whole are taken into account, namely, the classification of items operated by the referee, the median value going to the neutral items ignored by the referee. The global result is a correlation which expresses the relationship between a referee's pattern of answers and a pattern of reference answers elaborated by a group of experts. In the French version of Q-ISAT, at present, there are two references[4] : social desire and professional integrity. Finally, the results sheet of the questionnaire provides a coherence index of choices and a psychological profile placing the results on each of the FFM dimensions.

In order to meet the requirements of this study, after translating the items and the instructions into Romanian, a prototype of the model student has been created, starting from the answers of a sample of 34 professors of different disciplines and from different faculties from the university from Timisoara : Hydraulics, Mechanics, Construction Engineering, Computer Science, Management, Economics, Finance, Mathematics, Industrialization, Psychology,

[4] There are other reference patterns that could be established, such as « manager », « shop assistant », « good pupil »…; there are specific profile types that could be also established upon the request of an enterprise or training authority.

Organic Chemistry, Electrical Engineering, Chemistry, Automatics. They had to follow the instruction: "Establish the prototype of the model student who will succeed in his future career".

The first items chosen *"the best"* are*:* active, ambitious, conscientious, self controlled, passionate. The next items chosen *"very well"* are*:* cooperative, decided, balanced, creative, open-minded, reader, meticulous, tidy, perseverant, considerate, and sociable. The third items chosen *"well"* are : adaptable, agreeable, intellectual, compliant, controlled, cultivated, curious, composed, determined, devoted, direct, humanistic, meticulous, innovative, progressive, self-controlled, strong, concerned, self confident, tenacious.

The describers which were not used: keen on culture; calm; conservative; courteous; relaxed; tactful; dominating; in retreat; ethnocentric; expeditious; introvert; normative; shadowy; unthreatening; persuasive; little / not very combative; fastidious; pugnacious; self contained; routine; merciless; honest; lonely; submissive; traditionalist; transcendental.

The items of the first rejection *"the less well"* are: rough, uncultivated, indolent, irresponsible, rebellious. The items of the second rejection *"very bad"* are: fitful; unsociable; superficial; untidy; narrow minded; aggressive; ignorant; uncivil; firm; irritable; withdrawn. The items of the third rejection *"bad"* are: obstinate; anxious; unpleasant; distant; unobtrusive; egocentric; irritated; weak; impenetrable; individualistic; uneasy; insensitive; intolerant; suspicious; withdrawn; secretive; sectarian; tacit; distrustful; weak-willed; vulnerable.

It will be noticed that the experts' choices only regard positive features, socially desirable ones, and their rejections only regard negative features, socially undesirable ones. Table 1 shows the averages and the deviation types of each of the poles of FFM dimensions, as they result from the experts' choice.

Table 1
Characteristics of dimensions poles of FFM experts' prototype

Dimensions poles	m	σ
C+ Conscientiousness	5.30	1.16
C- Immaturity	2.50	1.27
O+ Openness to experience	5.20	0.63
O- Conservativeness	3.10	3.10
G+ Agreeableness	4.90	0.74
G- Harshness	2.90	0.57
E+ Extraversion	5.10	1.66
E- Introversion	3.30	0.67
N+ Emotional Stability	4.90	0.99
N- Neuroticism	2.80	1.14

When we consider the dimensions poles of the five factors model, we notice the decreasing order of choices: Conscientiousness (5.30); Openness to experience (5.20); Extraversion (5.10); Agreeableness and Emotional Stability (4.90). The decreasing order of rejections is: Introversion (3.30); Conservativeness (3.10); Harshness (2.90); Neuroticism (2.80); Immaturity (2.50).

Table 2
Inter-prototypes Correlations

	SD	**PI**	**St**
SD	1		
PI	r=0.86	1	
St	r=0.76	r=0.75	1

(p<.00);
SD: social desirability, French experts; PI: professional integrity, French experts; St: student, Romanian experts.

The table of correlations, among the three prototypes established today by the panel of experts (Table 2), shows high positive values. It is noticed that the prototype Student maintains high positive correlations with the social desirability and professional integrity prototypes, which is explained by the fact that these prototypes only take into account the positive indicative items while for the rejections – only negative counter-indicative items. We can conclude that the choices of three panels of experts, French or Romanian, are biased by the social desirability in the background of explicit instructions of professional integrity or of model students.

RESULTS

We next focus on the correlations between predictors and criterion, the regressions predictors-criterion, and finally the implicative relationships between predictors and criterion. The criterion is represented by the average academic grades obtained by the students during the academic year. The predictors are the results of general mental ability obtained with D70, and the following indices given by Q-ISAT: (a) the correlation between the classification of items produced by students and the prototype of social desirability, the prototype of model student; (b) the correlation adjusted by the social desirability between the classification of items produced by students and the prototype of model student; (c) the ten results related to the dimensions poles of FFM; (d) the coherence index of choices.

Correlations predictors- criterion

In order to limit the differences of the grading scales of different faculties, the grades obtained were centered and reduced per faculty. In this way, the groups of grades from different faculties have the same average grade (0) and the same deviation type (1).

Table 3
Correlations predictors-academic grades

Predictors	$R_{predictors\ grades}$	p	signification	d/Cohen.	p_{rep}
D70	0.14	0.13	NS	0.28	0.85
SOC_DES	0.05	0.62	NS	0.10	0.63
Mod_St	0.13	0.15	NS	0.26	0.84
Adj_Mod_St	**0.20**	**0.03**	**S**	**0.41**	**0.93**
C+ Conscientiousness	**0.17**	**0.06**	**S**	**0.35**	**0.90**
C- Immaturity	-0.08	0.36	NS	0.16	0.74
O+ Openness to experience	-0.01	0.94	NS	0.02	0.52
O- Conservativeness	-0.08	0.39	NS	0.16	0.72
G+ Agreeableness	0.02	0.85	NS	0.04	0.55
G- Harshness	**-0.19**	**0.04**	**S**	**0.39**	**0.92**
E+ Extraversion	-0.07	0.45	NS	0.14	0.70
E- Introversion	0.06	0.50	NS	0.12	0.68
N+ Emotional stability	0.01	0.92	NS	0.02	0.52
N- Neuroticism	0.10	0.29	NS	0.20	0.77
Coherence	**0.31**	**0.00**	**S**	**0.65**	**0.99**

SOC_DES: social desirability; Mod_St: proximity to the model student prototype; Adj Mod_St_: proximity to the prototype of adjusted model student;
NS: nonsignificant; S: significant;

The correlations between this criterion of academic success and the different predictors are shown in the second column of Table 3. These correlations have been transformed in d of Cohen's after the formula[5] proposed by Friedman's (1968, p. 246). Cohen (1977) proposes that an insignificant effect occurs in case d is rated around 0.20, an intermediate effect when d is rated around 0.50 and a notable effect when d is rated around 0.80. In addition, Corroyer and Wolf (2003, p. 243) suggest the following limits: 0 to 0.35 for an insignificant effect; 0.35 to 0.65 for an intermediate effect and more than 0.65 for a notable effect. These limits have been used in order to appreciate the effect sizes. Finally, replication[6]

[5] $\underline{d} = [2\ (\underline{r})] / [(1 - \underline{r}^2)^5]$
[6] Calculated with LePac Version 1.5.6 (Lecoutre & Poitevineau, 2008).

probability (p_{rep}) shows the predictive probability of finding an effect of the same sign in a replica of experience (Killeen, 2005). The convergence of different indicators is to be observed, since the significant correlations reflect effects at least intermediate whose replication probability equals or exceeds 90%.

The coherence index shows the best predictive value (r=0.31; that is 9,61% of explained variance), followed proximately by the adjusted model student (r=0.20, that is 4% of explained variance), then the poles G- (r=-0.19 that is 3,61% of explained variance) and C+ (r=0.17; that is 2,89% of explained variance). Contrary to our expectations induced by existing literature, the D70 does not appear as a predictor of students' success that overpasses the established threshold, even if it is relatively close. Maybe within a student population selected for their enrollment at the university, the general factor represents no longer a really discriminative index. On the contrary, the indices coming from Q-ISAT provide correlations values situated in the limits recorded by the authors quoted in the present article.

As far as the poles of personological dimensions are concerned, a specifically predictive value of the conscientiousness dimension (C+) is found. More originally, the harshness (G-) is added here, as an unfavorable factor of success. Maybe it is the effect of Romanian culture where the collective dimension still remains largely marked *a contrario* from western countries where individualism occupies the field of mental preoccupations and determines individuals' behavior.

Table 4
Calculus of coherence index

Dimensions poles	Scores items pairs	Scores items impairs
C+ Conscientiousness	24	25
C- Immaturity	23	26
O+ Openness to Experience	27	26
O- Conservativeness	21	22
G+ Agreeableness	30	22
G- Harshness	17	15
E+ Extraversion	15	17
E- Introversion	12	12
N+ Emotional Stability	17	20
N- Neuroticism	12	17

Correlation
0.82
Corrected correlation
0.90

As compared to the former reported studies, the originality of Q-ISAT, as related to prediction, would be the coherence index. This index is calculated as the adjusted correlation between the results of two sub lists made each from half the descriptors of the dimensions poles. In the example below (Table 4), an adjusted correlation of 0.90 is obtained, which shows a high Cohen's d, namely a notable effect. In fact, we can infer that the referee remains faithful to his choices, as related to the items of dimensions poles of FFM, both for peer items and for odd items. The conclusion is that these choices obey an established logic and definite criteria all over the duration of the test. Starting from this point, we can say that a high coherence index shows that a referee's self image at work remains close to the personological parts of FFM during the whole questionnaire. Thus, it shows a high personological maturity, a good self – knowledge being a good indicator of success in one's study. *A contrario*, a weak index shows either instability in choices, which reflects either a certain disinclination of self image, or a certain distance from FFM model, the choices being made according to other logic.

Regressions predictors, criterion; incremental validity

Table 5 presents the calculus of regression predictors / criterion (overall academic grades) for the incremental validity study. The table is divided into five parts. The first column gives the variables introduced. The next four columns show the quota of each variable in the regression of standard beta, of Student t, of threshold of statistic signification. The next columns give the regression characteristics, the multiple correlations (R), the explained variance (R^2), the Snedecor's F, statistic signification threshold. The last row of each block represents the benefit obtained by introducing personological variable/s.

Table 5
Predictors-criterion regression

variables	beta st	t	p	signification	R	R^2	F	p	Signification
D70	0.15	1.66	0.10	QS	0.25	0.06	3.85	0.02	S
Adj_Mod_St	0.21	2.29	0.02	S	**gain /D70 :** 0.04 or 4%				
D70	0.12	1.26	0.21	NS	0.20	0.04	2.56	0.08	QS
C+	0.15	1.65	0.10	QS	**gain /D70 :** 0.02 or 2%				
D70	0.12	1.35	0.18	NS	0.22	0.05	3.06	0.05	S
G-	-0.17	-1.93	0.06	QS	**gain /D70 :** 0.03 or 3%				
D70	0.12	1.40	0.17	NS	0.33	0.11	7.09	0.00	TS
coherence	0.30	3.41	0.00	TS	**gain /D70 :** 0.09 or 9%				
D70	0.12	1.35	0.18	NS	0.34	0.12	3.04	0.01	TS

Adj_Mod_St	0.08	0.79	0.43	NS	**gain /D70 :** 0.10 or 10%
C+	0.01	0.06	.95	NS	
G-	-0.06	-0.67	0.51	NS	
coherence	0.23	2.15	0.03	S	

NS: non-significant; QS: significant for p between 0.05 and 0.10, S: significant for p between 0.01 and 0.5, TS: very significant for p less than or equal to 0.01

Generally, the results follow the direction of the incremental validity as described in literature. The benefit, as related to the only mental ability test (D70) reaches 10% when the group of significant predictors of Q-ISAT is introduced. It is just the coherence index alone that provides 9% of the benefit. The other variables provide more moderate benefits: 4% for the proximity to the model student prototype, 3% harshness (G-) and 2% for conscience (C+). As for the level of beta ratios, it can be noticed that this index is not significant for the D70 variable, except for its association with integrity (QS). Contrary to results of previous studies that rate the general mental ability as first for prediction, the results of this study rank the personological indicators as being first.

When the Q-ISAT group of indicators is introduced in the regression equation $r=0.51$ et $r^2=0.26$ that is 26% of explained variance is obtained and when D70 is added to this, r becomes again 0.53 and r^2 0.28 that is 28% of explained variance is obtained.

Quasi-implicative Analysis

The quasi implicative analysis under CHIC allows the regrouping of variables into classes that are constituted according to an A => B type implicative logic, but not the opposite. The variables are then distributed according to rules between variables couples (A => B) and to meta rules between an implication and a variable (A => B) => C, or between two implications such as (A => B) => (C => D).

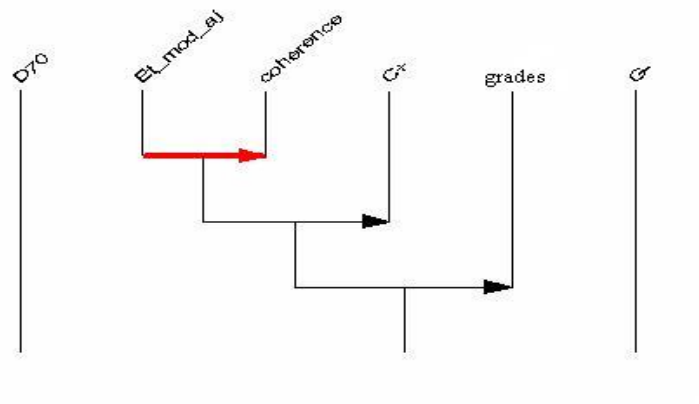

Figure1
Cohesive graph

The cohesive graph product (Figure 1) includes the only predictors whose validity has been proved. It is noticed from the very beginning that D70 and G-function autonomously, without any implicative connection between them, or to the other variables. Consequently, one could infer nothing in terms of the subsequent process of finding their values.

The first implicative level, with a significant cohesion index (0.80), defines a rule stating that the proximity with the model student prototype (correlation adjusted in order to lessen the bias of social desirability) involves the coherence, but not the opposite. So, people close to the prototype of model student "purged" by the social desirability offer a strong probability of having a good personological coherence level, while the sole knowledge of the coherence level does not allow conclusions related to integrity.

At the next level, a first meta rule (cohesion index to 0.46) tells us that the previous implication involves the positive pole of the dimension conscience (C+). At the last level, a second meta rule implicatively links this group of relations to grades (cohesion index 0.30).

Starting from these observations, a causal scheme turns up, postulating that the first determinant of academic success would be the proximity of the prototype adjusted model student, namely, the internalization degree of a prototype, thus of a social norm. This occurs because with an individual the personological standard was correctly interiorized, namely he can show himself coherent in his self description and can meet his professors' expectations.

More than a matter of intellectual abilities, more than personality traits, eventually genetically determined, for the students group beforehand selected, academic success comes out from a social homogamy law (Valéau & Pasquier, 2007).

The FFM comes neither in the first row, nor in its global nature as students' success predictor. The proximity of the students' and professors' representations are two parts of the same norm and psychological-social conformism – products of the course of subsequent socializations that define a life history.

The proximity, or normative distance, at which an individual is situated, as compared to a reference prototype only reflects the interiorization ways and forms of the experienced social relations, or, according to Gangloff (2003), the norm learnt of submission or allegiance to these social relations of domination. Within this process, the personality trait is implicated just with the positive pole of Conscientiousness (in conformity with previous studies results) and the negative pole of Agreeableness.

CONCLUSION

This study confirms the predictive value of the Conscientiousness dimension, at least its positive pole; here the dimension agreeableness is added. The implicative statistic analysis helps detail the subjacent process with predictive value of the conscientiousness personological trait. It is not about a direct influence of conscientiousness on success. The mediatory variables that interfere, first and foremost, are the proximity or normative distance of the self image to the model student prototype.

This proximity generates the choice coherence as related to the five-factor model, coherence that allows the emergence of the dimension Conscientiousness.

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