Time Factor in Psychological Profiling of Information Technology Specialists for Future Career Success

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Abstract

The article contains results of the research of chronological and psychological prediction of inclinations to computer activity during occupational choice based on innate inclinations of young people. Purpose: To determine the impact of the time factor on the career success of IT professionals. The research involved 40 Computer Science (Informatics) students with a Master's degree, 21-24 years of age, with their own voluntary consent, and 20 teachers with an academic degree. Research methods: experimental method of chronometric sampling using an electronic chronoscope; questionnaires, mathematical statistics methods (descriptive statistics, percentile statistics, variance analysis of mean-square error), reliability of differences in sample averages was based on Student's t-test values at permissible significance 5% (p <0.05). Qualified IT specialists' effectiveness under time-scarcity is determined by the subjective time reckoning principle and depends on the individual unit duration ("τ-type"). The analysis of the profiles revealed that talented IT specialists-to-be belong to the stable group, and are characterized by the most differentiated and clear attitude to time; they consider time as their property, as the reality given, they manage it effectively, basing on high logical thinking and well-developed intuition.

Keywords: Information technology, Innate abilities, Chronological and psychological prediction, Chronoscope

1 Introduction

According to various researchers, effective studying for students is based upon such important factors, as motivation to study (2), functional lability of nervous processes (3), physical fitness and physical activity and sports (20), self-regulation ability (10), including self-regulated learning (10), optimism, educational ingenuity (11). The concept of "ability" is mentioned in discussions on particular personal professional preferences. Because of insufficient researches on influence of abilities on success career, first we will analyze the consistency between differentiation of individual psychological attributes of the student's personality and learning success, as well as predictability and determination of students' abilities considering their typological groups.

Let's start an analysis with *differentiation of special abilities*, which correspondence to the chosen specialty determines successful learning and future professional life. Facing differentiation of academic disciplines in higher education, students demonstrate their preferences or dislikes, caused by their comprehension or incomprehension (15).

Such internal perception or non-perception depends on their right- or left-brain dominance (9). Relation between inclinations and abilities seems to be in contradiction between necessity and sufficiency. Innate inclinations are surely required in order to acquire certain abilities, but an ability level is determined by inclinations and means forming the ability. Modern psychologists' researches (1) prove that development affects an individual's abilities. Therefore, to meet a carrier of developing methods (teacher, mentor, coach) seems to be very important to acquire abilities. Those who disclose someone's natural abilities of the first tests can develop a way to form them and bring to perfection (6). At the same time, it should be noted that special abilities cannot be fully developed without *general mental (intellectual) abilities*. In other words, all and any activities are adapted to general inclinations and abilities (16). Special inclinations and abilities can be mentioned as well, which, in particular, work as personal factors of success or unsuccess in young specialist's future career (19). Thus, a really innate trait in the individual's personality is believed to determine the success of cognition and understanding.

If students fail to perceive and understand educational material, any successful activity cannot be expected. These inborn trait is confirmed by high correlation (r = +0.9) of reliability of IQ tests. Such high correlation confirms that the

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individual's cognition and understanding are based on so-called general intelligence, or *g* factor (4). Reasoning from high reliability, the g factor can be stated to be an individual's stable component, not changed with age or affected by the environment. This important component has long been noticed and mentioned for example, in the proverb: "If the God has not given a mind, it cannot be acquired." The issue of intelligence seems to be complicated enough. On the one hand, innate intelligence ("g factor") is undoubted, but on the other, according to P. Fress (1961) (8), this mysterious component is hard to be determined. Researches conducted within "Psychology of time" subject (5) answer the question. As noted above, innate inclinations depend on structural and functional features of the individual brain. According to B.Y. Tsukanov's (2000) researches, an individual brain works as a clock mechanism and measures the individual's psychological time (21). The time unit is a subjective "step" (ᵵ), which lasts differently in different people (18). Within four typological groups, this "step" at different durations of subjective time says about the quality of internal biological clocks. Based on quality, good and poor clocks can be determined. Comparing quadratic deviations ϭ (individual clock quality index) in the representative sample subjects to their psychometric intelligence (IQ), B.Y. Tsukanov (2000) got simple dependence: the smaller ϭ, the higher IQ (21). Both quality of the individual's clock and the clock itself are innate, so the quality index (ϭ) should be considered as one of the indicators of the individual's base intellectual potential ("g factor"). Thus, the contingent of highly intelligent and gifted students is determined by the quality of their internal clocks, equal to ϭ ≤ 0.03 s (16).

Considering individual traits in dynamics of time experience and individuals' generalized profiles, we have tried to determine criteria of typology of abilities for students' future professional engagement (7). For this purpose we have to answer the question: is there a consistency between ᵵ-type localization in the typological spectrum and student's inclination to certain professions? Therefore, the purpose of the research is to determine specific inclinations and abilities to work with computer technology which determines future success in the IT business, considering the individual's internal biological clock (13). The research is based upon assumption that cognitive efficiency depends on the individual's approach to one of five pure temperament types in the τ-type continuous spectrum and to good circadian clocks. Hypothesis. A future IT specialist's profile is assumed to be successful if localized near a particular typological group, thus the closer one approaches that group, the more successful one becomes.

2 Methods of the Research
2.1 Material
The research involved 40 students in Computer Science (Informatics) with master's degree, aged 21-24 years, with voluntary consent (the study lasted for three years - 1 year of master's degree and 2 years of their professional life), from the Sukhomlynskyi Mykolaiv National University.

2.2 The research Arrangement
The study was conducted in two stages. At the first stage, an individual's time unit was determined – for students with high and low professional engagement.

At the second stage, the individual's clock quality was determined by calculating the deviation in the proposed time intervals. A t-type was determined in each subject with chronometrical sampling (19), using the classical method of intervals of τ = 2, 3, 4, 5 s, set by the investigator and simulated by the subject with an electron chronoscope with the accuracy of 0.001 s (22). Thus each subject was asked to define the duration experienced and limited by two signals - "start" and "end" as a beep of the chronoscope when switched on and off. The subject simulated the intervals set on this chronoscope. The individual τ-type indicator was calculated by the formula:

$$\tau = \frac{\Sigma\, t_s}{\Sigma\, t_o},$$

where t_0 is duration specified by the investigator and t_s is duration simulated by the subject. Each time interval was repeated five times, and then the statistically average value of each individual's time unit was calculated. This value, as proved in the researches by B.Y. Tsukanov (2000) and I.I. Savenkova (2019) (17), does not change during an individual's life being a constant.

However, on the procedural side of the method, a very important feature is hidden: the specified duration (t_0) and simulation duration (t_s) represent different time segments on an arrow of the individual's subjective time. Since t_s consists of integer τ0, then, considering the successive t_s row on an arrow of the individual's subjective time, an analogy with *the procedure of checking the the good clock quality* is seen in simulation. The clock means *a mechanism that maintains high stability at different time intervals with minimal options* (21). Deviation τ can be regarded as variations in the work of an individual's internal clock. These quite natural deviations from the mean in any psychological experiment are usually characterized by the *mean-square deviation σ* (21). The smaller the deviation, the more stable the τ indicator at different time intervals, the higher the individual's intelligence.

An analogue of good clocks (with high intelligence) should meet two conditions: 1) τ = const; 2) σ is about 0. An ideal variant of good clocks is the condition σ = 0. But it is not complied because of minimum ability equal to 0.01 s in the individual's mind (5). Besides, systematic errors are expected in measuring equipment used. Therefore, the second condition (low variability τ) should be considered as an individual measure showing real approximation to the good clock analogue (within the limit σ = 0.01 s). *Statistical analysis.* Mathematical statistics methods (descriptive statistics, percentile statistics, variance analysis of mean-square error). The reliability of differences in the sample averages was based on Student's t-test at 5% significance level ($p < 0.05$).

3 Results

The first group consisted of Computer Science (Informatics) students with a 90 grade point average at least, and successful in practical and academic activity in their specialty within two years after graduation (see Table 1). The second group consisted of Computer Science (Informatics) students with lower grade point average, under 62, and unable to achieve career goals within two years after graduation (see Table 2). Regardless of the time unit value in the sample of *successful students*, the *constant condition* is met at all durations. *The difference between quadratic deviations is no more than $0.02 \ s \leq \sigma \leq 0.06 \ s$.* According to the results of observation over successful students in the τ-type spectrum from $0.7 \ s \leq \tau \ 1.1 \ s$ (see Table 1), graphical profiles of the groups of gifted students were created: choleric (5% (p <0.05)), sanguine (20% (p <0.001)), stable (70% (p <0.001)), melancholic (5% (p <0.05)). Based on these profiles, a portrait of successful IT specialists-to-be was built. A specific area of localization of individuals belonging to talented future IT specialists was determined. Using mathematical expectation and variance, we obtained the standard or mean-square deviation: $\sigma = 0.04 \ s$. Thus, our successful average student has $\tau = 0.9 \ s$ and the localization zone is within: $0.86 \ s \leq \tau < 0.94 \ s$, which corresponds to the stable group in the τ-type continuous spectrum. According to the data obtained, the group with high intellectual inclinations includes those individuals with $\sigma < 0.05 \ s$.

The analysis of the created profiles revealed that *individuals from the stable group*, in comparison with the others, are characterized by the most differentiated and clear attitude to time. They consider time as their property, as the reality given, they can wait, but feel slight time scarcity in life. The stable students are present-oriented: they focus on the present not on the past or future, most live under the "right here, right now" and "my life is my present" principles. They feel calm about their future and respect their past. In terms of business attitude to time, they prepare for important tasks beforehand, properly distribute time while working with software programs, and strength while executing responsible tasks, being adjustable to the situation. Compared to the other groups, they feel deeper the time instant.

Comparing the results of non-successful students to successful ones shows: the subject's cognitive activity is determined by relation to one of five pure types, and by own innate clock - human brain (see Table 2). The results of observation over non-successful students (see Table 2) show that those with various innate clocks can be related to subjects with low intelligence: $0.1 \ s \leq \sigma \leq 0.2 \ s$.

4 Discussion

The research has shown that future IT specialists' effectiveness under time-scarcity is determined by the subjective time reckoning principle and depends on own unit duration ("τ-type"). We confirm the findings by P. Montel (1910) that "a well formed brain is more valuable than a well filled one" (12). We are not far from the truth saying that *a brain built like clockwork with high organization and orderliness (minimum of own variations) has qualities to produce any highly organized and orderly mental function.* Therefore, in general, it is possible that such intelligence features as lightness, subtlety, fragility, originality involved in solving complex problems, are related to characteristics of good biological clocks. Thus, the obtained results of the relative error of the duration reproduction in the experimental group of successful students equal to the results of the relative error of the duration reproduction in the experimental group of unsuccessful students and are unambiguously interpreted, confirming the research results by H. Ehrenwald (2014). H. Ehrenwald's (2014) thesis about connection of the individual's clock accuracy with talent and intelligence seems to be significant.

Table 1: Quality of internal clocks in high professional engagement of subjects (students)

#	Research	Faculty	2s	3s	4s	5s	τ	σ
1	A	Informatics	0.88	0.85	0.86	0.88	0.86	0.03
2	B	Informatics	0.81	0.77	0.77	0.8	0.78	0.04
3	V	Informatics	0.82	0.81	0.82	0.83	0.83	0.05
4	S	Informatics	0.86	0.87	0.88	0.89	0.88	0.02
5	L	Informatics	0.84	0.84	0.86	0.85	0.84	0.05
6	G	Informatics	0.86	0.87	0.85	0.86	0.86	0.04
7	K	Informatics	0.91	0.91	0.89	0.91	0.91	0.03
8	T	Informatics	0.92	0.92	0.92	0.94	0.92	0.02
9	D	Informatics	0.93	0.88	0.89	0.9	0.91	0.03
10	Z	Informatics	0.92	0.91	0.9	0.88	0.9	0.03
11	Zh	Informatics	0.94	0.91	0.92	0.93	0.94	0.04
12	Ts	Informatics	0.93	0.94	0.95	0.96	0.94	0.04
13	N	Informatics	0.96	0.93	0.94	0.95	0.95	0.05
14	O	Informatics	0.98	0.96	0.97	0.95	0.97	0.04
15	U	Informatics	1.01	1.0	1.0	0.99	1.01	0.05
16	M	Informatics	0.99	1.02	1.01	1.0	1.0	0.04
17	P	Informatics	1.0	0.99	0.98	0.98	1.0	0.04
18	R	Informatics	0.99	1.02	1.03	1.06	1.02	0.05
19	T	Informatics	1.08	1.1	1.13	1.12	1.1	0.05
20	Ch	Informatics	1.11	1.13	1.12	1.11	1.1	0.04
	Mean		**0.94**	**0.91**	**0.9**	**0.91**	**0.9**	**0.04**

Table 2: Quality of internal clocks in low professional engagement of subjects (students)

#	Research	Faculty	2s	3s	4s	5s	τ	σ
1	A	Informatics	1.04	1.02	0.81	0.75	0.88	0.13
2	B	Informatics	0.96	1.0	0.8	0.82	0.9	0.19
3	V	Informatics	0.73	0.72	0.77	0.88	0.77	0.12
4	S	Informatics	1.12	1.02	0.96	0.86	0.88	2.8
5	L	Informatics	1.2	1.18	0.91	0.77	1.02	0.27
6	G	Informatics	1.16	1.09	1.01	0.97	1.06	0.23
7	K	Informatics	1.21	1.12	1.11	0.97	1.16	0.26
8	T	Informatics	0.86	0.79	0.65	0.64	0.84	0.19
9	D	Informatics	0.96	1.03	0.91	0.93	0.95	0.12
10	Z	Informatics	0.99	0.88	0.86	0.85	0.94	0.19
11	Zh	Informatics	0.94	0.98	0.87	0.93	0.93	0.14
12	Ts	Informatics	0.9	0.94	0.85	0.76	0.84	0.18
13	N	Informatics	0.96	0.83	0.74	0.95	0.85	0.25
14	O	Informatics	0.98	0.86	0.77	0.95	0.77	0.24
15	U	Informatics	1.01	0.86	1.0	0.77	1.01	0.25
16	M	Informatics	0.99	1.02	0.87	0.78	1.0	0.16
17	P	Informatics	1.0	0.78	0.98	0.74	0.88	0.24
18	R	Informatics	0.99	1.02	0.72	1.06	0.76	0.18
19	T	Informatics	1.08	0.76	1.13	0.86	1.1	0.25
20	Ch	Informatics	1.11	1.13	0.82	1.11	0.7	0.24
	Mean		**0.94**	**0.82**	**0.78**	**0.91**	**0.8**	**0.18**

The novelty of our research results is that, for the first time, according to the proposed model, the accuracy and quality of the information display of the cognitive system, key to discovering students' intelligence and abilities, means innate clock accurateness. Thus, the duration simulation can be considered objective in predicting the success of future IT professionals.

Based on the above data, it is evident there are individuals with different clockwork: from good to poor. We do not intend to reduce the intelligence issue to a clockwork. The analysis of good clocks should be considered as one of the preconditions for high intelligence. If an individual is born with good clock, then he or she has the potential to exhibit both high understanding, wide knowledge, and global ability to "think properly" in the chosen area of activity.

5 Conclusions

The analysis of the created profiles revealed that individuals from the stable group, comparing to the others, are characterized by the most differentiated and clear attitude to their own time. They consider time as their property, as the reality given, they can wait, but feel slight time scarcity in life. They feel calm about their future and respect their past. In terms of business attitude to time, they prepare for important tasks beforehand, properly distribute time and strength during complex tasks, being adjustable to the situation. Compared to other groups, they feel deeper the time instant.

But at the same time, they are able to manage time efficiently for making decisions, mobilization and effective job. We can conclude that our assumption is true and that the profile of a future successful IT specialist is localized near the stable group, and the closer one approaches to it, the more successful he is.

The data of individuals and "average group subject" shows that the condition of τ steadiness in representatives of different typological groups is also met here. Since the group of students has enrolled individuals with academic 4.5 points (very good), the range of values of quadratic deviations is in the range of 0.04 s $<\sigma<$ 0.08 s. These results indicate that the performance of the subject's cognitive activity is determined not by belonging to one of the five "pure" types, but by the quality of its own clock. Considering the data presented in all groups, you can say the following.

The highest ability to learn computer engineering and to master the surrounding reality, other things being equal, is observed in those individuals whose subjective time course corresponds to good clocks. According to the data obtained, the group with high intellectual inclinations enrolled those individuals with $\sigma<$ 0.05 s. These makings can be transformed in life into certain intellectual abilities. Besides, a person's relation to a typological group is his innate characteristic, and the τ-type is a constant not changed over time. And if the type of a successful IT specialist is localized on the τ type scale, then we can agree with those researchers claiming that *IT specialists can become talented, but also can be born.* Certainly, this does not diminish the importance of training and education of future specialists, because in addition to innate components, a person should have adequate motivation and knowledge and skills. At the same time, the research proves the crucial role of the time factor in the successful professionals' activities and reveals new opportunities for preparation of talented IT professionals. However it does not claim to be a definitive solution to the problem.

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