The Proforientation Method of Students with Directions of Training "Information Security" and its Software Implementation

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Abstract
The article shows the relevance of the problem of specialization of senior students on the example of bachelors of the training direction 10.03.01 "Information security" and its specificity. Data are presented that indicate the need for the selection of methods based on the analysis of the psychological properties of a person in order to orient senior students to the most suitable specialization for them in terms of not only their professional competencies but also the psychological characteristics of the personality. The methodology and the software that implements it, which solve the problem, are described, and the results of testing its applicability are one of the Russian universities are presented.

Keywords [1]
Information security, higher education, personality, specialization, vocational guidance of students

1. Introduction

Technical areas of training are becoming more and more popular among applicants every year. This trend is associated primarily with the programs of the government of the Russian Federation aimed at supporting and popularizing engineering education, and the development of the domestic industry.

Nevertheless, about 30% of applicants to universities in the Russian Federation do not cite a conscious choice of the engineering profession as the reason for their choice of technical areas: among the motivators they indicated are deferral from the army, parental advice, a prestigious profession, a fun pastime, high salaries, the prospect of a successful marriage, etc. And even those applicants who deliberately chose a university, institute, faculty, direction, and profile of training, in most cases do not have a clear idea of their future profession [11]. In the undergraduate program, recruitment is carried out per direction, and profiling (narrow focus) begins from the third year, therefore, the question of choice arises for the student several years after entering the university.

Let us consider this problem using the example of students and graduates of bachelors of the training direction "Information Security" In addition to the above, the demand for this specialty is also due to the lack of specialists in the field of information security: according to the International Consortium for Certification in the field of information systems security, in 2019 66% of heads of departments and information security departments have recognized an acute shortage of staff in their divisions, and, according to forecasts, by 2022 the shortage of specialists in this area will amount to 1,800,000 people worldwide [12].

Moreover, this specialty has a number of narrowly focused specializations:

- Organizational and legal protection of information (regulation of official activities and relationships of employees of the organization on a legal basis, development of regulatory documents);
- software and hardware information protection (providing protection at the physical and software level, limiting the capabilities of hardware and software control of the computer);
- cryptographic protection of information (encryption and decryption, key management, digital signature, information protection at the level of quantum physics, obtaining hidden information) [1];
- technical protection of information (construction of a TZI system aimed at ensuring the protection of information from unauthorized physical access through various types of channels).
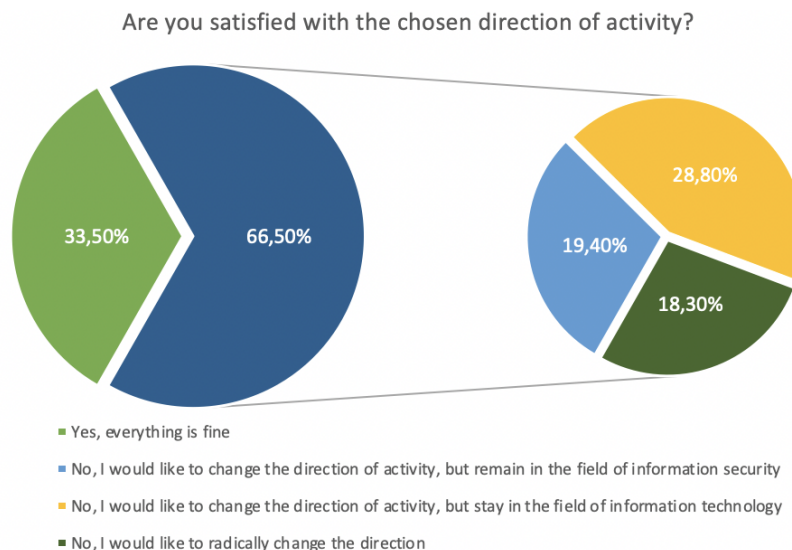
Separately, you can also highlight areas related to the teaching of disciplines in the field of information security, as well as leadership positions, for example, the head of the security department in an organization, who, in addition to knowledge in all areas of information security, must also have organizational and management skills that are characteristic only for certain personality types.

Students of the 10.03.01 "Information Security" training direction are trained according to the general curriculum, which implies passing 240 credit units. The variable part includes 16 disciplines, which makes it possible for students to choose a narrow specialization in the senior courses. Often, when choosing a specialization, a student experiences difficulties, since each of them has its own specific characteristics, which requires a future graduate to balance his own capabilities with the necessary skills, while the predisposition of the individual to this work is extremely rarely taken into account, which subsequently leads to professional burnout and retirement from the profession [2].

2. Justification of the hypothesis

To confirm this fact, a survey was conducted among the bachelors of the direction 10.03.01 "Information Security" of the Federal State Budgetary Educational Institution of Higher Education "Astrakhan State University".

137 graduates of Astrakhan universities over the past 5 years who studied in this specialty took part in the survey. The participants were asked one question: "Are you satisfied with your chosen field of activity?" The survey results are shown graphically in Figure 1:

Are you satisfied with the chosen direction of activity?

33,50%   66,50%   28,80%   19,40%   18,30%

- Yes, everything is fine
- No, I would like to change the direction of activity, but remain in the field of information security
- No, I would like to change the direction of activity, but stay in the field of information technology
- No, I would like to radically change the direction

Figure 1: Results of a survey of graduates of Astrakhan universities

The poll showed that only 33.5% of the surveyed graduates of the Information Security direction are satisfied with the chosen specialization. Such a low percentage, in our opinion, is due to the lack of a methodology for vocational guidance work with senior students, taking into account the specific features of the specialty and the psychological predisposition of students to it.

To study the causes of dissatisfaction with work in the chosen direction, the focus group method was applied. A graduate was randomly selected who expressed a desire to change the scope of work: the number of participants was 6 people. The organized group was heterogeneous in terms of gender and age. The respondents were asked questions regarding the reasons for dissatisfaction with the chosen direction. Among the reasons, the following were announced:

- I don't like working with documents - it's too boring work;
- I would like to interact more with people, and not spend all my working time at the computer;
- I would like to do programming, information security is too narrow a specialty.

Based on the answers received as a result of the focus group work, it can be concluded that the named reasons for the desire to change the professional sphere are associated with the psychological characteristics of the graduate's personality.

3. Purpose and objectives of the research

From all of the above, it follows that it is necessary to develop a methodology for vocational guidance work, which makes it possible to identify not only competencies, but also personal qualities of students for their most suitable professional career [6]. It is the purpose of this work.

4. Literature review

Within the framework of higher and secondary education, various vocational guidance methods are used. One of the most popular is the "Differential-diagnostic questionnaire" by psychologist E.A. Klimov, which is based on the classification of professional interests. Among the frequently used ones is the "Map of interests" by A.Ye. Golomstock, which is a questionnaire for identifying the scientific interests of the students [4, 5, 7].

Comparison of the main vocational guidance techniques is shown in Table 1.

Table 1

Comparison of different career guidance methodology

Name of methodology	Authors	General part of methodology
Methodology "Differential Diagnostic Questionnaire"	E.A. Klimova	The methodology is intended for selection for various types of professions in accordance with the classification of types of professions. Used in career guidance for adolescents and adults. Shows what professional field a person is inclined to and shows interest
Methodology "Map of interests"	A.E. Golomstock	The methodology designed to study the interests and inclinations of schoolchildren in various fields of activity: physics, mathematics, chemistry, astronomy, biology, medicine, agriculture, etc
Diagnostics of the structure of signaling systems	E.F. Zeer, A.M. Pavlova, N.O. Sadovnikova	On the basis of the relative predominance of the first or second signaling system in a person, specific types of higher nervous activity are determined: artistic, mental, and average
Methodology for determining	L.A. Yovashi	It is intended to determine the

| professional inclinations | | personality's inclinations to various areas of professional activity (art, technical interests, working with people, mental labor, physical labor, and the sphere of material interests) |
| Methodology for determining professional inclinations | I.L. Solomina | The questionnaire is suitable for self-assessment of a person's professional interests and abilities. Determines the tendency and ability to one of five types of professions |

The considered methods of vocational guidance are a questionnaire survey, the results of which make it possible to identify a person's professional inclinations. This method is quite effective and fast, since it takes a small amount of time to analyze the answers. However, often the results of the questionnaire are general and do not allow to unambiguously determine the propensity of the subject to one or another direction of work. For example, when passing the "Differential-diagnostic questionnaire", the subject considers himself to be one of the groups "man-nature", "man-technology", "man-sign system", "man-artistic image", "man-man". In turn, each group represents more than 50 professions, which also presents a rather difficult choice for the individual. Thus, the considered methods do not allow to distribute students to narrow areas of one specialty and, in general, are not focused on students.

5. Methodology

In this regard, it was decided to use the technology of visual recognition of the character components "Seven Radicals", developed by the Russian scientist V.V. Ponomarenko [9]. This technique has not only been successfully used for about 20 years in the special services of the Russian Federation but is also one of the main tools in working with future personnel. The key concept of the technique - radical (from the Latin radix - "root"), or, as it is also called, accentuation, is a group of homogeneous psychological qualities. It is based on internal mental conditions - the strength and mobility of the nervous system, especially the emotional and intellectual spheres. The same radicals are found in different people, and the list of radicals known to psychologists is not that great. It is enough to know the signs of these 7 radicals to form a psychological portrait of a person. The following radicals are distinguished:
- hysterical (demonstrative);
- epileptoid (stuck and excitable);
- paranoid (purposeful);
- emotive (sensitive);
- schizoid (creative);
- hyperthymic (cheerful, optimistic);
- anxious (fearful).

Collectively, a person's character consists of several radicals. It is something like a cocktail where a certain set of radicals are mixed in certain proportions. There is always one leading radical, which forms the basis of character and determines the main motive of human behavior, and several additional ones, which are behavioral means of realizing the motive.

There are many methods of recruiting personnel for information security departments. But all of them are aimed not at the psychological properties of an individual's character, but at his professional competence. It is important to note that most often vocational guidance of students is carried out precisely on the basis of an analysis of his mental abilities and knowledge, without taking into account their psychological characteristics.

"Seven radicals" will allow the visual method to determine the group of psychological qualities of an individual student or graduate, which are based on internal mental conditions - the strength and mobility of the nervous system, especially the emotional and intellectual spheres.

Having identified a set of radicals included in a person's character, the following features can be identified:

- attitude to the types of activity, which tasks the owner of this profile will solve always and everywhere, and which ones he will not be able to solve under any circumstances;

- hidden character traits, how and under what circumstances those character traits will appear that a person usually does not demonstrate;

- phenomena and patterns of behavior.

In order to use the methodology in the vocational guidance work of students, a questionnaire survey and a personal interview were conducted with current information security specialists who conduct their activities in one or another of its narrow profile. This was done in order to identify what character traits are common among specialists in one field. As a result, it was determined that in each group the subjects in each of its participants revealed common features presented in Table 2.

Table 2

General features in the character of the specialists

Field of activity	The most prominent radical	The second most intense radical
Organizational and legal protection of information	epileptoid	anyone
Cryptographic protection of information	schizoid	anyone
Technical protection of information	hyperthymic	anyone
Hardware and software protection of information	schizoid	epileptoid
Information security teaching	epileptoid	hysterical
Heads of information security departments	anyone	paranoid

After that, a list of questions (questionnaire) was developed for students and for an employee of the department.

The questionnaire for students consists of 30 questions, each of which looks like:

<Which statement is closer to you?>

<Statement # 1>

<Statement # 2>

<Statement # 3>.

The student needs to choose 1 statement in each question.

The questionnaire for an employee of the department responsible for vocational guidance of the contingent contains lists of signs - appearance, behavior, facial expressions, speech, features.

For example:

Block "Appearance"

1. Lack of catchiness, brightness (yes / no)
2. The appearance is functional, appropriate to the situation (yes / no)
3. There is sloppiness in appearance (yes / no)

For students, 10 random questions are generated from the database of questions. For each question, the student must choose one answer that best matches his typical behavior. For instance:

Which of the topics presented are you interested in talking about?

- Beauty and individuality (beauty industry, art, publicity, perfectionism) (hysterical)

- Strength and status (social activities, norms and laws, sports, economics, jurisprudence). (epileptoid)

- Knowledge and technology (trends and prospects, finance and banking, philosophy, science). (schizoid)

- Relationships and care (family, self-development, charity, non-political social news). (emotive)

- Variety and drive (entertainment, recreation, travel, extreme sports, startups and communications) (hyperthymic)
- Money and power (career, success, politics, high technology, investment). (paranoid)
- Stability and safety (social problems, prices, health and traditional medicine, news in a problematic aspect) (anxious)

An employee of the department notes the signs that are observed in the student, the data of the student and teacher polls are aggregated, processed, as a result of which, using a set of keys, the first and second most intense manifestations of radicals in the student's character are determined.

To recommend the choice of a further direction, a comparison is made between the sets of the student's radicals and the data on the radicals of specialists who are successful in one direction or another (Table 2). The data obtained as a result of the analysis on the most suitable direction of work is communicated to the students. If the set of prevailing radicals of a student does not correspond to any standard set of radicals, the choice of specialization remains at the discretion of the student himself.

To automate and reduce the time for processing test keys based on the described methodology, a software product was developed in the form of a web application, which is a testing platform with two interfaces - a department employee and a student.

Figure 2 shows a data flow diagram of the developed software.
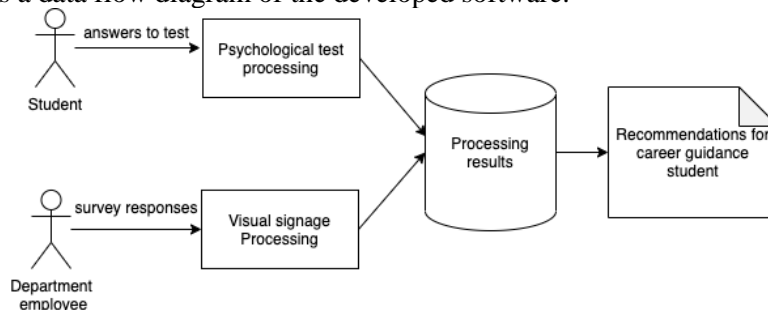
Figure 2: Data flow diagram

To build a psychological profile of a student, an employee of the department needs to select the observed signs of a student from the proposed list, and the student needs to undergo psychological testing in his personal account. After processing the data, the prevailing radicals in the character of the student are determined, on the basis of which recommendations are given on his specialization in information security, in which he could prove himself most effectively. It is important to note that the questioning of a student and an employee of the department may not take place simultaneously, but the final recommendations for career guidance will be issued when both users of the system enter the necessary information.

6. Results

The program for building a psychological profile based on the test results and describing visual signs is currently being tested at the Astrakhan State University. At this stage, the first results have already been obtained with its help.

In 2019, 16 students of the 3rd year of the Department of Information Security took part in trial testing. For each student who took part, his psychotype was determined, after which personal recommendations were given on the further choice of variable disciplines implemented by the Department of Information Security. After completing the study of the disciplines of the variable block, the students recognized the fact that the recommendations they received after psychological typing helped them choose the disciplines that they were best able to master, while the average academic performance of the group increased by 9.3%.

7. Discussion

In the future, it is planned to improve the methodology by increasing the number of questions for a deeper analysis of the psychological properties of the personality of the tested, as well as to modernize the testing platform by placing it in the public domain so that it is available to everyone, and not only within the local network of the university.

8. Conclusion

Most of the technical specialties of higher education include a number of narrow areas, the distribution of students to which most often occurs in a random, unmotivated manner, without taking into account the predisposition of students to one or another activity. In this regard, the task of carrying out vocational guidance work with students arises. Within the framework of this article, an analysis of the available vocational guidance methods was carried out, which showed that at the moment there is no methodology that would be focused on students and would take into account the specific features of the technical areas of training for a bachelor's degree.

The proposed methodology for vocational guidance of senior students based on the works of V.V. Ponomarenko and the software that implements it on the example of the bachelor's degree in Information Security allows students to be assigned to the disciplines of the variable part of the curriculum and to give recommendations for further work, taking into account their psychological personality traits. The practical implementation of the vocational guidance methodology is a web application in the form of a testing platform, which makes it possible to identify the psychological characteristics of the tested students and give them recommendations for further specialization.

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